ATTACHMENT A

PGH2O Pittsburgh
Water & Sewer
Authority

October 2, 2017

Dominique Lueckenhoff
Acting Director
U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Re: Opportunity to Confer and Resolve Clean Water Act Violations by Pittsburgh Water and Sewer Authority (PWSA) and City of Pittsburgh (City), Pennsylvania

Dear Ms. Lueckenhoff:

Please see the following response from the City of Pittsburgh and Pittsburgh Water and Sewer Authority to your letter dated September 6, 2017 received on September 18, 2017.

1. **Provide the Excel spreadsheet(s) of all the information included on the map in attachment 1-c (e.g. list of outfalls, outfall locations, receiving water) (Paragraph 1 in the response letter).**

   Please see the attached spreadsheet as well as the updated maps that were submitted with the 2017 renewal application (September 16, 2017). See Item 1 Attachment.

2. **Provide information on whether PWSA and/or the City has identified areas in the MS4 system that are high risk for dumping to storm sewer inlets and illegal connections to the system (Paragraph 2 in the response letter).**

   For the September 16, 2017 Renewal PWSA has created the Illicit Discharge Detection and Elimination Program Manual for all City (DPW) and PWSA staff to train and utilize during inspections. Please see section 4.2.1 Identification and Outfall Screening of Priority areas. High priority has been given to the Saw Mill Run watershed near the borders of Carrick, Overbrook and Bon Air neighborhoods. See Item 2 Attachment.

3. **Provide a description of the nature of the centralized activities and correspondence between PWSA and the City regarding the facilitation of private NPDES Permit applications (Paragraph 2 in the response letter).**

   PWSA is in the process of consolidating the oversight and compliance management of the Minimum Control Measures responsibilities required by the MS4 NPDES Permit, to be completed by January 1, 2018.

PWSA and the City are currently negotiating a formal agreement to properly assign activities related to MS4 that will be integrated into our cooperation agreement. Please see the attached responsibility delineation sheet.

PWSA plans to create a formal Storm Water Utility in 2019. This group will be responsible for stormwater inspections, maintenance, and compliance. See the attached proposed organization chart. See Item 3 Attachment

4. **Please provide details about the contracted resources, staff, and SOPs dedicated for the activities to commence in October, 2017 regarding the routine biannual dry weather screenings for the City of Pittsburgh's priority areas (Paragraph 3 in the response letter).**

Due to union staff rules, PWSA has been unable to conduct our dry weather stormwater outfall screenings. To resolve this issue, PWSA is evaluating assignment of additional services to one or more of three commercial laboratories: Pace Analytical, CWM Environmental and West Monroe. Once PWSA contracts with one of these companies, we will utilize our staff to conduct the dry weather screenings. Proposals are due from the laboratories by October 2, 2017 and the contract is expected to be signed by the end of October 2017.

These screenings will be conducted in accordance with PWSA's *Standard Operating Procedure* for *Illicit Discharge Detection and Elimination Sampling*. See Item 4 Attachment.

5. **Provide an example of dry weather flow sampling results with the new parameters included (Paragraph 4 in the response letter).**

Since we have changed the SOP to include the parameters that you have requested, PWSA has been unable to sample due to staffing issues. Please see the response to Item 4.

6. **Provide clarification on the spreadsheet in attachment 4-a. specifically, the last 4 lines on the spreadsheet seem to have discrepancies in the date visited and sampled columns versus the date analyzed column (Paragraph 4 in the response letter).**

There were mistakes in the spreadsheet which have been addressed in the attached revised spreadsheet. See Item 6 Attachment

7. **Provide a description of responsibilities of the private contractor that has been contracted to manage the primary vehicular maintenance facilities (Paragraph 7 in the response letter);**

   The primary vehicular maintenance facilities are contracted by the City to First Vehicle Services. Services include the management, maintenance, and repair of its fleet, fuel site, automated fuel management system, and any other fleet services required. The City's objective is to reduce fleet downtime and cost, while increasing reliability and protecting the City's overall investment in its fleet.

8. **Provide a description of the PWSA implemented program and schedule to target annual inspections of the MS4 system catch basins (Paragraph 8 in the response letter);**

   The 2016 Catch Basin contract replaced 148 catch basins and the contract is 100% complete. The 2017 contract was awarded to 2 contractors and they have completed 62 basins to date. The total percent complete for both of the 2017 replacement contracts is approximately 15-20% combined.

   PWSA's 2018 budget includes funding to hire professional services to inspect their approximately 5,000 catch basins. The budget is subject to Board approval at its December 2017 meeting.

9. **Provide details on the training programs to increase staff awareness of MS4 responsibilities, including curriculum outlines, attendance sheets, and training schedules for the future (Paragraph 9 in the response letter).**

   Training of relevant employees and contractors will be conducted annually for both general pollution prevention knowledge and identified Operations and Maintenance (O&M) Actions as they pertain to PWSA operations. A list of tasks as identified in regards to O&M Actions are (1) Upkeep and repairs to facilities, (2) Upkeep and repairs to vehicles, (3) Updating signage, (4) Waste transport, (5) Illicit connection investigation, (6) Verification that the activity is being performed according to given training, (7) Note if maintenance or repairs are needed, (8) Note if a spill, leak, or discharge was observed, (9) Any concerns that need to be addressed, and (10) Any follow-up activities that may be required such as training or spill control.

Please see the attached SOP for MCM 6, *O&M Program: Pollution Prevention and Good Housekeeping.* This SOP outlines PWSA's Training Program, our plan to provide training as well as training already conducted this year. See Item 9 Attachment.

10. **Provide examples of the new and improved signage posted as part of the basic awareness training of municipal employees (Paragraph 9 in the response letter).**

    The City of has posted the attached signage in their common areas as part of their basic awareness training of municipal employees.

11. **An updated comprehensive map of all PWSA's outfall sewer sheds by Mott MacDonald (Paragraph 1 in the response letter).**

    Please see the Item 1 Attachment referenced in Paragraph 1.

12. **Verification that the Environmental Enforcement Inspector position within the City's Department of Permits, Licenses and Inspections has been filled (Paragraph 5 in the response letter).**

    The Environmental Enforcement Inspector is a full time position that was budgeted in the 2017 budget. At this time the City has not filled this position. Please see Item 12 Attachment.

13. **A detailed description about the Environmental Compliance Group (Paragraph 5 in the response letter).**

    The Environmental Compliance Group is housed within PWSA's administration and is currently composed of an Environmental Compliance Manager and a Scientist I. The Group oversees the compliance related activities, reporting, and regulatory communications for the Authority. PWSA is currently seeking to add a second Scientist I and a Scientist II to this group by the end of 2017.

    The job descriptions for these referenced individuals are included it Item 13 Attachment.

14. **A detailed description of the formal stormwater facility documentation process that ensure municipally-owned stormwater control facilities are inspected at least annually**

and details the comprehensive vehicle operation and maintenance program (Paragraphs 6 and 7 in the response letter).

Currently PWSA owns two stormwater control facilities- River Avenue and Red Oak Drive and Hayson Avenue Green Infrastructure Facilities. Both facilities are located in combined sewer areas. When stormwater control facilities are implemented in separate storm sewer areas, we will adapt the inspection checklist currently used in combined sewer areas.

The Vehicle O&M Program will use East Brandywine, PA's program as a basis for the required activities. A walk through of all PWSA and City vehicle facilities shall be done before creating an accurate program. PWSA will complete this program outline by December 31, 2017.

15. **Clarification regarding whether the assignment of the MS4 permit oversight responsibilities will go to a newly created Environmental Compliance Officer position or be added to the job responsibilities of the existing Environmental Compliance Officer (Closing Paragraph in the response letter).**

PWSA is drafting a memorandum of understanding to document the assigned MS4 responsibilities to each party. PWSA will accept responsibility for oversight and compliance using its Environmental Compliance Group and the planned Stormwater Division staff within the Department of Engineering and Construction. The City will remain responsible for various activities such as drafting a Stormwater Ordinance and performing routine street sweeping. PWSA plans to conduct MS4 education for the City departments so they have a better understanding of their roles and responsibilities.

Please see Item 15 Attachment, a chart that will be used to delegate responsibilities.

The City and PWSA appreciate the opportunity to discuss this response with you at your convenience.

If you have any questions please feel free to call me at 412-255-8960.

ATTACHMENT A

Sincerely,

The Pittsburgh Water and Sewer Authority

Robert A Weimar

Robert A. Weimar, P.E., BCEE
Interim Executive Director

ATTACHMENTS:
https://pwsa.exavault.com/share/view/jpfx-1mwgprvc
Password: pgh2o

Pittsburgh
Water & Sewer
Authority

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ATTACHMENT A

PGH2O Pittsburgh Water & Sewer Authority

Item 12
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Item 13
PWSA Reorganization chart
Job Description – Environmental Compliance Manager
Job Description – Scientist I

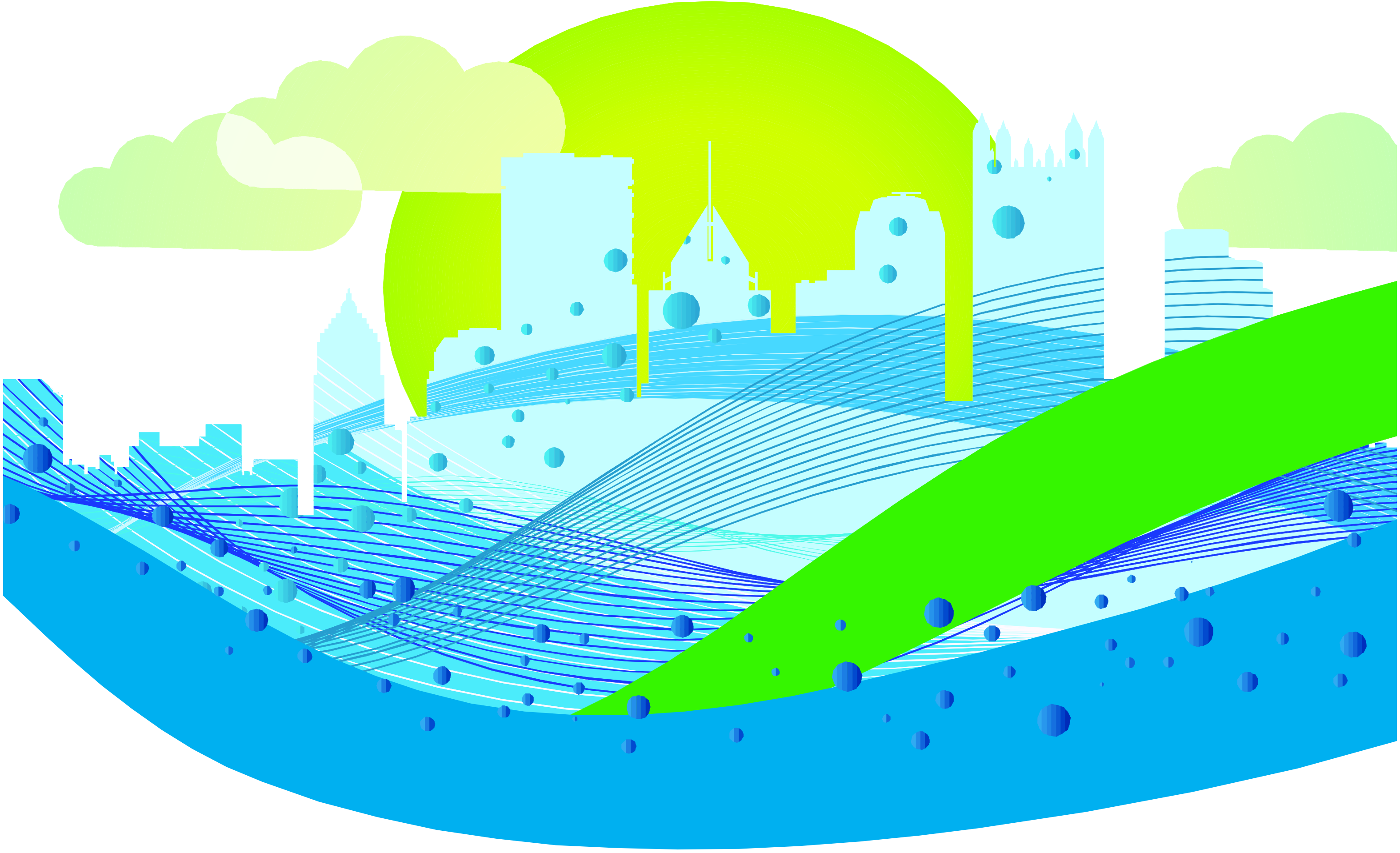
Item 15
PWSA and City Municipal Separate Storm Sewer System Responsibilities

Copy of Application Package
Submitted to the DEP on September 16, 2017

ATTACHMENT B

Wet Weather Feasibility Study

July 2013



Prepared For:

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

Prepared By:

AECOM

ATTACHMENT B

Wet Weather Feasibility Study

July 2013

Prepared for:

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Executive Summary

The Pittsburgh Water and Sewer Authority (PWSA) is submitting this Wet Weather Feasibility Study to the Pennsylvania Department of Environmental Protection (PaDEP) and the Allegheny County Health Department (ACHD) on July 31, 2013. The Executive Summary provides an overview of the Wet Weather Feasibility Study report, including the regulatory background, the alternative evaluation and recommended plan, financial and affordability analysis, implementation of the plan, and the integrated watershed planning approach.

REGULATORY REQUIREMENTS

Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued in early 2004 to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) conveyance and collection system, directing compliance with the Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA).

The ACOs were issued to separate sewer communities by the Allegheny County Health Department, and the COAs were issued to combined sewer communities, like the City of Pittsburgh, by the Pennsylvania Department of Environmental Protection. The initial COA among the PWSA, the City of Pittsburgh, the PaDEP, and the ACHD was entered into on January 29, 2004, and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the US Department of Justice and the US Environmental Protection Agency (USEPA), PaDEP, and ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs, COAs, and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, analyze and perform alternatives analyses, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSO), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission (by July 31, 2013).

BACKGROUND WORK BY PWSA

This Wet Weather Feasibility Study is the culmination of several studies and activities to fulfill the requirements of the City of Pittsburgh/PWSA COA. The first, most significant of these studies was the *PWSA Feasibility Study Report* (October 2008) which identified and presented technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan are still valid, were summarized, are presented in this Wet Weather Feasibility Study and form the foundation upon which this Feasibility Study is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with ALCOSAN in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for PWSA, which included the following:

- Closed-Circuit Television Report (February 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December 2006)
- PWSA Combined Sewer Overflow Report (January 2007)
- CSO Quality Assessment Technical Memo (June 2007)
- Collection System Inventory and Characterization Report (August 2008)
- Hydraulic and Hydrologic Characterization Report (September 2008)

As part of the more recent coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their *Wet Weather Plan*. PWSA provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. The preliminary information described the currently identified system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system. The report addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors.

OBJECTIVES OF THE WET WEATHER FEASIBILITY STUDY

The objectives of PWSA's Wet Weather Feasibility Study were generated from a combination of objectives outlined in the Feasibility Study Working Group (FSWG) Document 027 and the PaDEP's Draft Feasibility Study Outline. The objectives of this feasibility study include:

- Identify and present technology, cost, and non-cost analyses that will allow PWSA to select appropriate CSO control alternatives that best meet the requirements set forth in the City of Pittsburgh/PWSA COA (as amended)
- PWSA will, at the same time, lay the framework for maximizing utilization of green infrastructure technologies and explore the benefits of integrated watershed planning.
- Participate and cooperate with ALCOSAN in the development of their WWP.
- Submit a municipal flow management compliance plan, also known as a Feasibility Study (FS), by the end of July 2013. The FS will evaluate a range of practicable alternatives to:
    - Meet CWA and Clean Stream Law requirements
    - Eliminate SSOs
    - Fulfill Pennsylvania and USEPA CSO Policy obligations
    - Develop POC Feasibility Studies in conjunction with municipalities that are tributary to PWSA. These POC reports will be named by both the PWSA sewershed name and the ALCOSAN POC sewershed name, to enhance future coordination between the PWSA and ALCOSAN.
    - Develop short-term and long-term flow management proposals that will meet the PWSA's flow management objectives through September 30, 2046, in a manner that is affordable and acceptable to the PWSA and the City of Pittsburgh.

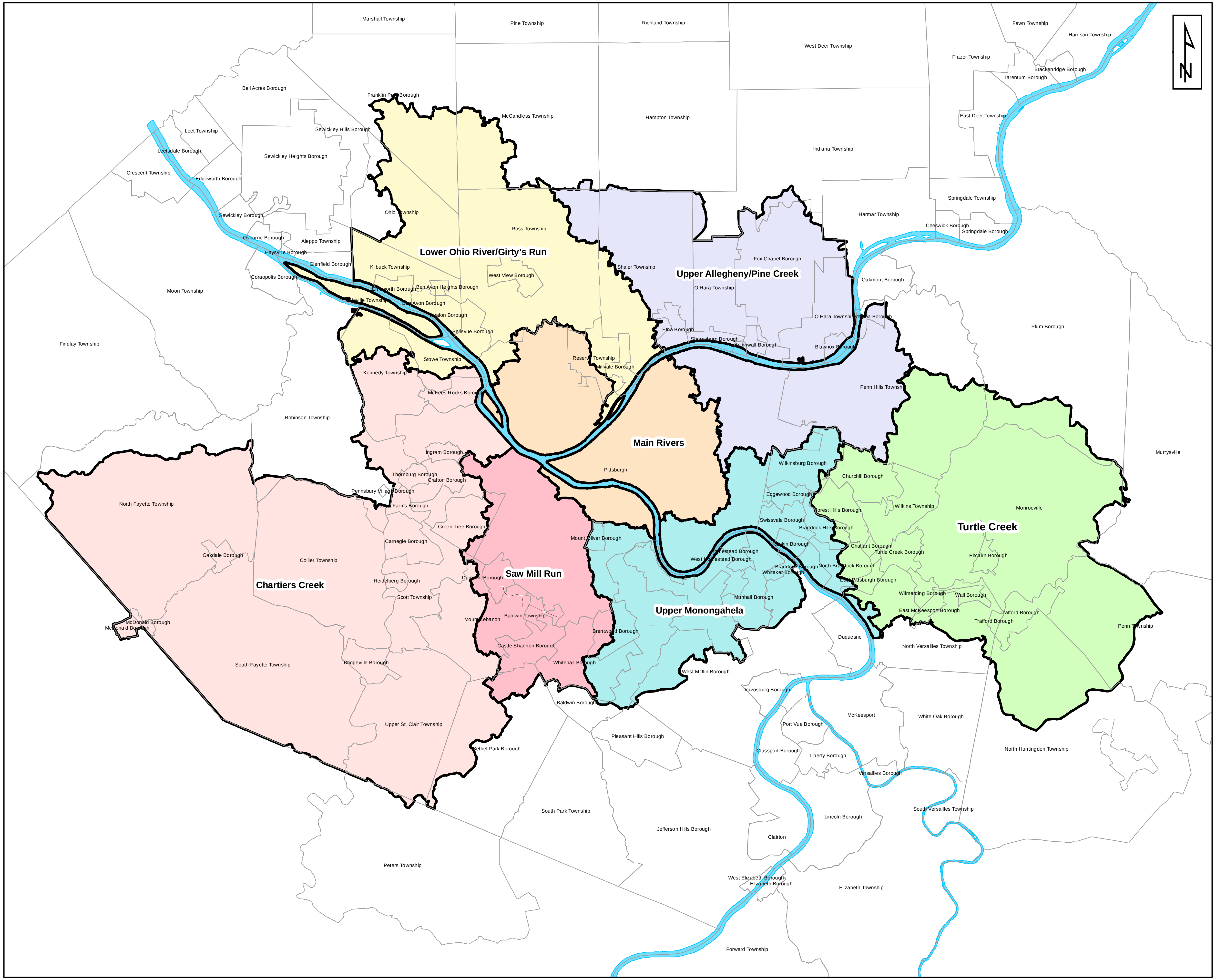
PWSA COORDINATION OVERVIEW

There are 24 communities adjacent to the City of Pittsburgh that are tributary to, and contribute flow to, the PWSA collection system. In accordance with the January 24, 2004 COA (as amended), PWSA has been coordinating directly with representatives from these municipalities and through the 3 Rivers Wet Weather Demonstration Program (3RWWDP). PWSA has maintained a close working relationship with 3RWWDP in order to facilitate an on-going exchange of mapping information and data.

In order for ALCOSAN to develop and formalize a Wet Weather Plan (WWP) in accordance with their CD, its service area was divided into seven planning basins and commissioned consulting firms with the task of studying each planning basin so that a uniform WWP approach can be achieved. This planning and study process was completed in 2012. ALCOSAN has integrated the recommended controls for each of the planning basins into a comprehensive WWP that was submitted to the appropriate regulatory agencies on January 30, 2013.

The PWSA sewage collection system is largely located within ALCOSAN's Main Rivers planning basin; however, the PWSA service area also extends into ALCOSAN's Upper Allegheny/Pine Creek, Lower Ohio/Girty's Run, Saw Mill Run, Chartiers Creek, and Upper Monongahela planning basins. To date, the PWSA has shared the results of their wet weather planning with ALCOSAN and the affected tributary municipalities, and will continue to coordinate with all involved parties as required such that all plans are complementary.

A map of the ALCOSAN service area and the seven planning basins is shown in Figure ES-1.



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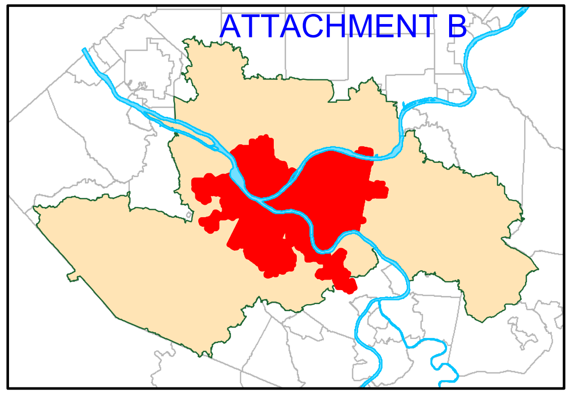

ALCOSAN Service Area Overview

Legend

- ☐ Municipal Boundary
- 🟥 Chartiers Creek
- 🟨 Lower Ohio River / Girty's Run
- 🟧 Main Rivers
- 🟥 Saw Mill Run
- 🟩 Turtle Creek
- 🟪 Upper Allegheny / Pine Creek
- 🟦 Upper Monongahela
- 🟦 River

14,000 7,000 0 14,000 Feet

Figure ES - 1: ALCOSAN Service Area & Planning Basins

PWSA
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July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE ES-1_ALCOSAN SERVICE AREA_PLANNING BASIN.mxd

DESCRIPTION OF SEWER SYSTEM

PWSA's downstream regional wastewater treatment provider is ALCOSAN. The ALCOSAN wastewater treatment plant (WWTP), which was first placed into operation in 1959, is located on a 50-acre site along the north shore of the Ohio River, downstream from Woods Run, in the City of Pittsburgh. Although the WWTP currently processes an average of 250 million gallons per day (mgd) of wastewater, which represents treatment service for the City of Pittsburgh and the other 82 customer municipalities, during wet weather events combined sewer overflows (CSOs) are discharged into the rivers.

This regional sewage treatment provider also maintains approximately 92 miles of interceptor sewer consisting of over 300 regulator structures, five pump stations, two ejector stations, deep tunnels, shallow-cut interceptor sewers, and river crossings. A number of the CSO diversion structures are located along ALCOSAN interceptors. The purpose of the diversion structures is to intercept and convey dry weather flows to the wastewater plant while diverting combined flows that would exceed the capacity of the interceptor and treatment plant to receiving waters. Overflows are discharged into receiving waters by a CSO outfall either located at the diversion structure or at the downstream end of an overflow pipe. Many diversion structures that have low invert elevations are equipped with flap gates to prevent water and sediment components of the receiving waters from entering the diversion structure and associated interceptor.

The PWSA sewer system is primarily a combined collection system that serves the City of Pittsburgh. The PWSA sewage collection system also serves as a conveyance system for portions of flows from 24 neighboring municipalities. Wastewater flows generated in neighboring communities are conveyed through parts of the PWSA collection system to the ALCOSAN interceptor system.

The PWSA sewer collection system consists of approximately 1,080 miles of sewer ranging in size from six inches to 156 inches, and 29,000 manholes. Approximately 77 percent of the PWSA service area is served by combined sewers; however, the percentage of separate sanitary and storm sewers is gradually increasing as required sewer separation occurs during redevelopment. There are 74 active diversion structures, also known as diversion chambers, within the PWSA sewer system.

There are four sewage pump stations within the PWSA sewer system.

The current NPDES permit that authorizes PWSA to discharge combined sewage requires that the Authority maintain all of its facilities in accordance with the Nine Minimum Controls (NMC) to minimize the duration and frequency of CSO discharges. PWSA has recently reconciled the number of permitted CSOs within their system, as some of them had been modified or closed as part of their COA compliance activities. A map of the PWSA sewer service area, including major trunk sewers, is shown as Figure ES-2 on the following page.

Multi-Municipal Systems and POC Reports

There are some points of connection (POCs) that receive flow from more than one municipality. These are considered to be "multi-municipal" systems and a solution for managing flow would have to consider each of the contributing municipalities. Based on the complexity and size of PWSA's system as well as potential required coordination with upstream municipalities and the downstream treatment provider ALCOSAN, PWSA has developed a total of 14 POC reports, one for each of the sewersheds in which improvements are proposed. Ten of the 14 sewersheds are multi-municipal; two of those have very minor tributary area contribution (A-51 and MH-11). A list of the POC reports, which are included in Appendix A of the Wet Weather Feasibility Study, is as follows:

1.	A-42	Negley Run
2.	A-51	East Street
3.	C-25	Bells Run
4.	M-34	Becks Run
5.	M-42	Streets Run
6.	M-47	Nine Mile Run
7.	MH-11	McCartney Run
8.	MH-18	Little Saw Mill Run
9.	MH-55	Timberland Street
10.	MH-77	Brookline Boulevard
11.	MH-80	Englert Street
12.	S-15	McNeilly / McDonough's Run
13.	S-23	Brook Street
14.	SMRE-40	Plummer's Run

Figure ES-3 shows the location of each of the 14 POC sewersheds relative to PWSA's service area.

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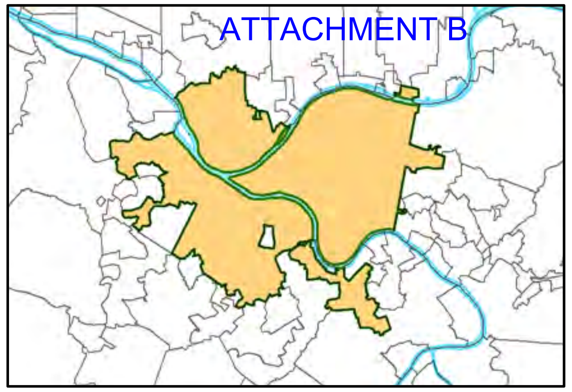
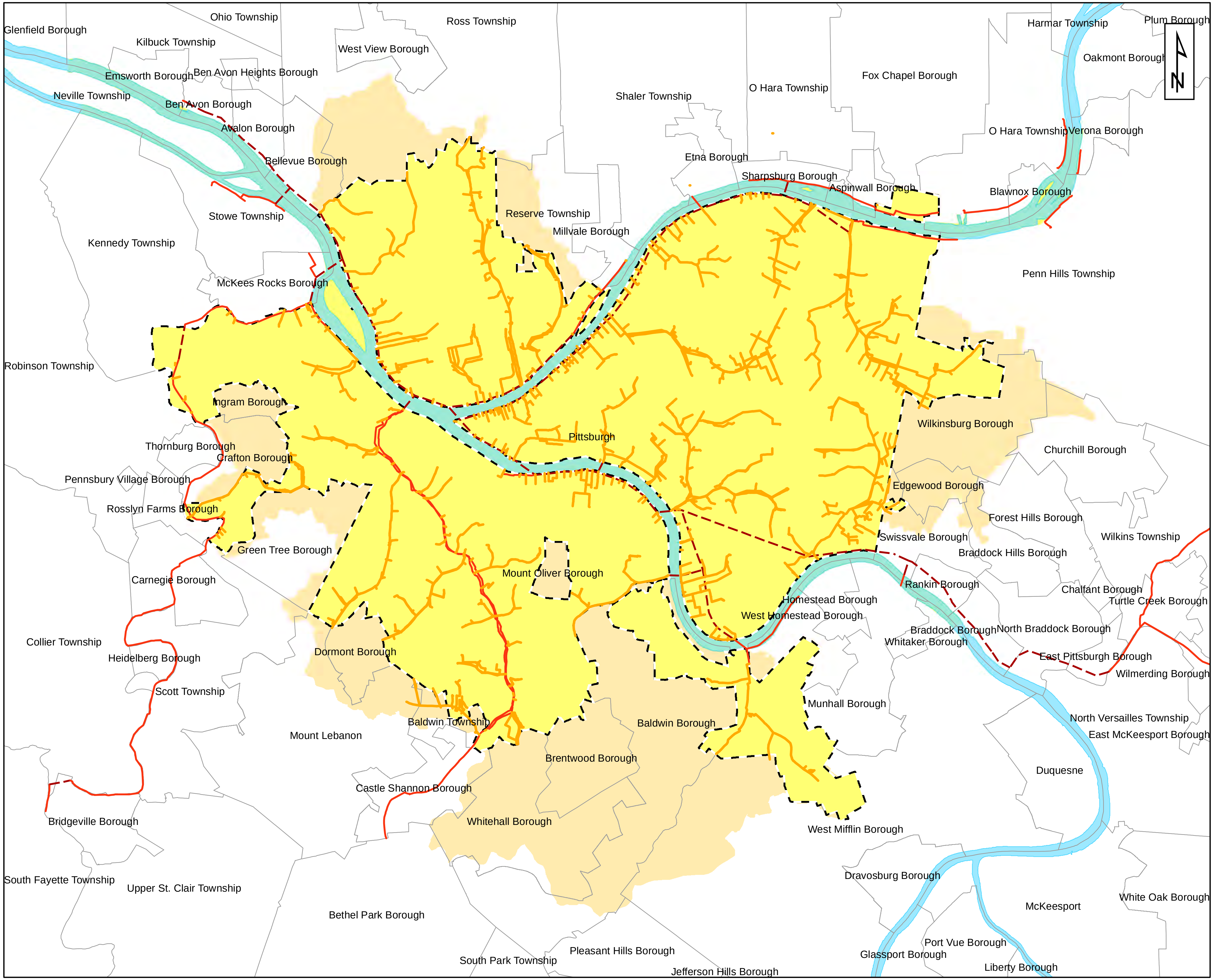


PWSA Service Area Overview



Legend

- Trunk Sewers
- PWSA Service Area Boundary
- Extended PWSA Service Area Boundary
- Municipal Boundary
- River

Existing ALCOSAN Interceptor

- Deep Tunnel
- Shallow Cut

Figure ES - 2: PWSA Service Area

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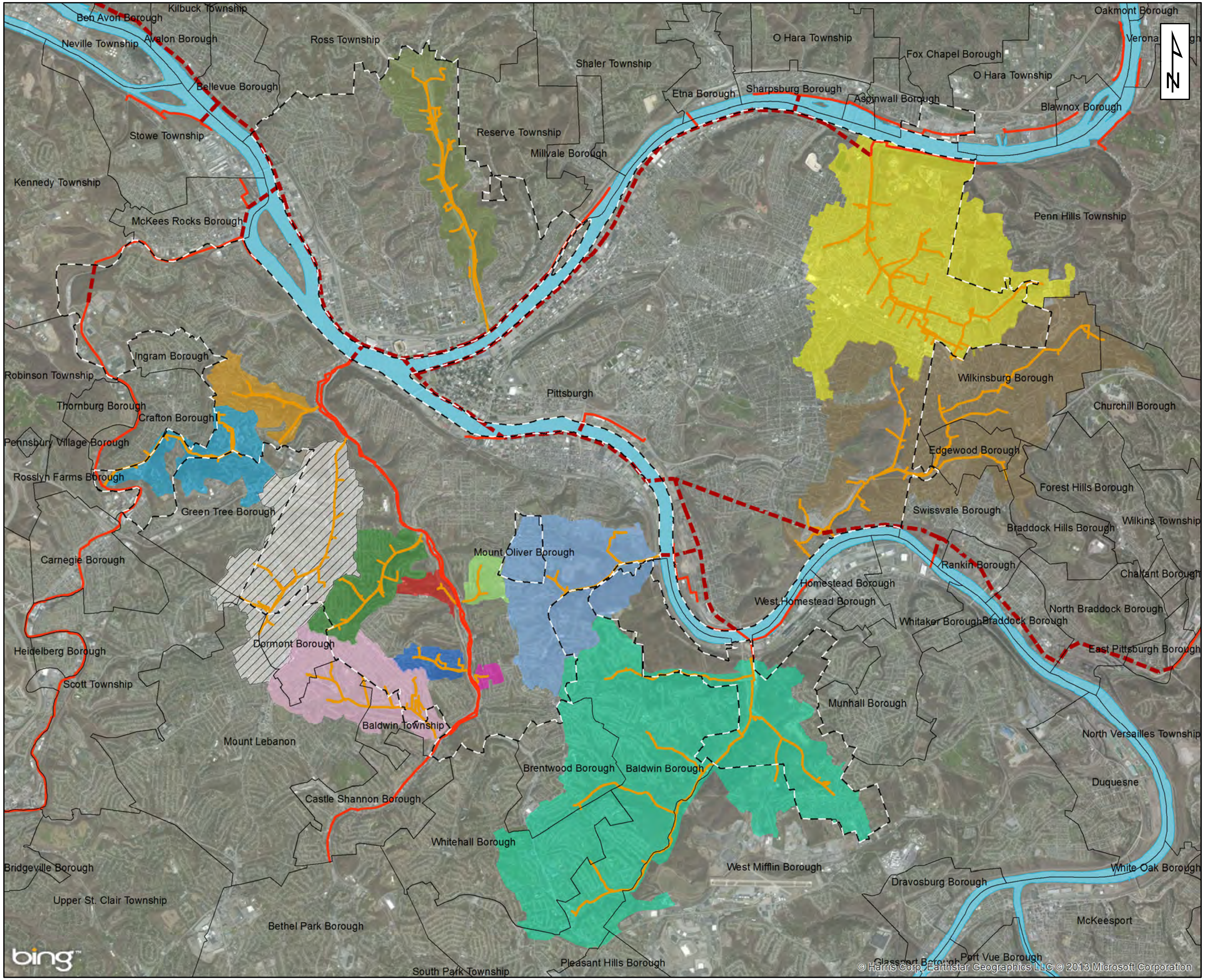

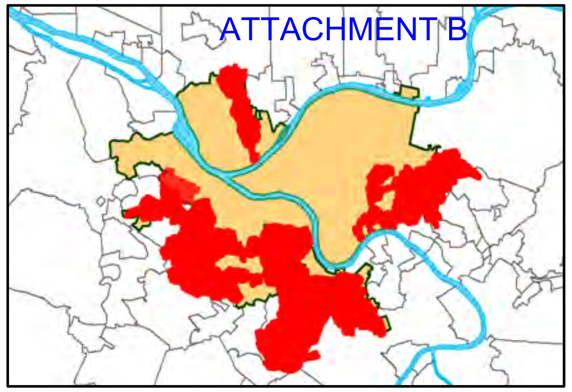

PWSA Service Area Overview

Legend

- Trunk Sewer
- ⌐ ¬ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟫 M-47 Sewershed Boundary
- ■ S-15 Sewershed Boundary
- 🟩 S-23 Sewershed Boundary
- 🟥 MH-55 Sewershed Boundary
- 🟦 MH-77 Sewershed Boundary
- ■ MH-80 Sewershed Boundary
- 🟨 A-42 Sewershed Boundary
- ■ M-34 Sewershed Boundary
- 🟧 MH-11 Sewershed Boundary
- ■ M-42 Sewershed Boundary
- ■ C-25 Sewershed Boundary
- 🟩 A-51 Sewershed Boundary
- ▨ MH-18 Sewershed Boundary
- 🟩 SMRE-40 Sewershed Boundary
- ■ River

Existing ALCOSAN Interceptor

- Deep Tunnel
- Shallow Cut

6,000 3,000 0 6,000 Feet

Figure ES - 3: POC Sewersheds

PWSA
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Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE ES-3 POC SEWERSHED MAP.mxd

Direct Stream Inflows

PWSA completed an evaluation of the cost effectiveness of disconnecting direct stream inflow (DSI) connections from their sewage conveyance system. The evaluation was conducted in accordance with Paragraph 8.a.ii of the COA. Significant stream inflow exists at these locations:

- Discharge from Panther Hollow Lake and the tributary stream in the Four Mile Run drainage area, tributary to ALCOSAN CSO structure M-29.
- Multiple locations in the Woods Run drainage area, tributary to ALCOSAN CSO structure O-27.
- Stream inflow into the Spring Garden drainage area in Reserve Township, tributary to ALCOSAN CSO structure A-60.
- Stream inflow from Corks Run drainage area, tributary to CSO O-13.
- Stream inflow in Sheraden Park, tributary to ALCOSAN CSO C-07.
- Stream inflow into the storm sewer system in the vicinity of Freid and Reineman Streets, tributary to ALCOSAN CSO A-66.

Conceptual approaches for the removal of the identified stream connections were developed. Sizing of separate storm sewer systems was completed using 5-year design storm conditions, and sizing of new separate sanitary sewer facilities was based on the 10-year design storm. Estimates of the cost of the facilities required to disconnect stream inflows from the PWSA and ALCOSAN systems were developed.

It was determined that the following two stream removal projects located within or directly impacting the PWSA system were cost effective and have either been completed or are in the process of being completed:

- Sheraden Park Direct Stream Inflow Removal and Stream Restoration. ALCOSAN, the City of Pittsburgh, PWSA, and the U.S. Army Corps of Engineers have and continue to partner in the removal of direct stream inflows into PWSA's combined sewer system in Sheraden Park. PWSA has completed rerouting of the combined sewer system from the culverted stream. The stream is being daylighted to flow into Chartiers Creek.
- Jack's Run Direct Stream Inflow Removal and Stream Restoration. ALCOSAN, the City of Pittsburgh, PWSA, Ross Township, and Bellevue Borough partnered to remove a major direct stream inflow into ALCOSAN's Lower Ohio River interceptor sewer. The stream was re-routed and the stream bed was reconstructed.

System Characterization

PWSA and Regional Flow Monitoring. In support of the previous planning studies, PWSA conducted a comprehensive sewer flow monitoring program in 2004. The purpose of the program was to collect sewer flow and rainfall data for the PWSA collection system, including inputs from outlying communities.

Potential monitoring sites were investigated between October 2003 and January 2004, and 418 monitors were then installed in selected sites between January and March 2004. Data from those meters were collected from March 2004 to July 2004, at which time 397 of the 418 flow monitors were removed. The remaining 21 flow monitors were left in place and continued to monitor flows through October 2004. The flow monitoring locations are shown in Figure ES-4 below.

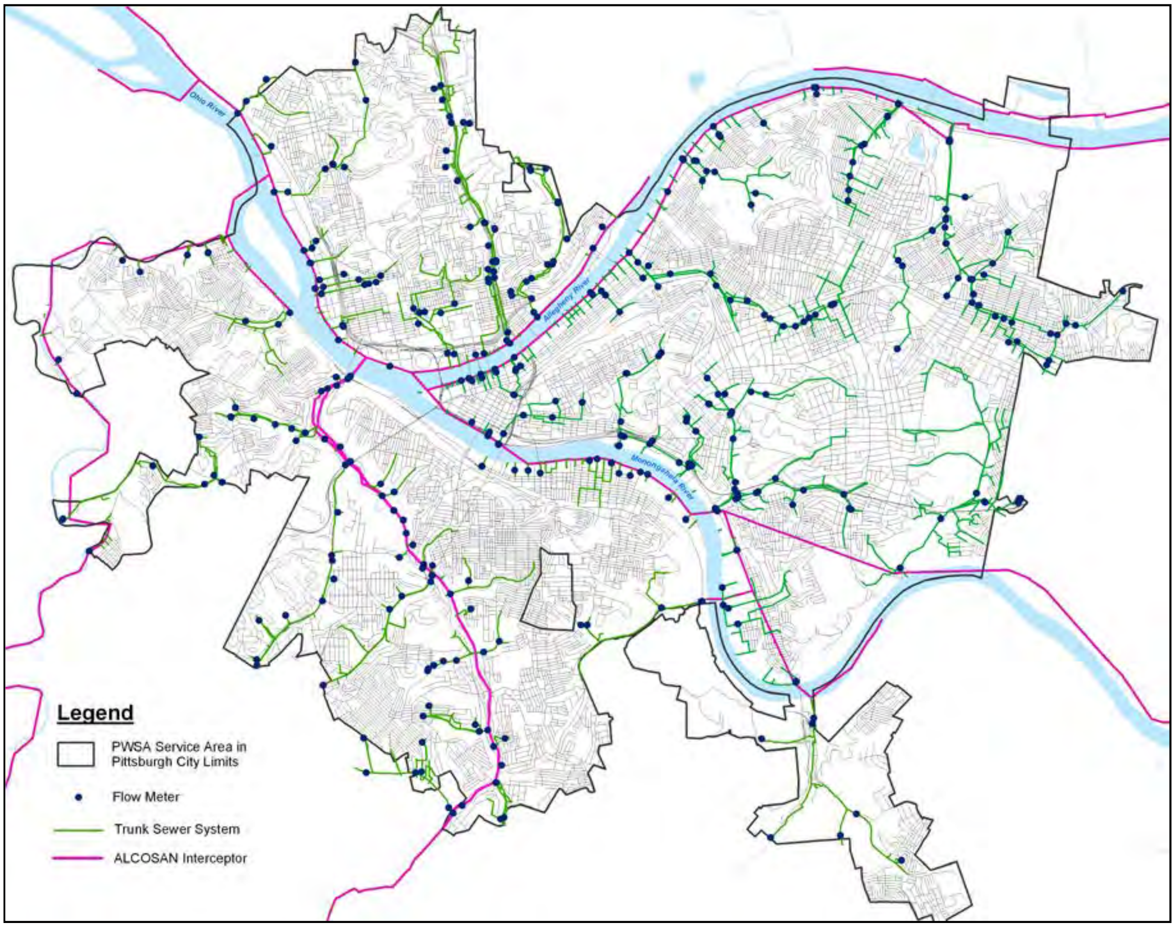


FIGURE ES-4. FLOW MONITORING LOCATIONS

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP), which was assembled by 3RWW with direct input from ALCOSAN, PWSA, and the Flow Monitoring Working Group (FMWG), was submitted to the PaDEP and the ACHD for review and approval. The FMWG was composed of engineers and technical representatives from ALCOSAN, regulatory agencies, and approximately 50 municipalities within the ALCOSAN service area, including PWSA.

In response to the Agencies' comments and provisions of the ALCOSAN CD, ALCOSAN prepared a Regional Collection System Flow Monitoring Plan (RCS-FMP) that incorporated most of the provisions of the RFMP and provided comprehensive flow monitoring of both the ALCOSAN system and the municipal collection systems.

In regards to sewer defects and repairs, PWSA is actively pursuing through a currently ongoing storm water drainage study the potential remedies to the identified illicit connections found via a COA mandated dye testing program. During the period from 2006 to 2012, sewers segments were rehabilitated in both the combined and sanitary portions of the collection systems by PWSA through a cured-in- place-pipe (CIPP) lining process. This is an important step in limiting the opportunities for infiltration to enter the sewer system and rehabbing defects such as fractured, broken, and deformed sections of pipe. Sewer lining has the additional benefit of reducing the number of lateral connections by only reinstating the active laterals.

Development and Calibration / Verification of H&H Models. The original 2008 Preliminary Draft Feasibility Study was updated for the 2012 Feasibility Study by utilizing the regional hydrologic and hydraulic (H&H) model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system H&H model that built upon and expanded the initial PWSA H&H model. The ALCOSAN model extends deeper into the municipal systems tributary to the PWSA system, and provides information about the performance and impacts of those tributary systems on the existing PWSA system. PWSA agreed to use the ALCOSAN H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region.

PWSA has coordinated with ALCOSAN by providing planning level information throughout the basin planning process. PWSA's information was used by

ALCOSAN and their basin planners to determine a number of conditions which were the basis for the ALCOSAN H&H models. The conditions are the following:

- **Existing Condition.** The state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 mgd (as of the first quarter of 2009).
- **Baseline Condition.** The state of the system and service area in 2008, with any planned ALCOSAN and municipal projects which are certain to be implemented.
- **Future Baseline Condition.** The state of the system and service area in 2046, including changes due to planned development/re-development, but without implementation of the wet weather plan improvements.
- **Future Condition (2046).** The predicted state of the system and the service area 20 years after the implementation of the planned improvements.

The planning horizon date for the H&H models is September 2046.

PWSA Sewer Capacity Analysis. The performance of the existing sewerage facilities was evaluated under the projected future loadings, current diversion structure settings and 2-year, 5-year, and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur.

There have been about 144 locations where more than one basement backup complaint between January 1, 2004 and December 31, 2012 was reported through PWSA's complaint/dispatch center. However, there is no conclusive correlation between these complaints and capacity constraints. A large majority of the complaints in the record were considered to be unrelated to insufficient capacity in the sewer. The complaint records include brief descriptions of the responses by PWSA operations staff to each report and often identify the apparent causes for the complaint. Typical causes for backups included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. Addresses for which more than one incident is reported were considered to be potentially caused by public sewer capacity problems.

Water Quality Issues. Water quality issues are the driving force behind the PWSA's COA requirements. These requirements stem from the existing water quality criteria in local streams that are not being met, some as a result of combined and separate overflows.

To develop a "water-quality based" plan for PWSA, initial water quality objectives were established:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the above requirements are not being met, PWSA must understand the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use," i.e. "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA) which, by definition, is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

Wherever a "designated use" is not being met due to water quality issues, the stream is said to be impaired. For example, if bacteria counts are consistently above 400 CFU/100 ml in streams, it means that partial or total body contact cannot be allowed. In other words, swimming, water skiing, and similar sports cannot be undertaken due to violations of the bacteria standards. "Use impairments" are normally documented in the USEPA's 303(d) list. The USEPA website states: "The term, '303(d) list', is short for the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem.

PWSA has over 150 outfalls that are jointly permitted with ALCOSAN. These outfalls are addressed in ALCOSAN's WWP. There are also a number of PWSA outfalls that discharge into various tributaries. Most of these PWSA-owned outfalls discharge into receiving waters classified as warm water fisheries (WWF). The only exception is Nine Mile Run, which is a trout stocking fishery (TSF). Applicable

PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are bacteria, dissolved oxygen, and pH. In addition, standards for aesthetics and public health protection are applicable.

The PWSA water quality monitoring program was initiated in 2005. Review of available data concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA service area. Sampling was conducted in 2006 at seven monitoring sites located along the five streams that flow through the City of Pittsburgh limits: Becks Run, Chartiers Creek, Nine Mile Run, Saw Mill Run, and Streets Run. Monitoring sites were either downstream from most of the outfalls within a stream and at the upstream boundaries of two of the streams: Chartiers Creek, and Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, phosphorus, ammonia, and oil and grease. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics.
ALCOSAN also conducted extensive CSO outfall and receiving water quality monitoring, which encompassed a much larger area than PWSA's program, as required by their CD. The ALCOSAN sampling program also included monitoring for industrial discharges and polychlorinated biphenyls (PCB) sampling. Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three wet weather and three dry weather events between 2006 and 2011. Monitoring was conducted in the three rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects, and tributaries were sampled during the recreational season of April 1 to October 31. According to ALCOSAN, the results of the water quality monitoring program indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters with fecal coliform bacteria being the primary concern.

CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, pollution contributed by CSOs is only part of the total pollutant loads from all such sources. In these areas, even complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses. However, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of these other pollution sources.

For PWSA's Feasibility Study, a range of CSO control levels were assessed. For the typical year, 0, 4, and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions.

IMPACT OF ALCOSAN'S CONSENT DECREE

ALCOSAN's *Wet Weather Plan* was finalized during the preparation of PWSA's Wet Weather Feasibility Study. The ALCOSAN CD requires that ALCOSAN handle all flows that its "customer municipalities," one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

Under ALCOSAN's selected alternative in their draft WWP, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two-year level of control was used for ALCOSAN SSOs. At the 4 to 6 OF/yr control level, ALCOSAN demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Allegheny, and Monongahela) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run).

PWSA CSO CONTROL LEVELS

For this Feasibility Study, the demonstration approach for CSO control levels was preferred as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flow would meet water quality standards by implementing CSO controls that will not allow more than an average of 4 to 6 overflow events per year on an annual average basis.

Based on the PWSA system model, CSO statistics (volume and peak flow) were generated for every outfall as well as for a selection of outfall groupings for control levels of 0, 4, and 10 overflow events per year, based on a "typical year" storm.

Since Saw Mill Run has a TMDL which requires a high level of phosphorous removal (98%), a higher level of control will be required. While 10, 4 and 0 OF/year were analyzed, 0 OF/year will be necessary for compliance. The TMDLs for Streets Run and Chartiers Creek (including its tributary Bells Run) are related to acid mine drainage parameters, and as such, maintaining 4 overflows per year for these tributaries is judged reasonable. For Chartiers Creek, ALCOSAN's receiving water modeling has demonstrated compliance with WQS at 4 to 6 overflows per year.

A range of design storms (2-year, 5-year, and 10-year) were evaluated for transport of flows. PWSA plans to use the 2-year storm. During project improvement design, the option of going to a higher level of service will be considered based on localized issues such as the existence of basement flooding complaints.

ALTERNATIVES EVALUATION

The approach used by PWSA to evaluate alternatives included:

- Determine the adequacy of existing PWSA collection systems
- Develop and implement a control technology screening process
- Develop control alternatives
- Evaluate control alternatives

To determine the adequacy of the PWSA collection systems upstream of the ALCOSAN operated diversion structures, the ALCOSAN H&H model was run under future baseline conditions. If the model results indicated that the PWSA collection systems could convey flows generated during typical year rainfall conditions, without excessive system surcharging (manhole flooding, basement backups, etc.) the system was considered adequate.

ALCOSAN's Consent Decree (CD) contains a requirement that they must accept and treat all flows that tributary municipalities convey to the ALCOSAN interceptor. Thus, for a selected level of control, if it could be shown that PWSA's existing collection system could adequately convey all flows to the nearest ALCOSAN interceptor, no additional PWSA control facilities would be required. On the other hand, if it is shown that PWSA's existing collection system could not adequately convey those flows, PWSA would need to develop and evaluate CSO control alternatives to achieve the selected level of control. If the PWSA collection system was shown to be adequate, the PWSA control alternative for that sewershed defaulted to "Convey All Flows to ALCOSAN." If not, the PWSA control alternative was developed and selected.

CONTROL TECHNOLOGY SCREENING PROCESS

The technology screening process provided a way of eliminating technologies from consideration that did not meet the basic criteria for consideration and would therefore not likely achieve program goals. First implemented by the PWSA during the development of the *PWSA Feasibility Study Report* (October 2008), the process was mirrored by ALCOSAN during the development of their *Wet Weather Plan*.

The technology screening process and results contained in the 2008 report are still applicable, and as such technology screening was not repeated during the development of this report. As part of the 2008 study, a technology review, initial analysis, and screening was performed to identify and categorize feasible wet-weather management technologies for use in developing CSO control alternatives. More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities, technical literature, and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet weather management technologies used: source control, collection system control, storage, and treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives. From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives. The four main categories of criteria included economic, environmental, implementation, and operational. The following technologies were considered feasible:

- **Source Controls.** Source reduction.
- **Collection System Controls.** Maintenance and repair, conveyance, and sewer separation.
- **Storage.** In-line storage, tunnel storage, and tank storage.
- **Treatment.** Screening, suspended solids control, disinfection, re-aeration, and secondary treatment.

CSO control alternatives were then developed for potential use within the PWSA system. During this process, it became evident that most of the control technologies considered to be feasible needed to be combined with one or more other feasible control technologies. As a result, viable combinations of control technologies were evaluated as CSO control alternatives. In order to properly evaluate the relative merit of each of the control alternatives, a consistent set of design criteria were established with which the sizes, costs, and physical impacts of each alternative could be estimated.

CONTROL ALTERNATIVES EVALUATION

As detailed in the *PWSA Feasibility Study Report* (October 2008), an evaluation process was performed to select the “highest ranked alternative” for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. The outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are thus still valid, but many have since been superseded by the Convey All Flows alternative.

The PWSA alternative evaluation process utilized 13 economic, environmental, implementation, and operational evaluation criteria to objectively assign scores to each alternative. PWSA also developed and applied “scaling” and “weighting” factors to each criterion to tailor the evaluation to PWSA needs. Scaling factors were used to represent the PWSA-specific measure of the benefit of each criterion, while weighting factors were used to represent the relative importance of each criterion amongst the overall group of criteria. For each outfall/region/subsystem/level of control, the evaluation process consisted of: estimating costs of each alternative, developing evaluation criteria, determining the alternative’s objective scores relative to each evaluation criteria, developing and applying scaling and weighting factors, and then ranking each alternative. This process was repeated for each level of control under which the alternative was to be considered for use.

It was noted that the conclusions of the October 2008 report were limited to a level of control of 4 OF/yr. The intent of the report was to place PWSA in a position to work with ALCOSAN in an effort to mutually develop the best regional plan as ALCOSAN’s work proceeded.

There are 14 POC sewersheds for which PWSA’s existing collection system could not adequately convey all typical year flows to the ALCOSAN interceptor. These 14 POCs are listed in the table below. Each of these POCs and their associated improvements are described in their respective POC reports, which are located as Appendix A to this Wet Weather Feasibility Study.

TABLE ES-1. POC SEWERSHEDS REQUIRING PWSA CONTROL ALTERNATIVES

POC Sewershed	Common Name	Receiving Water	ALCOSAN Planning Basin
M-34	Becks Run	Monongahela River	Upper Monongahela
M-47	Nine Mile Run	Monongahela River	
M-42	Streets Run	Monongahela River	
C-25	Bells Run	Chartiers Creek	Chartiers Creek
MH-18	Little Saw Mill Run	Saw Mill Run	Saw Mill Run
MH-11	McCartney Run	Saw Mill Run	
S-15	McDonoughs Run	Saw Mill Run	
S-23	Brook Street	Saw Mill Run	
MH-77	Brookline Blvd.	Saw Mill Run	
MH-80	Englert Street	Saw Mill Run	
MH-55	Timberland Street	Saw Mill Run	
MH-89	Weymans Run	Saw Mill Run	
SMRE-40	Plummers Run	Saw Mill Run	
A-42	Negley Run	Allegheny River	Upper Allegheny
A-51	East Street Valley	Allegheny River	Main Rivers

RECOMMENDED ALTERNATIVES

The recommended improvements for these 14 POC sewersheds consist mainly of new or upsized conveyance, modified or new regulators, screens, and a storage tank. A summary of the total estimated project cost for the recommended alternatives for addressing the entire PWSA sewer system is presented in the Table ES-2. These recommended improvements are also shown in the Figure ES-5.

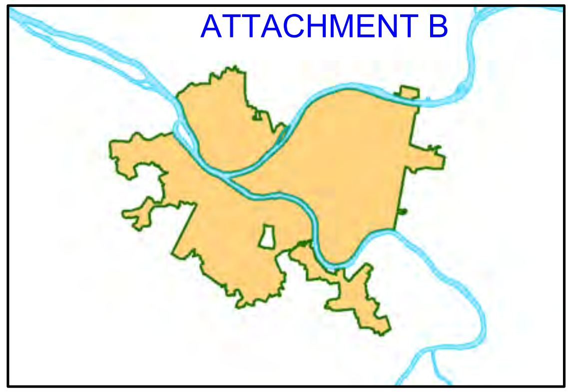
ATTACHMENT B

TABLE ES-2. SUMMARY OF ESTIMATED WET WEATHER PLAN COSTS

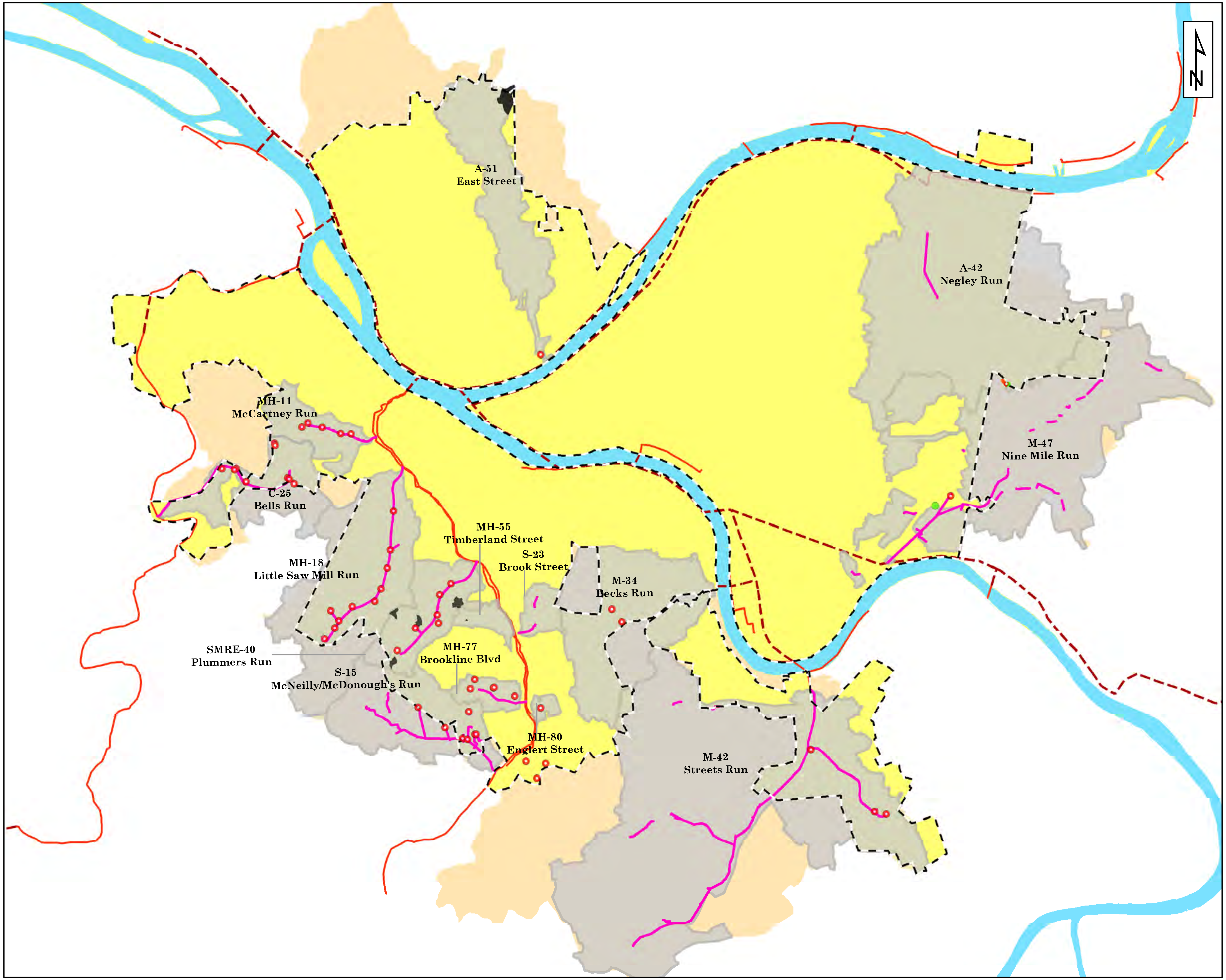
POC	CONTROL	TOTAL PW CAPITAL COST ($MM)	TOTAL PW TOTAL COST ($MM)	PWSA ONLY PW CAPITAL COST ($MM)	PWSA ONLY PW TOTAL COST ($MM)
A-42 (Negley Run)	Tank / Conveyance	$22.68	$23.30	$15.47	$15.89
A-51 (East Street)	Conveyance / Sewer Separation / Diversion Structures	$5.59	$5.68	$5.59	$5.68
C-25 (Bells Run)	Conveyance / Diversion Structures	$18.13	$18.51	$16.05	$16.48
M-34 (Becks Run)	Diversion Structures	$1.26	$1.27	$1.26	$1.27
M-42 (Streets Run)	Conveyance / Diversion Structures	$22.59	$22.95	$7.55	$7.75
M-47 (Nine Mile Run)	Conveyance / Diversion Structures	$33.97	$34.45	$18.38	$18.88
MH-11 (McCartney Run)	Conveyance / Diversion Structures	$6.10	$6.25	$6.10	$6.25
MH-18 (Little Saw Mill Run)	Conveyance / Diversion Structures	$27.81	$28.27	$24.73	$25.40
MH-55 (Timberland Street)	Sewer Separation	$0.14	$0.14	$0.14	$0.14
MH-77 (Brookline Boulevard)	Conveyance / Diversion Structures	$7.25	$7.37	$7.25	$7.37
MH-80 (Englert Street)	Diversion Structure	$0.45	$0.46	$0.45	$0.46
S-15 (McNeilly/McDonough's Run)	Conveyance / Diversion Structures	$21.83	$22.27	$14.83	$15.23
S-23 (Brook Street)	Conveyance / Diversion Structures	$2.80	$2.86	$2.80	$2.86
SMRE-40 (Plummers Run)	Conveyance / Sewer Separation / Diversion Structures	$29.55	$29.95	$28.08	$28.84
MH-89 (Weymans Run) *	Diversion Structures	$9.11	$9.15	$2.37	$2.43
Adaptive Management Plan	Green Infrastructure and Integrated Watershed Planning	$9.60	$9.86	$9.60	$9.86
TOTAL WET WEATHER PLAN COSTS		**$218.86**	**$222.74**	**$160.65**	**$164.79**

* = Not one of the 14 POC sewersheds
TOTAL = Cost for entire project (all municipalities)
PWSA ONLY = PWSA portion of the cost
PW = Present Worth
Total Cost = Capital Cost + O&M Costs

ATTACHMENT B



PWSA Service Area Overview



Legend

- ○ PWSA Diversion Structure Modification
- ● PWSA Sewer Outfall
- — Relief/Consolidation Sewers
- 🟩 PWSA Pumping Station
- 🟥 6.15 MG Storage Tank
- ■ Sewer Separation
- ▨ Sewershed Boundary
- ▭ PWSA Service Area Boundary
- ▨ Extended PWSA Service Area Boundary
- ▨ River

Existing ALCOSAN Interceptors

- - - Deep Tunnel
- — Shallow Tunnel

6,000 3,000 0 6,000 Feet

Figure ES - 5
Recommended Alternatives

PWSA THE PITTSBURGH WATER & SEWER AUTHORITY Quality Water Quality Service

July 2013

By implementing the recommended CSO Control alternatives listed above, the total CSO volume will be significantly reduced. Table ES-3 shows the modeled CSO volumes by POCs before and after the recommended CSO control implementation under the typical year. There is a total modeled reduction in CSO volume of 94% for the 14 POC specific alternatives in the PWSA system.

TABLE ES-3. EXISTING AND FUTURE ANNUAL UNTREATED CSO VOLUMES

POC	LEVEL OF CONTROL	UNTREATED CSO DISCHARGE ANNUAL VOLUME (MG) IN THE TYPICAL YEAR		PERCENT REDUCTION
		EXISTING CONDITIONS	FUTURE CONDITIONS W/ CONTROL	
A-42 (Negley Run)	4 OF/year	23.00	5.3	77%
A-51 (East Street)	4 OF/year	111.40	0.4	~100%
C-25 (Bells Run)	4 OF/year	26.00	2.8	89%
M-34 (Becks Run)	4 OF/year	0.28	0.1	64%
M-42 (Streets Run)	4 OF/year	4.40	1.2	73%
M-47 (Nine Mile Run)	4 OF/year	170.50	13.2	92%
MH-11 (McCartney Run)	0 OF/year	2.10	0.0	~100%
MH-18 (Little Saw Mill Run)	0 OF/year	12.00	0.0	~100%
MH-55 (Timberland Street)	0 OF/year	0.54	0.0	~100%
MH-77 (Brookline Boulevard)	0 OF/year	1.99	0.0	~100%
MH-80 (Englert Street)	0 OF/year	0.01	0.0	~100%
S-15 (McNeilly/McDonough's Run)	0 OF/year	12.00	0.0	~100%
S-23 (Brook Street)	0 OF/year	0.77	0.0	~100%
SMRE-40 (Plummer's Run)	0 OF/year	5.60	0.0	~100%
Total		**370.59**	**23.0**	**94%**

ADAPTIVE MANAGEMENT, GREEN INFRASTRUCTURE, AND INTEGRATED WATERSHED PLANNING

PWSA is proposing an evaluation of the ability of green infrastructure and integrated watershed management (IWM) to assist in the control of combined sewer overflows as the first step of a broader adaptive management plan aimed at optimizing the recommended approach to meeting the requirements of the COA. An integrated approach which utilizes a combination of 'green' and 'gray' solutions to address combined sewer overflows and which considers all types of pollutant sources in the watershed to holistically address water quality challenges has the potential to be more cost-effective than a 'gray' only approach and may result in additional triple-bottom-line benefits to the Authority, the city, and its rate payers.

Assessment and implementation of green infrastructure and IWM is proposed through an adaptive management plan designed to objectively assess the ability of green infrastructure to assist in the control of combined sewer overflows and IWM to achieve more efficient compliance with broader water quality standards. This process would utilize an upfront four-year-long, short-term adaptive management implementation plan which would be conducted at the same time as initial 'gray' improvements called for in the baseline compliance approach, but would be completed in time to allow for development of an optimized compliance approach should findings indicate a hybrid 'green/gray' solution or an IWM approach would result in lower costs and greater benefits. The short-term adaptive management implementation plan includes planning and analysis, education and outreach, and implementation and monitoring of demonstration projects.

Green infrastructure refers to a variety of strategies designed to mitigate the effects of development on the surrounding environment, typically using smaller, distributed management practices which infiltrate, evapotranspirate, and/or detain stormwater runoff on-site. Source control, or practices which prevent, eliminate or control the collection of stormwater or groundwater in combined or sanitary sewer systems, is considered a form of green infrastructure. Controlling the total volume of stormwater, timing of discharge, and peak discharge rate through the use of green infrastructure can assist in reducing or eliminating the frequency and total volume of sewer overflows. In addition, the widespread use of green infrastructure practices to manage urban stormwater runoff has been shown to offer numerous other social, economic, and environmental benefits. These include urban greening and revitalization, increases in property value, creation of urban habitat, increases in tree cover and reduction of the urban heat island effect, creation of community spaces and amenities, and traffic calming.

In addition to evaluation of the ability of green infrastructure to assist in the control of CSOs, the adaptive management plan also includes exploration and evaluation of IWM approaches. PWSA's IWM evaluation will focus on the Saw Mill Run watershed and aims to consider CSOs and SSOs in context with others pollutant sources that impact waterway water quality (such as stormwater runoff and dry weather sources). The proposed evaluation is in alignment with USEPA's June 2012 Integrated Planning Framework.

The table below summarizes the primary components and schedule of the short-term adaptive management implementation plan.

TABLE ES-4. SHORT-TERM ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

	Proposed Action
Year 1	The Year 1 Plan focuses on building support behind efforts to expand the use of green infrastructure and IWM in the region and culminates in the initiation of several early demonstration projects which will be used to assess the effectiveness of such practices.
Year 2 & 3	The Year 2 & 3 plan focuses on implementing green infrastructure and IWM projects and assessing the ability of system-wide green infrastructure to assist in the control of combined sewer overflows and the ability of IWM to improve broader water quality. The plan also includes several complimentary actions which will support the implementation, upkeep, and assessment of green infrastructure practices throughout the region.
Year 4	The Year 4 plan focuses on developing a detailed plan to integrate green infrastructure and IWM concepts into PWSA's COA compliance approach. This includes extensive assessment of completed projects, and determination of both the feasibility and cost effectiveness of utilizing green infrastructure to assist in the control of combined sewer overflows and IWM to improve water quality.

The goal of the proposed short-term adaptive management implementation plan is to identify the optimum balance between gray infrastructure, green infrastructure, and watershed-based controls in terms of cost of compliance, impact on water quality, and broader benefits to rate payers. The approach represents a prudent and objective assessment of cost and benefit leading to a reevaluation of the recommended baseline compliance approach. Depending on the results of this assessment, at the end of the initial four-year short-term adaptive management implementation period, a revised Feasibility Study may be submitted to formally request permission to modify or alter the baseline compliance approach. This process may also include or culminate in a formal proposal to PaDEP, ACHD, and US EPA to utilize an integrated planning framework.

MOU AND INTER-MUNICIPAL AGREEMENTS

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for each POC sewershed. Each contributing municipality was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements.

In general, each MOU states that, for the purpose of submitting the Feasibility Study, the municipalities agree on the estimated cost of the recommended alternative. Each municipality shall have the right to void the MOU if the total cost exceeds a certain threshold above the estimated cost. The MOU also states that the municipalities agree that the basis of allocation for costs of each segment is based on percentage of peak flow contributed to each segment at the time of the MOU, multiplied by the preliminary estimated total cost of each segment agreed to by the municipalities that will share in such costs. Each MOU summarizes the preliminary estimate of the percentage and amount of the total cost of implementation of the recommended alternative for each municipality. It is intended that an agreement will be entered into by all parties after an implementation order has been issued by the PaDEP and/or the ACHD. Signature pages of executed MOUs or other expressions of agreement as provided by the municipalities are provided as Addenda to their respective POC reports.

AFFORDABILITY AND FINANCIAL CAPABILITY ANALYSIS

A financial capability assessment of the wet weather plan was developed in accordance with USEPA's *Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development*, February 1997, and serves two purposes: it supports the development of a workable implementation schedule for the wet weather plan, and it can help determine the amount of external funding needed to maintain affordable rates for customers.

The residential indicator (RI) is an approximation of households' abilities to pay their total wastewater costs. An RI less than 1% of MHI is considered a low impact, RHI between 1% and 2% is a mid-range impact, and an RI greater than 2% of MHI is considered a high impact. The annual wastewater cost per household for the PWSA service area is comprised of two components: current (2012) PWSA sewer (collection and conveyance system) costs of $139, and ALCOSAN (conveyance and treatment) costs of $260, for a total of $399. The current (2012) MHI for Pittsburgh is $38,090. Thus, the current condition (2012) RI is approximately 1.05%, which means that the current wastewater costs within the PWSA service area impose mid-range burden on the residential users.

The financial capability indicator (FCI) complements the residential indicator analysis of household affordability by providing an assessment of PWSA's ability to finance the wet weather plan. The FCI compares PWSA, or the city of Pittsburgh, to six EPA-defined benchmarks in the areas of debt burden, socioeconomic conditions, and financial operations. EPA's debt and financial indicators are based on the use of tax revenues to finance wastewater system improvements through general obligation bonds. As a municipal authority, PWSA finances major capital improvements through revenue bonds. As such, where appropriate, a blend of PWSA and Pittsburgh data was used for this analysis. Table ES-5 summarizes the analysis of these financial indicators.

TABLE ES-5. FINANCIAL CAPABILITY INDICATORS

Metric	Value	Score	Score Value
Bond Rating	2.5	Mid-Range	2
Overall Net Debt (as a Percent of Full Market Property Value)	10.09%	Weak	1
Unemployment	0.3%	Mid-Range	2
Median Household Income	30%	Weak	1
Property Tax Revenues (as a Percent of Full Market Property Value)	2.1%	Mid-Range	2
Property Tax Revenue Collection Rate	93%	Weak	1
Indicators Score	-	Mid-Range	1.50

The current financial capability indicator is "mid-range" but very close to "weak." The scores in multiple areas would need to improve substantially in order to reach a "strong" rating, though a slight deterioration of any of the scores could make the indicator "weak."

The costs of PWSA's ongoing Capital Improvements Program along with capital cost inflation of 3.10% will result in increasing annual costs for the existing PWSA collection and conveyance system. The annual costs for the current PWSA facilities are projected to increase from an estimated $26 million in 2012, to $42 million in 2027, and the projected costs in 2046 would be approximately $62 million. The typical cost per household for PWSA's wastewater collection and conveyance services is estimated to be $139 in 2012. Without including the recommended wet weather projects, PWSA costs per typical household would be projected to grow at an annual rate of about 3.34% through 2046. The annual PWSA cost per typical household without the recommended wet weather projects would be projected at $207 in 2027. The ALCOSAN Draft Wet Weather Plan includes estimates for the impacts of a $1.5 billion program completed by 2026 on residential customers. As part of the analysis, an estimate of residential sewer costs without including the PWSA recommended wet weather projects determined that the ALCOSAN cost per household is estimated to increase to nearly $400 annually by 2027. Thus, the total cost per typical household in 2027 without the PWSA wet weather projects and without the ALCOSAN Wet Weather Plan would be approximately $600 annually. Over the time period, household income is projected to increase by 2.50% annually. The PWSA median household income of $38,090 in 2012 would therefore increase to $55,166 in 2027. Dividing the total wastewater costs by the median income yields a Residential Indicator of 1.1%.

The total cost for PWSA customers will be tripled from a projected $399 for the current system to a total of $1,113 during the first full year of operation (2027 dollars). Projected PWSA cost per household will total $306, including about $98 for wet weather plan improvements. The addition of the projected $808 in ALCOSAN costs to the projected $305 in PWSA system costs results in an estimated cost per household in 2027 of $1,113. The current (2012) Pittsburgh median household income of $38,090 is projected to increase to $55,166 in 2027. Dividing the projected annual cost per household of $1,113 by the projected MHI results in a Residential Indicator of 2.02%, or a "high burden" based on the EPA Guidance criteria. The

Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2035, before declining again.

The implementation of the wet weather plan and the related ALCOSAN improvements will result in a dramatic increase in the number of households within the PWSA service area for whom annual wastewater costs will constitute a high burden. The number of households in the service area with a high burden will increase from about 20,000 households in 2012 (15%) to more than 90,000 households in 2027 (68%). Over the same time period, the number of households with a low burden will decrease from around 43,000 (32%) to 4,000 households (2.8%).

Key variables beyond PWSA's control reduce the accuracy of long-term financial projections. Through a sensitivity analysis, PWSA has identified four factors, including residential share of wastewater costs, total capital cost, income growth, and bond interest rates that could materially affect the future residential indicator. The sensitivity analysis conducted on the best-case and worst-case scenarios for critical assumptions suggests a residential indicator range of 1.76% to 2.52%, as shown in the figure below:

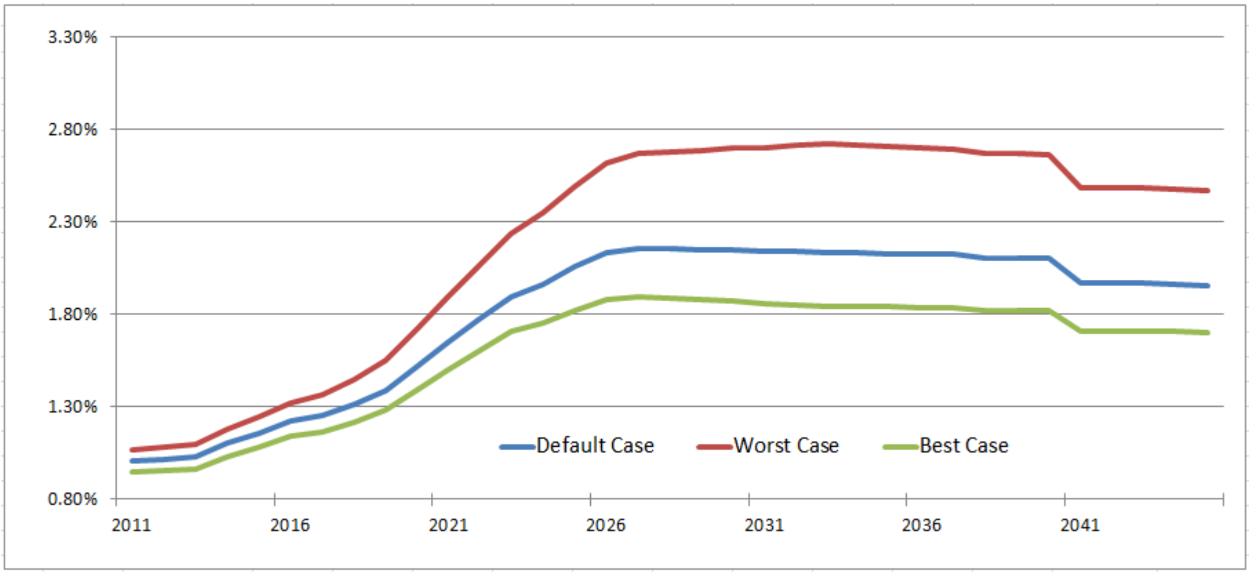


FIGURE ES-6. RESULTS OF SENSITIVITY ANALYSIS ON RESIDENTIAL INDICATOR

Since the ALCOSAN plan cost and timeframe is a significant uncertainty, for the sensitivity analysis, the ALCOSAN WWP is assumed to cost $1.5 billion and be completed by 2026 for all scenarios. For every $100 million increase in the cost of the ALCOSAN program (with no change in schedule), the 2027 PWSA residential indicator increases by 0.05%. Therefore, if the ALCOSAN program requirement reaches $3.1 billion, as some alternative Wet Weather Plans showed, the residential indicator for PWSA customers would increase by an additional 0.8% to nearly 3%.

The impact of implementation of the PWSA Wet Weather Feasibility Study is likely to diminish the future financial capability of the City of Pittsburgh and PWSA. Indicators such as the bond rating indicator and the property tax collection rate are likely to be adversely affected during the period of the Wet Weather Feasibility Study.

In summary, implementing the Wet Weather Feasibility Study and the related ALCOSAN improvements is anticipated to result in a Residential Indicator above 2%. The 2012 Financial Capability Score of 1.5 under current conditions falls into the bottom of the EPA “mid-range” and is at the threshold for a “weak” rating. The Wet Weather Program could easily push the Financial Capability Score below the “weak” threshold due to the increased risk to bond ratings as well as to tax collection rates. Therefore, the overall matrix score is “high burden.” The maximum RI produced by the affordability analysis performed based on the ALCOSAN 2026 Recommended Plan and PWSA construction ending in 2026 is 2.02%. The maximum RI increases to 2.62% when the analysis is changed to reflect the ALCOSAN Selected Plan and an extended construction schedule for PWSA to construct its improvements in alignment with ALCOSAN’s implementation of its Selected Plan.

STAKEHOLDER INVOLVEMENT

PWSA is committed to raising public awareness of the PWSA sewer infrastructure needs so that public support of capital improvement projects can be achieved. Stakeholder involvement and public awareness provide a mechanism to ensure that rate payers, system users, and the public understand the regulatory/environmental drivers for undertaking the wet weather projects and the economic impact that implementation will have on the region. PWSA's continuing goals are to promote stakeholder involvement and undertake a municipal coordination initiative.

PWSA considered it important to engage with the public and convey information on wet weather planning and receive feedback. PWSA's public involvement process included presentations to city council and various stakeholder groups. PWSA also presented at and attended the annual 3RWW sewer conferences, which are open to the public.

PWSA led a series of Wet Weather Feasibility Study coordination meetings with most of the contributing municipalities that are within each multi-municipal sewershed. These meetings with the contributing municipalities were utilized to discuss the information and findings in each of the respective POC feasibility studies.

The "Greening the Pittsburgh Wet Weather Plan" Charrette Project was developed in early 2013 with the primary objective to develop a consensus approach to reviewing, recommending, and incorporating a plan for the implementation of green stormwater infrastructure technologies and policies into the PWSA Wet Weather Feasibility Study. Overall, 125 independent individuals/ stakeholders participated, representing a diverse array of public, private, and non-profit organizations. Each charrette had nearly equal representation from all three sectors. These individuals collectively donated over 1,000 hours of their time to assist PWSA in its effort to better understand the challenges and opportunities associated with green infrastructure.

ALCOSAN created various stakeholder groups under their public participation and municipal coordination programs that were responsible for fostering a consensus-based planning process as well as a stakeholder-supported wet weather plan. PWSA committed to its direct and continuing involvement and cooperation with these stakeholder groups. They provided a forum or conduit for PWSA to convey its constituencies' thoughts and concerns to ALCOSAN so that the best interests of the PWSA and its rate payers were reflected in the regional plan. PWSA had an active role in the Customer Municipality Advisory Committee (CMAC) providing municipal feedback during ALCOSAN's planning process. PWSA and its representatives attended ALCOSAN public meetings and benefited from these opportunities to share public and municipal information and resources.

INTEGRATION WITH THE REGIONAL WET WEATHER PLAN

The selected PWSA improvements are intended to meet the COA requirements, be implemented in conjunction with the ALCOSAN WWP, and integrate new controls from tributary municipalities that discharge flows through the PWSA systems.

The PWSA municipal improvements are typically upstream of the ALCOSAN POCs and generally increase flow capacity in the system, whereas the ALCOSAN improvements are generally downstream of the POC and accept larger volumes of wastewater in order to reduce overflow volumes.

ALCOSAN's WWP consists of the following improvements:

- WWTP upgrades
- Regional tunnels with cross connections to the existing system
- Parallel relief sewers and storage tanks
- Tributary municipal improvements

ALCOSAN acknowledges that the WWP improvements may not be completed by 2026 and suggests a phased approach where a portion of the WWP facilities would be completed by 2026 and the remaining facilities to be completed after 2026.

Only a portion of the PWSA POCs will have their outfalls connected to new regional wet weather facilities. Regulator modifications will be completed at the remaining POCs in order to reduce overflows to the extent possible.

IMPLEMENTATION SCHEDULE

The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional (ALCOSAN) wet weather plan wherever possible. Affordability was also taken into consideration by balanced distribution of the costs of the POC specific and system-wide projects in phases. Inclusion of the adaptive plan management and the Act 537 submittal obligations were also considered in the schedule development process. The schedule assumes the period for review of the PWSA Plan ends July 2014, one year after submission of the FS to the regulatory agencies.

Large-scale design and construction projects require completion of a number of major tasks to progress from project initiation to project closeout. These major tasks considered during this schedule development process include:

- Funding and Public Coordination
- Preliminary Design (includes siting and property acquisition)
- Final Design
- Permitting
- Public Bid / Contract Award
- Construction
- Commissioning and Project Closeout

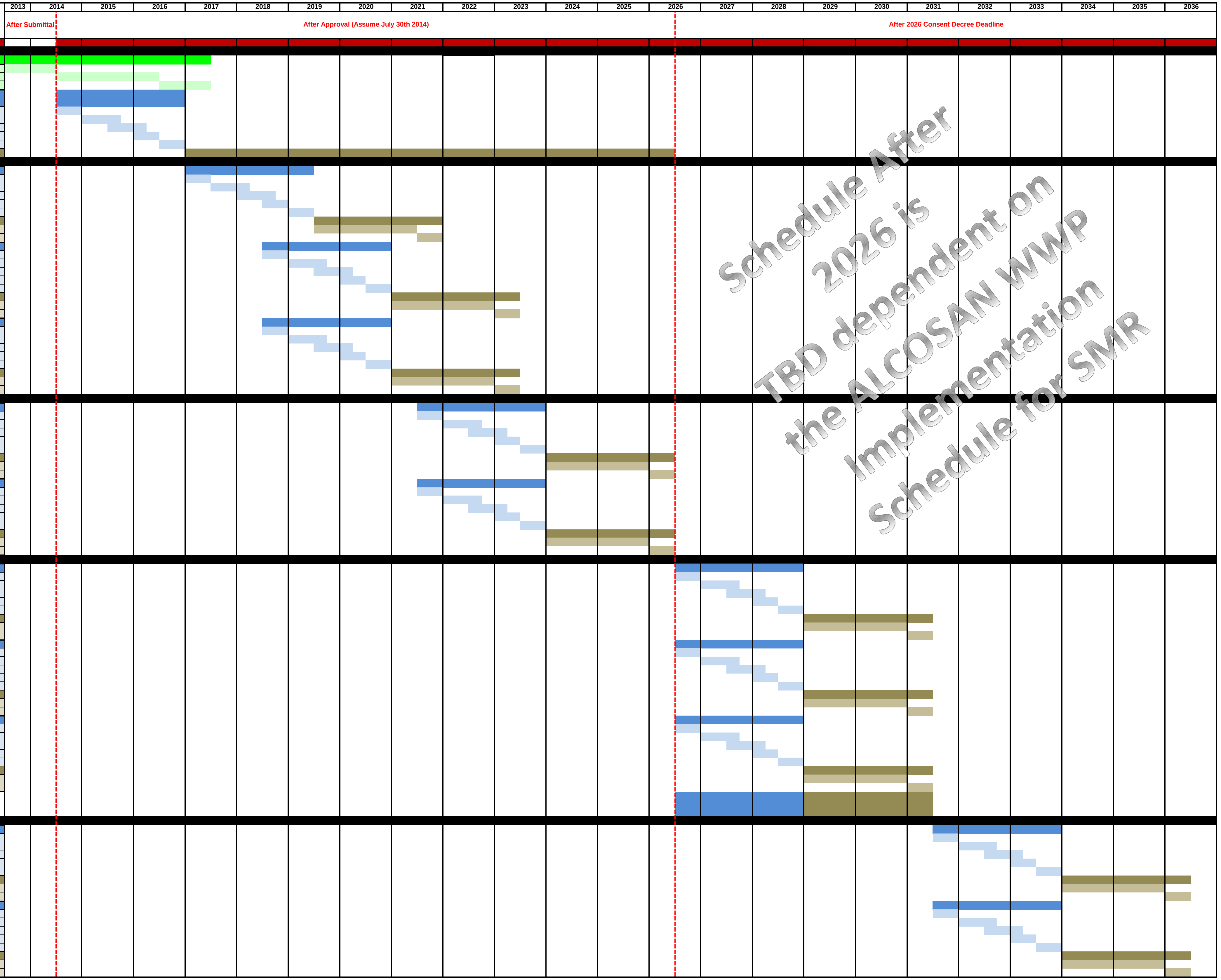
The current ALCOSAN WWP plan includes a schedule that shows the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/agency.

In developing the schedule, the sequencing of the POC specific projects was synchronized with the regional WWP wherever possible. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it is important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended to have the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to realize the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements coinciding closely the ALCOSAN capacity improvements within the portion ALCOSAN is constructing.

The overall implementation schedule is divided into five phases as described below and as shown in the following Figure ES-7.

FIGURE ES-7. IMPLEMENTATION SCHEDULE

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

Phase 1. Phase 1 includes the four-year Adaptive Plan Management and all of the diversion structure modifications and outfall screen installations for all the POC-specific improvements. The results of the Adaptive Management Plan potentially can affect the size and amount of "gray" facilities within all of the other POC-specific improvements other than the diversion chamber modifications and outfall screen installations. The diversion chamber modifications and outfall screens installation work can be started immediately and concurrently with the adaptive management plan since the results of the adaptive management work are not anticipated to affect either the need for or the major design elements of these improvements. The capital cost estimate is $54.1 million, and the phase is implemented between 2013 through 2026. This phase includes all the improvements for M-34, MH-55, and MH-80 which are significantly smaller projects (diversion structure modifications and installation of screens).

Phase 2. Phase 2 includes improvements for C-25, A-42, and A-51, which coincide with the improvements for the Allegheny River Segment and Chartiers Creek retention treatment basin in the ALCOSAN WWP. It is assumed that although the Allegheny River Segment of the regional tunnel does not extend up to the A-42 POC, that the capacity relief would extend upstream and benefit A-42. The capital cost estimate of Phase 2 is $27.6 million. Phase 2 would begin in 2017 and extend to 2023. There is a potential the C-25 construction period may extend to 2026 depending on the ALCOSAN WWP Chartiers Creek construction, which extends from 2018 to 2026.

Phase 3. Phase 3 includes improvements for M-42 and M-47, which coincide with the improvements for the Monongahela River Segment RTB in the ALCOSAN WWP. It is assumed that although the Monongahela River Segment of the regional tunnel does not extend up to these POCs, that the capacity relief would extend upstream and benefit M-42 and M-47. The capital cost estimate of Phase 3 is $21.7 million. Phase 3 would begin in 2021 and extend to 2026.

Phases 4 and 5. Phases 4 and 5 are the SMR POC improvements divided into two phases to distribute the costs if possible. As stated before, the ultimate schedule for SMR depends on the Regional Wet Weather Plan schedule to implement improvements in SMR. Phase 4 includes MH-11, MH-77, S-23, and SMRE-40. The capital cost estimate is $31.5 million. Phase 5 includes MH-18, and S-15 and the capital cost estimate is $25.8 million. The implementation dates are to be determined.

PWSA and their tributary municipalities intend to continue to cooperate in the joint planning and implementation of the recommended alternative. All associated parties in the POC sewershed have participated in planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements.

Section 1 Introduction

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establish criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) conveyance and collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PaDEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PaDEP and the ACHD was entered into on January 29, 2004, and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), PaDEP and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs, COAs (collectively known as the Orders), and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, analyze and perform alternatives analyses, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSO), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN, and other municipal sewer systems are physically and hydraulically interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that PWSA's Feasibility Study, and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, this feasibility study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, this Wet Weather Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required, or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA, are described within the body of this Wet Weather Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using the *Feasibility Study Report for Point of Connection [Name]* format provided by 3RWW (July 2012). These individual POC reports are included in Appendix A of this Wet Weather Feasibility Study.

1.1 FEASIBILITY STUDY OBJECTIVES

The Feasibility Study objectives for the PWSA sewerage system were generated from a combination of objectives outlined in the Feasibility Study Working Group

(FSWG) Document 027 and the PaDEP's Draft Feasibility Study Outline. The objectives of this feasibility study include:

- Identify and present technology, cost, and non-cost analyses that will allow the PWSA to select appropriate CSO control alternatives that best meet the requirements set forth in the City of Pittsburgh / PWSA COA (as amended).
- Participate and cooperate with ALCOSAN in the development of their WWP.
- Submit a municipal flow management compliance plan, also known as a Feasibility Study (FS), by the end of July 2013. The FS will evaluate a range of practicable alternatives to:
    - Meet CWA and Clean Stream Law requirements
    - Eliminate SSOs
    - Fulfill Pennsylvania and USEPA CSO Policy obligations
    - Develop POC Feasibility Studies in conjunction with municipalities that are tributary to PWSA. These POC reports will be named by both the PWSA sewershed name and the ALCOSAN POC sewershed name, to enhance future coordination between the PWSA and ALCOSAN.
    - Develop short-term and long-term flow management proposals that will meet the PWSA's flow management objectives through September 30, 2046, in a manner that is affordable and acceptable to the PWSA and the City of Pittsburgh.

The information documented in this Feasibility Study has been developed through continuing investigations, discussion and negotiations with affected municipalities, considerations regarding the findings of the ALCOSAN Wet Weather Plan, evaluations of receiving water quality issues, a financial capability and affordability analysis, and a determination of what is acceptable to PWSA and the City of Pittsburgh. It is also noted that the identified system improvements have been selected based upon the constraints and requirements of the ALCOSAN CD. Specifically, they represent flow management proposals that are most applicable considering the goal of implementation by 2026. Other solutions may be more appropriate for PWSA if: 1) the time frame for implementation can be significantly extended, 2) ALCOSAN's final plan differs significantly from what is submitted in their January 2013 plan to the regulators, 3) the solutions discussed in this document are not affordable, 4) or it is determined that different methods of managing flows that originate outside of the City are appropriate.

1.2 REPORT CONTENTS

This report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminate in recommended wet weather control alternatives. It presents information regarding:

- The development, evaluation, and selection of recommended alternatives for wet weather control.
- Identification of the highest ranked system improvements with their approximate locations, general facility arrangements, estimated costs, and anticipated performance levels in terms of frequency and amount of CSOs intended to discharge through outfalls.
- Flows to be conveyed to ALCOSAN interceptor facilities, to include flows generated within upstream municipalities that are tributary to the PWSA system.

This Feasibility Study was prepared in accordance with guidelines provided in the 3RWW FSWG Documents, which were developed specifically for this purpose, and in cooperation with participating tributary municipalities. This report is divided into 13 sections, and information contained in each section is summarized below:

Section 1 – Introduction. This section presents the objectives of this Feasibility Study.

Section 2 – Background. This section provides a discussion of the regulatory background and requirements under which this Feasibility Study was prepared, the role that the 3RWW FSWG played in the development of this study, and an overview of municipal coordination.

Section 3 – Existing System Description. This section provides a description of the PWSA sewersheds, the ALCOSAN planning basins within which each sewershed is located, the existing PWSA and tributary municipal systems that are the subject of this study, and the existing overflows that occur in those systems.

Section 4 – Sewer System Characterization. This section describes the flow monitoring data that was collected for the PWSA system, provides a summary of sewer system investigations that were conducted, and discusses defects that were identified and how they were addressed.

Section 5 – Sewer System Capacity Analysis. This section explains the development of the hydraulic analysis tools that were used and the model conditions that were developed and evaluated as a basis for alternatives development.

Section 6 – CSO Control Goals. This section presents the water quality issues that are the reason behind the need for controlling sewer overflows. The levels of CSO control and SSO control that will be evaluated are discussed.

Section 7 – Alternative Evaluation. This section describes the alternative development process. This includes control facilities that will be the responsibility of ALCOSAN, or control facilities that will be the responsibility of municipalities tributary to the PWSA. The alternatives evaluation process includes:

- Control technology screening process
- Control site screening processes
- Control alternative formation
- Control alternative evaluation process
- Cost estimating procedures
- Control alternative selection

Section 8 – Recommended Alternatives. This section provides an overview of each of the selected alternative components for each of the POC sewersheds, the associated alternative costs, and a summary of estimated costs to PWSA.

Section 9 – Adaptive Management, Green Infrastructure, and Integrated Watershed Planning. This section provides a discussion on green infrastructure in the context of wet weather controls, challenges and obstacles to the implementation of green infrastructure, and the PWSA's integrated planning approach to utilize both green and gray solutions to minimize control costs, maximize benefits, and address other community concerns and opportunities.

Section 10 – Financial and Institutional Considerations. This section provides a discussion of how costs will be allocated for implementation of the recommended alternative, including details on financial responsibility agreements, affordability analyses, and funding alternatives.

Section 11 – Stakeholder Involvement. This section provides a summary of meetings and activities which PWSA has sponsored and participated in to facilitate stakeholder involvement and municipal coordination.

Section 12 – Integration of Selected Alternatives. This section explains how the recommended alternative meshes with internal municipal projects that are to be implemented separately from the recommended alternative, and how it will mesh with the overall regional ALCOSAN Recommended Alternative.

Section 13 – Implementation Plan. This section includes details about how the recommended alternative will be implemented including schedule, cost sharing agreements, and O&M agreements.

Section 2 Background

This Feasibility Study (FS) is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

The objective of the *PWSA Feasibility Study Report* (October 2008) was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in this Wet Weather Feasibility Study (WWFS). Those processes and analyses are still valid and form the foundation upon which this Feasibility Study is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which included the following:

- Closed-Circuit Television Report (February 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December 2006)
- PWSA Combined Sewer Overflow Report (January 2007)
- CSO Quality Assessment Technical Memo (June 2007)
- Collection System Inventory and Characterization Report (August 2008)
- Hydraulic and Hydrologic Characterization Report (September 2008)

The *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012) was prepared in response to a request by ALCOSAN, made to all of ALCOSAN's tributary communities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The report was also submitted on behalf of affected municipalities tributary to PWSA.

Details of the regulatory requirements and activities performed leading to this Feasibility Study are presented in the following sections.

2.1 REGULATORY REQUIREMENTS

PWSA's COA of January 2004 (as amended) requires PWSA to coordinate with ALCOSAN and other municipalities in the preparation of a coordinated Feasibility Study. PWSA was also required to implement its own Nine Minimum Controls (NMC) and flow monitoring programs, to develop a plan to eliminate sanitary sewer overflows (SSO), and to control CSOs in compliance with federal, state, and local laws.

Concurrently, ALCOSAN was negotiating its Consent Decree (CD) with the U.S Department of Justice, United States Environmental Protection Agency (USEPA), PaDEP, and ACHD. The ALCOSAN CD, entered on January 23, 2008, called for the submittal of ALCOSAN's Wet Weather Plan (WWP) by January 2013. Many of the requirements of the ALCOSAN CD directly impact the direction PWSA must take as they complete this Feasibility Study. Specifically, ALCOSAN is required under their CD to coordinate with their customer municipalities, which includes the PWSA. ALCOSAN is required to seek specific municipal planning information from their customer municipalities and is also required to provide specific ALCOSAN planning information to their customer municipalities.

In accordance with its COA, the PWSA is preparing this Wet Weather Feasibility Study report. The ultimate goal of the FS is to identify cost-effective CSO control alternatives that, when fully implemented, will serve to protect water quality by meeting CWA and Clean Streams law requirements, eliminating SSOs and fulfilling Pennsylvania and USEPA CSO Policy obligations.

2.2 ROLE OF THE FEASIBILITY STUDY WORKING GROUP

The role of the FSWG has been to facilitate coordination between the municipalities and the regulatory agencies and to provide guidance to the municipalities through the course of achieving compliance with regulatory requirements. The FSWG coordinated with PaDEP at FSWG meetings specifically regarding the Feasibility Studies. The PaDEP provided input on the major points they want each municipality to address in their feasibility studies. These points are as follows:

- Describe the combined sewer system (CSS) hydraulic characterization efforts, hydraulic characterization parameters, tools and other evaluation and estimation tools used by PWSA to develop their Feasibility Study.
- Identify and summarize additional flow monitoring efforts conducted, and other related flow information utilized by PWSA, which is in addition to the ALCOSAN sponsored flow monitoring program.
- For each POC sewershed, describe and comment on the inter-municipal and ALCOSAN cooperation and coordination efforts for which PWSA has actively participated to develop its Feasibility Study.
- For each POC sewershed, briefly outline the flow management proposals developed with all municipalities and ALCOSAN. Should another municipality fail to propose Feasibility Study improvements PWSA deems necessary to fulfill the Feasibility Study objectives, then PWSA should outline those for ACHD and/or Department consideration.

This report, and the tasks performed to generate this report, primarily follows the outline of tasks that the 3RWW FSWG developed with minor deviations. The tasks are listed below:

Task 1 – System Inventory/System Investigation. This task is addressed in Section 3 – Existing System Description of this Wet Weather Feasibility Study, and includes:

- Geographic information systems (GIS) map of the PWSA service area.
- Existing outfalls in the PWSA sewer system.
- Direct stream inflows (DSI) that occur in the PWSA sewer system.

Task 2 – Flow Monitoring Program. This task is addressed in Section 4 – Sewer System Characterization, of this Wet Weather Feasibility Study and includes:

- PWSA flow monitoring efforts completed in support of the *PWSA Feasibility Study Report (October 2008).*

- Regional Collection System Flow Monitoring Program administered by ALCOSAN and coordinated with municipalities and authorities.
- QA/QC'd flow monitoring data.

Task 3 – System Characterization. This task is also addressed in Section 4 – Sewer System Characterization, and includes:

- A summary of sewer system investigations conducted.
- A discussion of any defects that were identified and how they were addressed.
- Identification of defects related to pipe structure, capacity restriction, and inflow.

Task 4 – System Capacity Analysis. This task is addressed in Section 5 – Sewer System Capacity Analysis, of this Wet Weather Feasibility Study and includes:

- Development of the hydraulic analysis tools that were used and the model conditions that were developed and evaluated as a basis for alternative development.
- Establishment of baseline H&H conditions.
- Establishment of future baseline H&H conditions.
- Dry and wet weather evaluations.
- Overflow volumes, frequencies and durations.
- Identification of capacity deficiencies.
- Identification of required capacities.

Task 5 – System Infiltration/Inflow Investigation (separate sanitary sewer systems). This task is also addressed in Section 5 – Sewer System Capacity Analysis, and includes:

- Initial infiltration/inflow screening.

Task 6 – Alternative Evaluation. This task is addressed in Section 7 – Alternative Evaluation, of this Wet Weather Feasibility Study and includes descriptions of:

- The alternative development process.
- The control technology screening process.
- The control site screening processes.

- The control alternative development process.
- The control alternative evaluation process.
- Cost estimating procedures.
- Control alternative selection.
- An estimate of design flows from PWSA to ALCOSAN, for those sewersheds in which PWSA is the only contributor to an ALCOSAN point-of-connection.

The identification and development of control alternatives for the PWSA's separate and combined systems, including internal PWSA CSOs, will be coordinated with ALCOSAN's controls, as recommended in the WWP, and with other municipalities tributary to PWSA.

Task 7 – Alternative Evaluation. This task is addressed in Section 7 and Section 8 - Recommended Alternatives, of this Wet Weather Feasibility Study and includes descriptions of:

- Alternative development process for controls developed for PWSA sewersheds that include facilities that will be the responsibility of the PWSA.
- Alternative development process for controls developed for PWSA sewersheds that include facilities that will be the joint responsibility of the PWSA and one or more upstream tributary municipality.
- The control technology screening process.
- The control site screening processes.
- The control alternative development process.
- The control alternative evaluation process.
- Cost estimating procedures.
- Control alternative selection.

Task 8 – Compare/Review Alternatives with Regional/ ALCOSAN System Alternatives. This task is addressed in Section 12 – Integration of Selected Alternatives, of this Wet Weather Feasibility Study and includes:

- Local governing body acceptance of internal and multi-municipal approaches**.**
- Coordinated evaluation of PWSA and ALCOSAN control alternatives.
- Integration with neighboring municipalities.

Task 9 – Financial and Institutional Analysis. This task is addressed in Section 10 – Financial and Institutional Considerations, of this Wet Weather Feasibility Study and includes:

- MOU and inter-municipal agreements
- Financial analyses.
- Institutional analyses.
- Details on financial responsibility agreements.
- Affordability analyses.
- Funding alternatives.

Task 10 – Feasibility Study Report(s). This task is addressed in Section 12 – Integration of Selected Alternatives, and in Section 13 – Implementation, of this Wet Weather Feasibility Study and includes:

- Explanations on how the recommended alternative meshes with any internal PWSA projects.
- Discussions on how the recommended alternative will mesh with the overall regional ALCOSAN Recommended Alternative.
- Implementation schedule.

2.3 PWSA COORDINATION OVERVIEW

An overall plan for coordination with tributary municipalities is presented in 3RWW FSWG Document 002A. Coordination information specific to PWSA is provided in the following sections.

There are 24 communities adjacent to the City of Pittsburgh that are tributary to, and contribute flow to, the PWSA collection system. In accordance with the January 24, 2004 COA (as amended), PWSA has been coordinating directly with representatives from these municipalities. In addition, PWSA has been coordinating with them through the 3 Rivers Wet Weather Demonstration Program (3RWWDP). Because the 3RWWDP has become the repository for mapping data for these municipalities, PWSA has maintained a close working relationship with 3RWWDP in order to facilitate an on-going exchange of information. The COA requires that all municipalities that are tributary to ALCOSAN develop and conduct a flow monitoring program to obtain data valuable for evaluating current system conditions as well as predicting available system capacity. While PWSA has performed the required flow monitoring (discussed in Section 4 of this Wet Weather Feasibility Study), PWSA has also worked closely and cooperatively with ALCOSAN, as ALCOSAN spearheaded the regional flow-monitoring program.

In order for ALCOSAN to develop and formalize a Wet Weather Plan (WWP) in accordance with their CD, ALCOSAN divided its service area into seven planning basins and commissioned consulting firms with the task of studying each planning basin so that a uniform WWP approach can be achieved. This planning and study process was completed in 2012. ALCOSAN has integrated the recommended controls for each of the planning basins into a comprehensive WWP that was submitted to the appropriate regulatory agencies on January 30, 2013.

The PWSA sewage collection system is largely located within ALCOSAN's Main Rivers planning basin; however, the PWSA service area also extends into ALCOSAN's Upper Allegheny/Pine Creek, Lower Ohio/Girty's Run, Saw Mill Run, Chartiers Creek, and Upper Monongahela planning basins. To date, the PWSA has shared the results of their wet weather planning with ALCOSAN and the affected tributary municipalities, and will continue to coordinate with all involved parties as required such that all plans are complementary.

3.1 ALCOSAN SYSTEM

3.1.1 ALCOSAN Wastewater Treatment Plant

The ALCOSAN wastewater treatment plant (WWTP) is located on the north shore of the Ohio River, downstream from Woods Run, in the City of Pittsburgh. Since it was placed into operation in 1959, the 50-acre site has undergone many improvements to improve effluent to receiving waters.

The WWTP currently processes an average of 250 million gallons per day (mgd) of wastewater, representing treatment service for the City of Pittsburgh and 82 customer municipalities[1]. Despite all the upgrades and expansions made to the WWTP, during wet weather events some combined flows are discharged into the rivers in the form of combined sewer overflows (CSOs).

3.1.2 ALCOSAN Interceptor System

Construction of the ALCOSAN interceptor system began in 1956. ALCOSAN currently maintains approximately 92 miles of interceptor sewer consisting of over 300 regulator structures, five pump stations, two ejector stations, deep tunnels, shallow-cut interceptor sewers, and river crossings[2]. ALCOSAN, for the purposes of completing a comprehensive Wet Weather Plan (WWP), divided its service area into the seven planning basins listed below:

- Main Rivers
- Upper Allegheny River
- Lower Ohio / Girty's Run
- Upper Monongahela River
- Saw Mill Run
- Turtle Creek
- Chartiers Creek

The City of Pittsburgh and satellite communities that PWSA serves are located within the majority of these ALCOSAN service areas/planning basins. A map of the ALCOSAN service area and the seven planning basins is shown in Figure 3-1.

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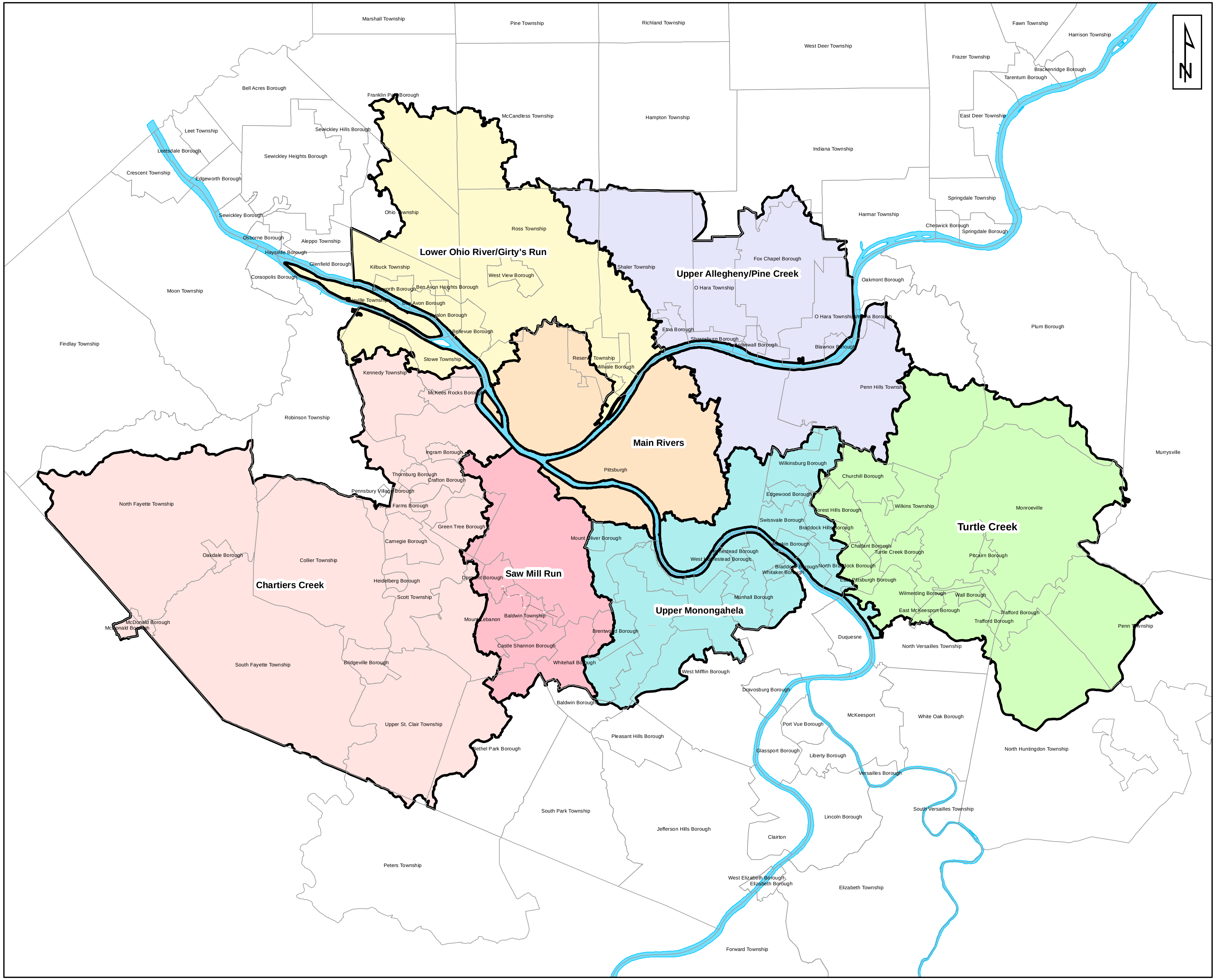
[1] Information from *ALCOSAN Wet Weather Plan* (January 30, 2013).
[2] Information from *ALCOSAN Wet Weather Plan* (January 30, 2013).



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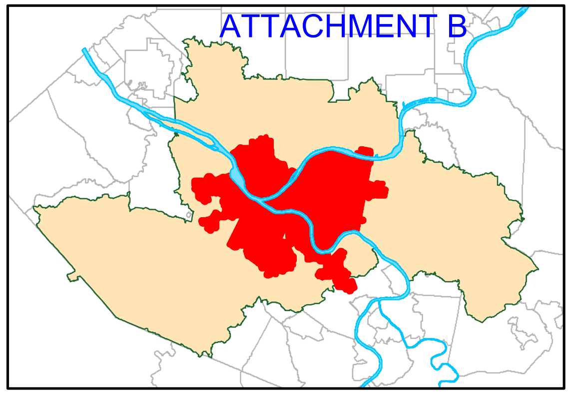

ALCOSAN Service Area Overview

Legend

- □ Municipal Boundary
- ■ Chartiers Creek
- ■ Lower Ohio River / Girty's Run
- ■ Main Rivers
- ■ Saw Mill Run
- ■ Turtle Creek
- ■ Upper Allegheny / Pine Creek
- ■ Upper Monongahela
- ■ River

14,000 7,000 0 14,000 Feet

Figure 3 - 1: ALCOSAN Service Area & Planning Basins

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 3-1_ALCOSAN SERVICE AREA_PLANNING BASIN.mxd

A number of the CSO diversion structures are located along ALCOSAN interceptors. The purpose of the diversion structures is to intercept and convey dry weather flows to the wastewater plant and divert combined flows that would exceed the capacity of the interceptor and treatment plant to receiving waters. Overflows are discharged into receiving waters by a CSO outfall either located at the diversion structure or at the downstream end of an overflow pipe. Many diversion structures that have low invert elevations are equipped with flap gates to prevent water and sediment components of the receiving waters from entering the diversion structure and associated interceptor.

Typically, CSO diversion structures discharge CSO into receiving waters when wet weather flow increases in the interceptor and causes the hydraulic grade line (HGL) to reach a level high enough to activate the overflow. The HGL required to activate an overflow is typically governed by the control elevation within the structure or by the hydraulic grade line of the receiving waters. Abnormal discharges from diversion structures can occur during dry weather when the interceptor becomes blocked or partially blocked with debris or grease. These discharges are not permitted and are subject to enforcement action.

3.2 PWSA SYSTEM

The PWSA sewer system is primarily a combined collection system that serves the entire City of Pittsburgh. The PWSA sewage collection system also serves as a conveyance system for portions of flows from 24 neighboring municipal communities. Wastewater flows generated in neighboring communities are conveyed through parts of the PWSA collection system to the ALCOSAN interceptor system. The wastewater collected by the PWSA system is treated and managed by ALCOSAN. ALCOSAN also manages enforcement of industrial pretreatment in the PWSA service area. The PWSA service area, including the City of Pittsburgh and satellite communities served by PWSA, is illustrated in Figure 3-2.

The PWSA sewer system is comprised of sanitary, storm, and combined sewers, manholes, inlets, catch basins, diversion structures, flow dividers, outfalls, pump stations, and ancillary facilities. A limited quantity of dedicated sanitary and storm sewer systems exist throughout the PWSA service area. At present, the PaDEP requires that all new developments provide separate sanitary and storm sewers. Thus, the proportion of separate sewers is gradually increasing.

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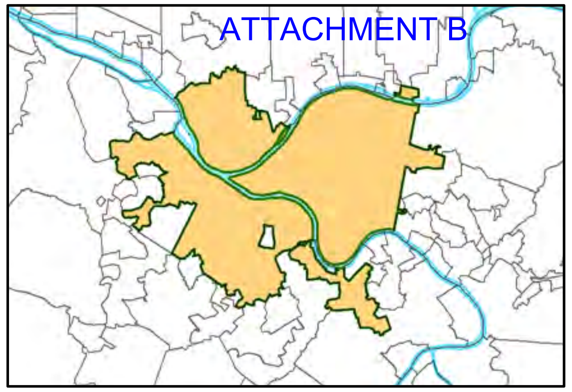
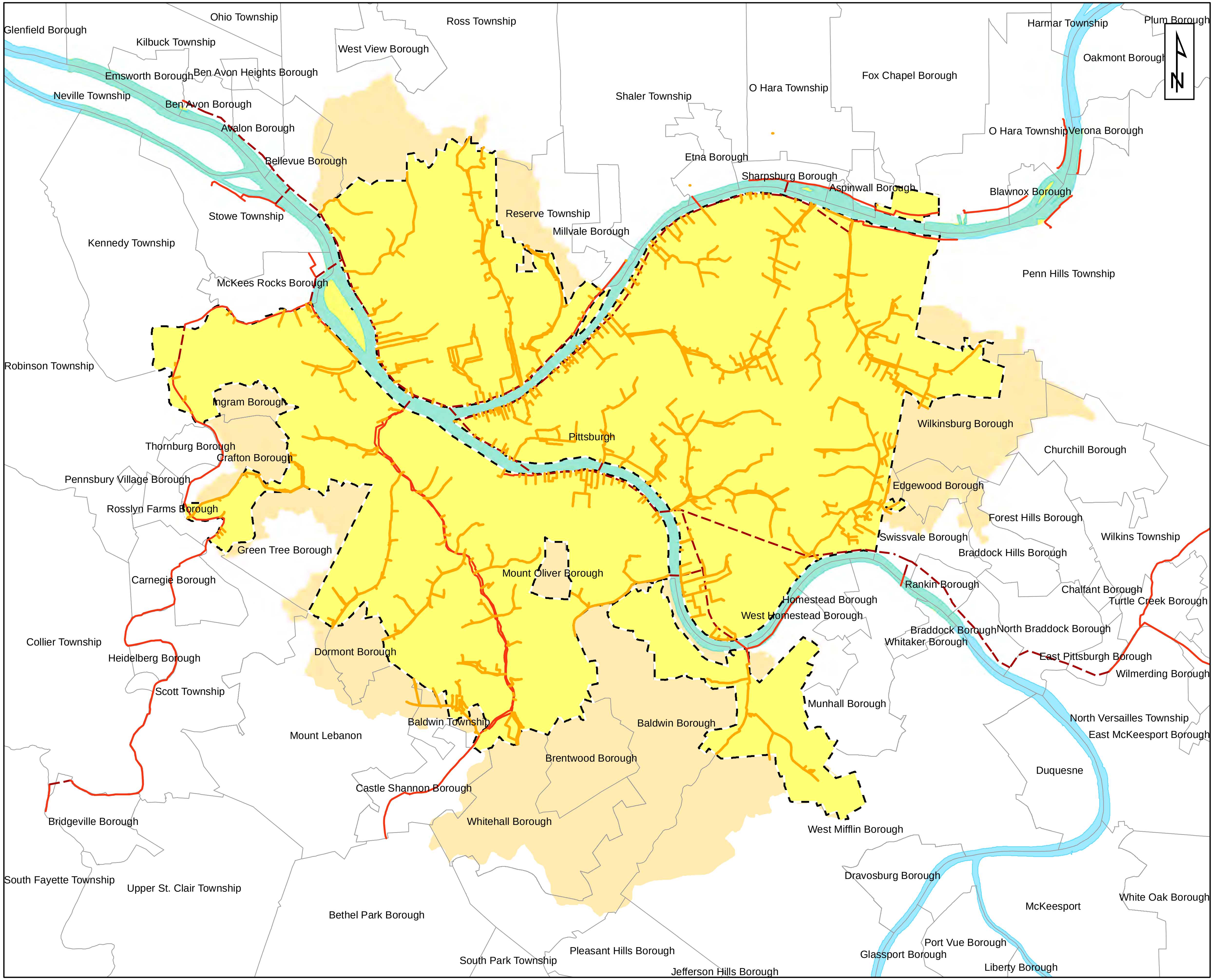


PWSA Service Area Overview



Legend

- Trunk Sewers
- PWSA Service Area Boundary
- Extended PWSA Service Area Boundary
- Municipal Boundary
- River

Existing ALCOSAN Interceptor

- Deep Tunnel
- Shallow Cut

7,000 3,500 0 7,000 Feet

Figure 3 - 2: PWSA Service Area

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE ES-1 PWSA SERVICE AREA OVERVIEW.mxd

PWSA maintains Geographic Information System (GIS)-based mapping of its entire wastewater collection system in a North American Datum of 1983 (NAD 83) Pennsylvania South projection. Although the collection system assets have not been fully field verified, surveyed, or updated to incorporate sewer system changes from capital improvement projects, PWSA continues to perform field inspections to update present GIS-based mapping. PWSA recognizes that this resource represents the most accurate inventory of its collection system assets. Combined with PWSA's as-built and record drawings, existing data regarding the PWSA's collection system is extensive. Further inventory activities of the PWSA combined collection system manholes and stormwater catch basins were conducted as part of PWSA's COA compliance program. The quantities identified herein are approximations based upon PWSA's most current GIS-based mapping of its wastewater collection system. Details regarding the asset information can be found in the *Collection System Inventory and Characterization Report* (August 2008).

3.2.1 Pipes

The PWSA sewer collection system consists of approximately 1,080 miles of sewer ranging in size from six inches to 156 inches. Approximately 77 percent of the PWSA service area is served by combined sewers; however, as noted above, the percentage of separate sanitary and storm sewers is gradually increasing.

3.2.2 Manholes

The PWSA sewer system consists of approximately 29,000 manholes.

3.2.3 Diversion Structures

There are 74 active diversion structures, also known as diversion chambers (identified with DC prefix), within the PWSA sewer system. The diversion structures regulate combined flows during wet weather conditions to prevent surcharges within the system.

3.2.4 Outfalls

PWSA is currently authorized by the PaDEP to discharge combined sewage during wet weather events from CSO outfalls located throughout the City of Pittsburgh. The current NPDES permit that authorizes PWSA to discharge combined sewage requires that the Authority maintain all of its facilities in accordance with the Nine Minimum Controls (NMC) to minimize the duration and frequency of CSO discharges. Moreover, PWSA has recently reconciled the number of permitted CSOs within their system, as some of them had been modified or closed as part of their COA compliance activities. Detailed write-ups for each of the outfalls, both PWSA- and ALCOSAN-owned, are included below in Section 3.3. The outfall locations are illustrated in Figure 3-3.

3.2.5 Pump Stations

There are four sewage pump stations within the PWSA sewer system. The stations are located at Evergreen Road, Mifflin Road, Rodgers Street, and Browns Hill Road. All four pump stations underwent rehabilitation in 1983 and 1984, which consisted of replacement of the pumps and drive units. Each station is also outfitted with Supervisory Control and Data Acquisition (SCADA) instrumentation and telemetry systems to enable PWSA to monitor conditions from a central control station at the water treatment plant. The systems allow PWSA to identify operational issues on a 24–hour-per-day basis. Furthermore, each station is inspected daily to verify pump station performance and reduce overflows.

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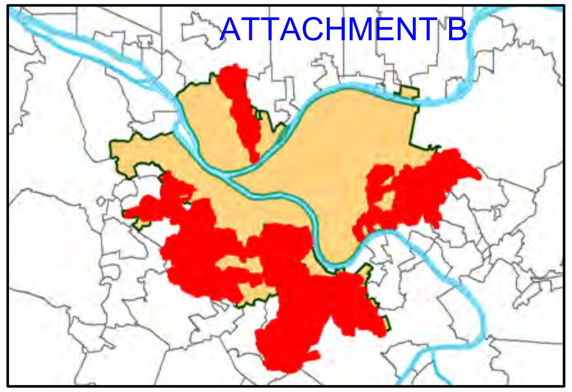
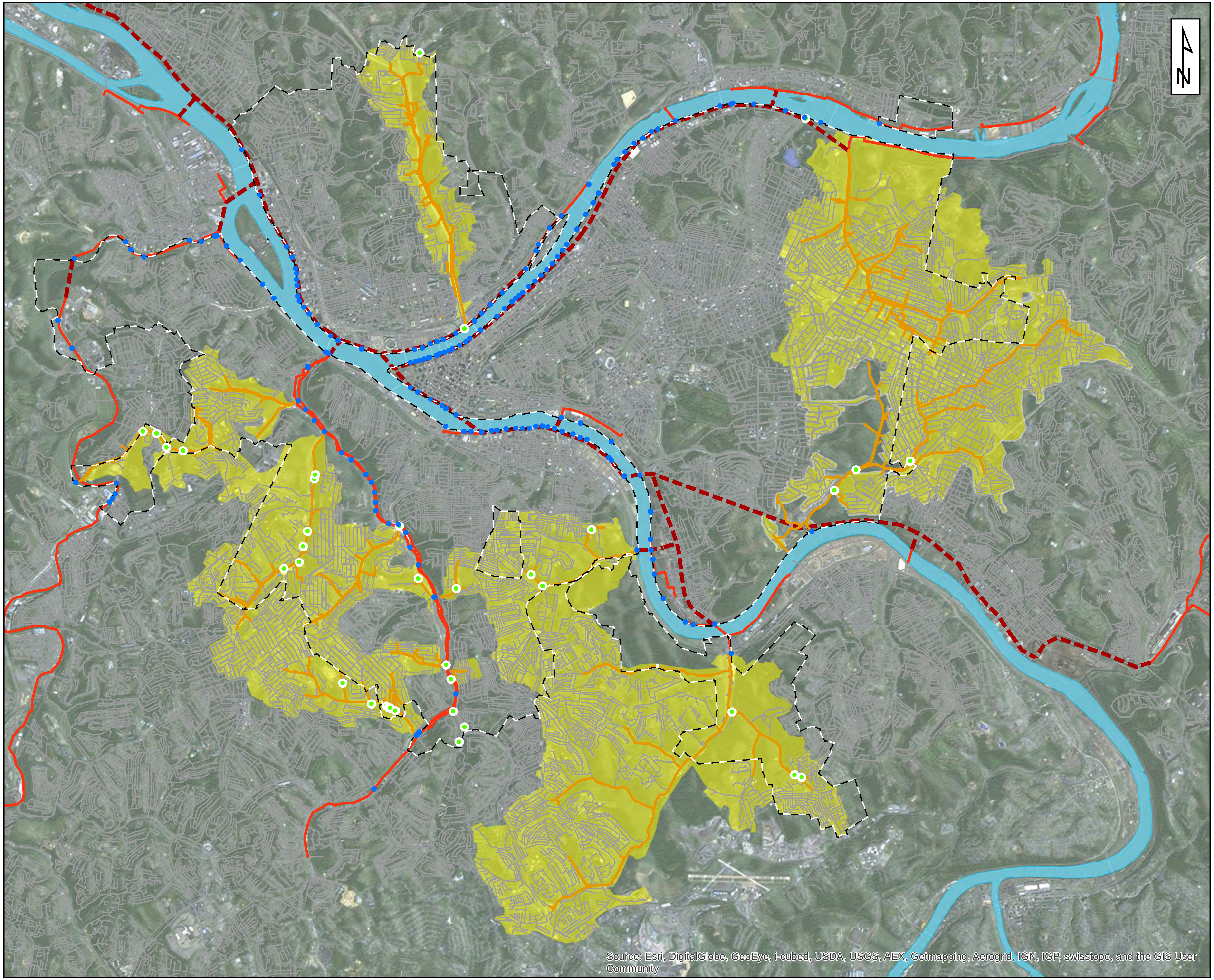


PWSA Service Area Overview



Legend

- ● PWSA Sewer Outfall
- ● ALCOSAN Sewer Outfall
- — Trunk Sewer
- — Collector Sewer
- 🟨 14 POC Sewershed Boundaries
- ▭ PWSA Service Area Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ▬ ▬ Deep Tunnel
- — Shallow Cut

Figure 3 - 3: CSO Locations

July 2013

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3.3 EXISTING OUTFALL / SEWERSHED DESCRIPTIONS

Summaries of both PWSA and ALCOSAN-owned outfalls, applicable sewershed(s), and other relevant appurtenances are described in this section. The majority of this information was derived from the outfall/sewershed descriptions found in the *PWSA Feasibility Study Report* (October 2008). More detailed information related to the sewersheds, including descriptions, mapping, and statistics, can be found in PWSA's *Collection System Inventory and Characterization Report* (August 2008).

These summaries are arranged geographically in the following groups (see report sub-section):

• Downtown Allegheny Sewersheds	(3.3.1)
• Strip District Sewersheds	(3.3.2)
• Two Mile Run Sewersheds	(3.3.3)
• Lawrenceville Sewersheds	(3.3.4)
• Heth's Run Sewersheds	(3.3.5)
• Negley Run Sewershed	(3.3.6)
• Dasher Street Sewersheds	(3.3.7)
• Spring Garden Sewersheds	(3.3.8)
• Downtown Monongahela Sewersheds	(3.3.9)
• Second Avenue Sewersheds	(3.3.10)
• Boundary Street Sewershed	(3.3.11)
• Hazelwood Sewersheds	(3.3.12)
• Nine Mile Run Sewershed	(3.3.13)
• Jacks Run and Woods Run Sewersheds	(3.3.14)
• Ohio River North Sewersheds	(3.3.15)
• East Street Sewersheds	(3.3.16)
• Lower Chartiers Creek Sewersheds	(3.3.17)
• Upper Chartiers Creek Sewersheds	(3.3.18)
• Bells Run Sewersheds	(3.3.19)
• Glen Mawr Sewersheds	(3.3.20)

- Saw Mill Run Interceptor Sewersheds	(3.3.21)
- Olympia, Shaler, and Woodruff Sewersheds	(3.3.22)
- Little Saw Mill Run Sewersheds	(3.3.23)
- Miscellaneous Saw Mill Run Sewersheds	(3.3.24)
- Plummer's Run Sewershed	(3.3.25)
- McDonough's/McNeilly Run Sewershed	(3.3.36)
- Arlington through 25th Street Sewersheds	(3.3.27)
- Becks Run Sewersheds	(3.3.28)
- Streets Run Sewersheds	(3.3.29)
- Weymans Run Sewershed	(3.3.30)

3.3.1 Downtown Allegheny Sewersheds

A-01, Barbeau Street Sewershed. Outfall 008PA01 conveys overflows from the ALCOSAN diversion structure A-01 to the Allegheny River. The outfall and diversion structure are located along the Allegheny River at Commonwealth Place. The service area includes approximately 8 acres (total) of commercial and residential property along Commonwealth Place, including the Wyndham Grand Hotel and Gateway Center Tower #3. The collection and conveyance system consists of approximately 4,900 linear feet of sewers and 24 manholes. The service area contains some dedicated storm sewers that are located along Liberty Avenue and within Point State Park, however flows in dedicated storm sewers are combined with sanitary flows before being regulated by the ALCOSAN system.

A-02, Fancourt Street Sewershed. Outfall 008RA02 conveys overflows from the ALCOSAN diversion structure A-02 to the Allegheny River. The outfall and diversion structure are located along the Allegheny River at Gateway Center. The service area includes approximately 1 acre (total) of residential and commercial property along Fort Duquesne Boulevard, including parts of Gateway Center complex. The collection and conveyance system consists of approximately 500 linear feet of sewers and 3 manholes. Nearly all of the service area is combined sewer.

A-03, Evans Way Sewershed. Outfall 008RA03 conveys overflows from the ALCOSAN diversion structure A-03 to the Allegheny River. The outfall and diversion structure are located along the Allegheny River at Gateway Center. The service area includes approximately 2 acres (total) of residential and commercial property along Fort Duquesne Boulevard, including the Gateway Center complex. The collection and conveyance system consists of approximately 250 linear feet of sewers and 1 manhole. Nearly all of the service area is combined sewer.

A-04, Stanwix Street Sewershed. Outfall 008RA04 conveys overflows from the ALCOSAN diversion structure A-04 to the Allegheny River. The outfall and diversion structure are located along the Allegheny River at Stanwix Street. The service area includes approximately 20 acres (total) of residential and commercial property along Stanwix Street. The collection and conveyance system consists of approximately 8,600 linear feet of sewers and 60 manholes. Nearly all of the service area is combined sewer.

A-05, Cecil Place Sewershed. Outfall 008RA05 conveys overflows from the ALCOSAN diversion structure A-05 to the Allegheny River. The outfall and diversion structure are located along the Allegheny River at Cecil Place. The service area includes approximately 5 acres (total) of residential and commercial property along Cecil Place and Fifth Avenue. The collection and conveyance system consists of approximately 2,600 linear feet of sewers and 15 manholes. Nearly all of the service area is combined sewer.

A-06, Sixth Street Sewershed. Outfall 008SA06 conveys overflows from the ALCOSAN diversion structure A-06 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at the Roberto Clemente Bridge. The service area includes approximately 12 acres (total) of residential and commercial property along Sixth Street and Market Street. The collection and conveyance system consists of approximately 4,500 linear feet of sewers and 26 manholes. Nearly all of the service area is combined sewer.

A-07, Barkers Place Sewershed. Outfall 008SA07 conveys overflows from the ALCOSAN diversion structure A-07 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at Barkers Place. The service area includes approximately 7 acres (total) of residential and commercial property along Barkers Place and Penn Avenue. The collection and conveyance system consists of approximately 3,100 linear feet of sewers and 21 manholes. Nearly all of the service area is combined sewer.

A-08, Scott Place Sewershed. Outfall 008SA08 conveys overflows from the ALCOSAN diversion structure A-08 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at Scott Place. The service area includes approximately 2 acres (total) of residential and commercial property between Barkers Place and Seventh Street. The collection and conveyance system consists of approximately 900 linear feet of sewers and 3 manholes. Nearly all of the service area is combined sewer.

A-09, Seventh Street Sewershed. Outfall 008SA09 conveys overflows from the ALCOSAN diversion structure A-09 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at the Seventh Street Bridge. The service area includes approximately 23 acres (total) of residential and commercial property along Seventh Street, Oliver Street, and Sixth Avenue. The collection and conveyance system consists of approximately 8,600 linear feet of sewers and 58 manholes. Sewer separation occurred along Sixth Avenue during the construction of the light rail corridor, however the sewer separation is local and the remainder of the drainage area is combined sewer.

A-10, Eighth Street Sewershed. Outfall 008SA10 conveys overflows from the ALCOSAN diversion structure A-10 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at Eighth Street. The service area includes approximately 11 acres (total) of residential and commercial property along Eighth Street and Strawberry Way. The collection and conveyance system consists of approximately 4,100 linear feet of sewers and 17 manholes. Nearly all of the service area is combined sewer.

A-11, Ninth Street Sewershed. Outfall 009JA11 conveys overflows from the ALCOSAN diversion structure A-11 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at the Ninth Street Bridge. The service area includes approximately 6 acres (total) of residential and commercial property along Ninth Street. The collection and conveyance system consists of approximately 1,500 linear feet of sewers and 6 manholes. Nearly all of the service area is combined sewer.

A-12, Garrison Place Sewershed. Outfall 009JA12 conveys overflows from the ALCOSAN diversion structure A-12 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at Garrison Place. The service area includes approximately 74 acres (total) of residential and commercial property in the Downtown area and Hill District. The collection and conveyance system consists of approximately 14,500 linear feet of sewers and 80 manholes. Nearly all of the service area is combined sewer.

A-13, 10th Street Sewershed. Outfall 009JA13 conveys overflows from the ALCOSAN diversion structure A-13 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at the Convention Center. The service area includes approximately 17 acres (total) of residential and commercial property along Tenth Street and Liberty Avenue. The collection and conveyance system consists of approximately 3,500 linear feet of sewers and 26 manholes. Sewer separation occurred within the vicinity of the Convention Center during its construction. The remainder of the drainage area is combined sewer.

A-13A, 11th Street Sewershed. Outfall 009JA13A conveys overflows from the ALCOSAN diversion structure A-13A to the Allegheny River. The outfall is located along the south bank of the Allegheny River at Eleventh Street, while the ALCOSAN diversion structure is located at the intersection of Eleventh Street and Smallman Street. The service area includes approximately 22 acres (total) of residential and commercial property in the Downtown area. The collection and conveyance system consists of approximately 7,100 linear feet of sewers and 44 manholes. Nearly all of the service area is combined sewer.

A-14, 12th Street Sewershed. Outfall 009KA14 conveys overflows from the ALCOSAN diversion structure A-14 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 12th Street. The service area includes approximately 61 acres (total) of residential and commercial property in the Downtown area and Hill District. The collection and conveyance system consists of approximately 15,500 linear feet of sewers and 80 manholes. Nearly all of the service area is combined sewer.

A-14A, 13th Street Sewershed. Outfall 009FA14A conveys overflows from the ALCOSAN diversion structure A-14A to the Allegheny River. The outfall is located along the south bank of the Allegheny River at 13th Street, while the ALCOSAN diversion structure is located at the intersection of Smallman Street and 13th Street. The service area includes approximately 4 acres (total) of commercial property in the Strip District within the vicinity of 13th Street. Regulated flows from the ALCOSAN structure are conveyed and introduced to the A-15 sewershed. The collection and conveyance system consists of approximately 690 linear feet of sewers and 5 manholes. A dedicated storm sewer system is located within the sewershed, however it is unknown exactly to what extent the sewershed is separated.

A-15, 14th Street Sewershed. Outfall 009FA15 conveys overflows from the ALCOSAN diversion structure A-15 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 14th Street. The service area includes approximately 16 acres (total) of commercial property in the Strip District between 14th Street and 16th Street, which includes 3 acres of commercial property in the A-14A sewershed. The A-14A structure directs regulated flows to the A-15 sewershed. This configuration allows sanitary flow in the A-14A shed to reach the ALCOSAN system. The collection and conveyance system consists of approximately 6,600 linear feet of sewers and 34 manholes. Nearly all of the service area is combined sewer.

3.3.2 Strip District Sewersheds

A-16, 17th Street Sewershed. Outfall 009CA16 conveys overflows from the ALCOSAN diversion structure A-16 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 17th Street. The service area includes approximately 28 acres (total) of commercial property in the Strip District between 15th Street and 18th Street, which includes a significant portion of the business district/marketplace section of the Strip District. The collection and conveyance system consists of approximately 4,600 linear feet of sewers and 35 manholes. Nearly all of the service area is combined sewer.

A-17, 20th Street Sewershed. Outfall 024SA17 conveys overflows from the ALCOSAN diversion structure A-17 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 20th Street. The service area includes approximately 27 acres (total) of commercial property in the Strip District between 18th Street and 21st Street, which includes a significant portion of the business district/marketplace section of the Strip District. The collection and conveyance system consists of approximately 8,100 linear feet of sewers and 40 manholes. Nearly all of the service area is combined sewer.

A-17A, 22nd Street Sewershed. Outfall 024SA17A conveys overflows from the ALCOSAN diversion structure A-17A to the Allegheny River. The outfall is located along the south bank of the Allegheny River at 22nd Street, while the ALCOSAN diversion structure is located at the intersection of Railroad Street and 22nd Street. The service area includes approximately 3 acres (total) of commercial property in the Strip District along 22nd Street. The collection and conveyance system consists of approximately 900 linear feet of sewers and 3 manholes. Nearly all of the service area is combined sewer.

A-17B, 23rd Street Sewershed. Outfall 024SA17B conveys overflows from the ALCOSAN diversion structure A-17B to the Allegheny River. The outfall is located along the Allegheny River at 23rd Street, while the ALCOSAN structure is located at the intersection of Railroad Street and 23rd Street. The service area includes approximately 5 acres (total) of commercial property in the Strip District along 23rd Street. Nearly all of the service area is combined sewer.

A-18, 24th Street Sewershed. Outfall 024MA18 conveys overflows from the ALCOSAN diversion structure A-18 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 24th Street. The service area includes approximately 43 acres (total) of commercial property in the Strip District. The collection and conveyance system consists of approximately 4,000 linear feet of sewers and 21 manholes. Nearly all of the service area is combined sewer.

A-18A, 25th Street Sewershed. Outfall 025JA18A conveys overflows from the ALCOSAN diversion structure A-18A to the Allegheny River. The outfall is located along the south bank of the Allegheny River at 25th Street, while the ALCOSAN diversion structure is located at the intersection of Railroad Street and 25th Street. The service area includes approximately 19 acres (total) of commercial property in the Strip District between 25th Street and 26th Street. The collection and conveyance system consists of approximately 2,100 linear feet of sewers and 9 manholes. Nearly all of the service area is combined sewer.

A-18B, 26th Street Sewershed. Outfall 025JA18B conveys overflows from the ALCOSAN diversion structure A-18B to the Allegheny River. The outfall is located along the south bank of the Allegheny River at 26th Street, while the ALCOSAN diversion structure is located at the intersection of Railroad Street and 26th Street. The service area includes approximately 5 acres (total) of commercial property in the Strip District along 26th Street. Nearly all of the service area is combined sewer.

A-19, 27th Street Sewershed. Outfall 025EA19 conveys overflows from the ALCOSAN diversion structure A-19 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 27th Street. The service area includes approximately 16 acres (total) of commercial property in the Strip District along 27th Street. The collection and conveyance system consists of approximately 3,000 linear feet of sewers and 16 manholes. Nearly all of the service area is combined sewer.

A-19A, 28th Street Sewershed. Outfall 025FA19A conveys overflows from the ALCOSAN diversion structure A-19A to the Allegheny River. The outfall is located along the south bank of the Allegheny River at 28th Street, while the ALCOSAN diversion structure is located at the intersection of Railroad Street and 28th Street. The service area includes approximately 145 acres (total) of residential and commercial property in the Strip District and Polish Hill. The collection and conveyance system consists of approximately 26,000 linear feet of sewers and 110 manholes. Nearly all of the service area is combined sewer.

A-19B, 29th Street Sewershed. Outfall 025BA19B conveys overflows from the ALCOSAN diversion structure A-19B to the Allegheny River. The outfall and diversion structure are located along the Allegheny River at 29th Street. The service area includes approximately 1 acre (total) of commercial property in the Strip District along 29th Street. Nearly all of the service area is combined sewer.

A-20, 30th Street Sewershed. Outfall 025BA20 conveys overflows from the ALCOSAN diversion structure A-20 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 30th Street. The service area includes approximately 53 acres (total) of commercial property in the Strip District between 29th Street and 31st Street. The collection and conveyance system consists of approximately 8,900 linear feet of sewers and 50 manholes. Nearly all of the service area is combined sewer.

A-21, 31st Street Sewershed. Outfall 048PA21 conveys overflows from the ALCOSAN diversion structure A-21 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 31st Street. The service area includes approximately 50 acres (total) of commercial and residential property in the Strip District and Polish Hill in the vicinity of 31st Street. The collection and conveyance system consists of approximately 10,000 linear feet of sewers and 31 manholes. Nearly all of the service area is combined sewer.

3.3.3 Two Mile Run Sewersheds

A-22, 32nd Street Sewershed. Outfall 048RA22 conveys overflows from the ALCOSAN diversion structure A-22 to the Allegheny River. The outfall is located along the south bank of the Allegheny River at 32nd Street, while the. ALCOSAN diversion structure is located near the intersection of Smallman Street and 32nd Street. The service area includes approximately 1,610 acres (total) residential and commercial property of the Strip District, Polish Hill, Bloomfield, Oakland, Shadyside, Friendship, and East Liberty neighborhoods. The UPMC Shadyside Hospital and West Penn Hospital are also located in this service area. The collection and conveyance system consists of approximately 376,000 linear feet (71 miles) of sewers and 1,400 manholes. Nearly all of the service area is combined sewer.

The two primary trunk sewers providing service in the sewershed travel through the East Busway/Norfolk Southern Railroad corridor. These trunk sewers vary in size from 6 feet to 13 feet in size.

A-23, 33rd Street Sewershed. Outfall 048LA23 conveys overflows from the ALCOSAN diversion structure A-23 to the Allegheny River. The outfall is located along the Allegheny River at 33rd Street, while the ALCOSAN structure is located near the intersection of Smallman Street and 33rd Street. The service area includes approximately 270 acres (total) of residential a commercial property in the Strip District and Bloomfield neighborhoods. The collection and conveyance system consists of approximately 63,000 linear feet (12 miles) and 250 manholes. Nearly all of the service area is combined sewer.

An 8-ft diameter trunk sewer that provides service for the collection area travels through the East Busway/Norfolk Southern Railroad corridor from Cayuga Street to Smallman Street.

3.3.4 Lawrenceville Sewersheds

A-25, 36th Street Sewershed. Outfall 048GA25 conveys overflows from the ALCOSAN diversion structure A-25 to the Allegheny River. The outfall and ALCOSAN diversion structure are located along the south bank of the Allegheny River at 36th Street. The service area includes approximately 42 acres (total) of commercial and residential property in the Lawrenceville neighborhood in the vicinity of 36th Street. The collection and conveyance system consists of approximately 6,500 linear feet of sewers and 31 manholes. Nearly all of the service area is combined sewer.

A-26, 38th Street Sewershed. Outfall 048DA26 conveys flows from ALCOSAN diversion structure A-26 to the Allegheny River. The outfall and ALCOSAN diversion structure are located along the south bank of the Allegheny River at 38th Street. The service area includes approximately 58 acres (total) of commercial and residential property in the Lawrenceville neighborhood in the vicinity of 38th Street. The collection and conveyance system consists of approximately 6,300 linear feet of sewers and 23 manholes. Nearly all of the service area is combined sewer.

A-27, 40th Street Sewershed. Outfall 048DA27 conveys overflows from ALCOSAN diversion structure A-27 to the Allegheny River. The outfall and ALCOSAN diversion structure are located along the south bank of the Allegheny River at 40th Street. ALCOSAN structure A-27 also accommodates regulated flows from ALCOSAN structure A-27A. The service area includes approximately 15 acres (total) of commercial and residential property in the Lawrenceville neighborhood between 40th Street and Main Street. The collection and conveyance system consists of approximately 7,600 linear feet of sewers and 30 manholes. Nearly all of the service area is combined sewer.

A-27A, 40th Street Sewershed. Outfall 048DA27A conveys overflows from ALCOSAN diversion structure A-27A to the Allegheny River. The outfall and ALCOSAN diversion structure are located along the south bank of the Allegheny River at 40th Street. ALCOSAN diversion structure A-27A directs its regulated flows to ALCOSAN diversion structure A-27. The service area includes approximately 39 acres (total) of commercial and residential property in the Lawrenceville neighborhood along 40th Street. The collection and conveyance system consists of approximately 3,600 linear feet of sewers and 16 manholes. Nearly all of the service area is combined sewer.

A-28, 43rd Street Sewershed. Outfall 080NA28 conveys overflows from the ALCOSAN diversion structure A-28 to the Allegheny River. The outfall and ALCOSAN diversion structure are located along the south bank of the Allegheny River at 43rd Street. The service area includes approximately 111 acres (total) residential and commercial property of the Lawrenceville neighborhood. The collection and conveyance system consists of about 28,400 linear feet (5 miles) of sewers and 145 manholes. Nearly all of the service area is combined sewer.

A-29, 48th Street Sewershed. Outfall 080EA29 conveys overflows from the ALCOSAN diversion structure A-29 to the Allegheny River. The outfall and ALCOSAN diversion structure are located along the south bank of the Allegheny River at 48th Street. The service area includes approximately 107 acres (total) of commercial and residential property in the Lawrenceville neighborhood between 45th Street and 48th Street. The collection and conveyance system consists of approximately 15,300 linear feet of sewers and 59 manholes. Nearly all of the service area is combined sewer.

A-29A, 48th Street Sewershed. Outfall 080BA29A conveys overflows from the ALCOSAN diversion structure A-29A to the Allegheny River. The outfall is located along the south bank of the Allegheny River at 49th Street, while the ALCOSAN diversion structure is located along the Allegheny Valley Railroad at 49th Street. The service area includes approximately 629 acres (total) of commercial and residential property in Lawrenceville, Stanton Heights, Garfield, and Allegheny Cemetery. The collection and conveyance system consists of approximately 82,000 linear feet of sewers and 300 manholes. Nearly all of the service area is combined sewer.

A-30, 51st Street Sewershed. Outfall 080BA30 conveys overflows from the ALCOSAN diversion structure A-30 to the Allegheny River. The outfall and ALCOSAN diversion structure are located along the south bank of the Allegheny River at 51st Street. The service area includes approximately 20 acres (total) of commercial property in Lawrenceville in the vicinity of 51st Street. The collection and conveyance system consists of approximately 1,600 linear feet of sewers and 6 manholes. Nearly all of the service area is combined sewer.

A-31, 52nd Street Sewershed. Outfall 119RA31 conveys overflows from the ALCOSAN diversion structure A-31 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 52nd Street. The service area includes approximately 20 acres (total) of commercial property in Lawrenceville in the vicinity of 52nd Street. The collection and conveyance system consists of approximately 2,900 linear feet of sewers and 11 manholes. Nearly all of the service area is combined sewer.

A-32, McCandless Street Sewershed. Outfall 119RA32 conveys overflows from the ALCOSAN diversion structure A-32 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at McCandless Street. The service area includes approximately 84 acres (total) of commercial and residential property in Lawrenceville in the vicinity of McCandless Street. The collection and conveyance system consists of about 27,000 linear feet of sewers and 120 manholes. Nearly all of the service area is combined sewer.

A-33, 54th Street Sewershed. Outfall 119MA33 conveys overflows from the ALCOSAN diversion structure A-33 to the Allegheny River. The outfall and diversion structure are located along south bank of the Allegheny River at 54th Street. The service area includes approximately 48 acres (total) of commercial and residential property in Lawrenceville in the vicinity of 54th Street. The collection and conveyance system consists of approximately 11,600 linear feet of sewers and 38 manholes. Nearly all of the service area is combined sewer.

A-34, 55th Street Sewershed. Outfall 119MA34 conveys overflows from the ALCOSAN diversion structure A-34 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 55th Street. The service area includes approximately 46 acres (total) of commercial and residential property in Lawrenceville between 54th Street and 57th Street. The collection and conveyance system consists of approximately 6,200 linear feet of sewers and 27 manholes. Nearly all of the service area is combined sewer.

A-35, 57th Street Sewershed. Outfall 120EA35 conveys overflows from the ALCOSAN diversion structure A-35 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at 57th Street. The service area includes approximately 150 acres (total) of residential and commercial property of the Lawrenceville and Stanton Heights Neighborhoods. The collection and conveyance system consists of approximately 19,300 linear feet of sewers and 66 manholes. Nearly all of the service area is combined sewer.

A-36, 62nd Street Sewershed. Outfall 120CA36 conveys overflows from the ALCOSAN diversion structure A-36 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at the 62nd Street Bridge. The service area includes approximately 23 acres (total) of residential and commercial property of the Lawrenceville and Stanton Heights neighborhoods. The collection and conveyance system consists of approximately 2,700 linear feet of sewers and 12 manholes. Nearly all of the service area is combined sewer.

A-37, Voltz Way Sewershed. Outfall 120DA37 conveys overflows from the ALCOSAN diversion structure A-37 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River east of the 62nd Street Bridge. The service area includes approximately 18 acres (total) of residential and commercial property of the Lawrenceville neighborhood. The collection and conveyance system consists of approximately 1,500 linear feet of sewers and 8 manholes. Nearly all of the service area is combined sewer.

A-37A, Voltz Way Sewershed. Outfall 120DA37A conveys overflows from the ALCOSAN diversion structure A-37A to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River east of the 62nd Street Bridge. The service area includes approximately 45 acres (total) of residential and commercial property of the Lawrenceville and Stanton Heights neighborhoods. The collection and conveyance system consists of approximately 10,100 linear feet of sewers and 49 manholes. Nearly all of the service area is combined sewer.

3.3.5 Heth's Run Sewersheds

The Heth's Run sewersheds are located in the City of Pittsburgh's Morningside and Highland Park areas. Together, they consist of 780 acres (total) of residential, business and commercial users that contribute flow to three ALCOSAN diversion structures/outfalls and one PWSA-owned diversion structure/outfall.

A-38, Gatewood Way Sewershed. Outfall 121AA38 conveys overflows from the ALCOSAN diversion structure A-38 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at Gatewood Way in Morningside. The service area includes approximately 18 acres (total) of residential property in Morningside. The collection and conveyance system consists of approximately 2,700 linear feet of sewers and 8 manholes. Nearly all of the service area is combined sewer.

A-40, Chislett Street Sewershed. Outfall 121CA40 conveys overflows from the ALCOSAN diversion structure A-40 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at Chislett Street in Morningside. The service area includes approximately 22 acres (total) of residential property in Morningside. The collection and conveyance system consists of approximately 5,800 linear feet of sewers and 22 manholes. Nearly all of the service area is combined sewer.

A-41, Heth's Run Sewershed. Outfall 121HA41 conveys overflows from the ALCOSAN diversion structure A-41 to the Allegheny River. The outfall and diversion structure are located along the south bank of the Allegheny River at Heth's Run in Morningside. The service area includes approximately 740 acres (total) of residential property in Morningside and Highland Park, as well as the Pittsburgh Zoo and PPG Aquarium. The collection and conveyance system consists of approximately 165,000 linear feet (31 miles) of sewers and 600 manholes. Nearly all of the service area is combined sewer.

The sewershed served by Outfall 121HA41 is also served by PWSA Diversion Structure DC121L001 and Outfall 121H001.

DC121L001, Highland Park Zoo Parking Area Sewershed. Outfall 121H001 conveys overflows from the PWSA diversion structure DC121L001 to the Allegheny River. The outfall is located along the south bank of the Allegheny River at Heth's Run in Morningside, while the PWSA diversion structure is located under the parking lot of the Pittsburgh Zoo. The service area includes approximately 740 acres (total) of residential property in Morningside and Highland Park, as well as the Pittsburgh Zoo and PPG Aquarium. The collection and conveyance system consists of approximately 165,000 linear feet (31 miles) of sewers and 600 manholes. Nearly all of the service area is combined sewer.

The sewershed served by Outfall 121H001 is also served by Outfall 121HA41 and ALCOSAN structure A-41, which provide additional wastewater flow regulation for this sewershed.

3.3.6 Negley Run Sewershed

The Negley Run sewershed consists of nearly 3,600 acres (total) of residential and commercial users in the Homewood, East Liberty, Point Breeze, Highland Park, and Lincoln-Lemington neighborhoods of the City of Pittsburgh. The sewershed also receives tributary flow from parts of Penn Hills and Wilkinsburg.

The sewershed contributes flow to one ALCOSAN diversion structure and outfall. Flows are also regulated by four (4) PWSA-owned diversion structures, which discharge through one PWSA-owned outfall.

Note that the four PWSA-owned diversion structures (DC175G001, DC175G002, DC175L001, and DC175L002) are located in an area commonly called the Upper Nine Mile Run Sewershed. Dry weather flows from this area normally flow north to the Allegheny River through the Negley Run sewershed, while wet weather flows are diverted south to the Monongahela River through the Nine Mile Run sewershed.

A-42, Negley Run Sewershed. Outfall 122EA42 conveys overflows from the ALCOSAN diversion structures A-42 and A-42A to the Allegheny River. The outfall is located along the south bank of the Allegheny River at the Highland Park Lock & Dam, while ALCOSAN diversion structures A-42 & A-42A are located near the intersection of Allegheny River Boulevard and Washington Boulevard. The service area includes approximately 2,900 acres (total) of residential and commercial property in the neighborhoods of Homewood, East Liberty, Point Breeze, Highland Park, and Lincoln-Lemington. Flows from Penn Hills and Wilkinsburg are conveyed to the diversion structures by means of gravity sewers along Allegheny River Boulevard and Washington Boulevard. The collection and conveyance system consists of approximately 642,000 linear feet (122 miles) of sewers and 2,400 manholes. Nearly all of the service area is combined sewer.

Two primary trunk sewers provide service in the Negley Run Sewershed. Both trunk sewers travel along Washington Boulevard from Negley Run Boulevard to the ALCOSAN diversion structures. These trunk sewers vary in size from 8 feet to 9 feet in size.

DC175G001, DC175G002, DC175L001, and DC175L002, Upper Nine Mile Run Sewershed. The Upper Nine Mile Run sewershed is located in the East Hills neighborhood of the City of Pittsburgh and also serves part of the Borough of Penn Hills.

Outfall 177K001 conveys overflows from several PWSA diversion structures to Nine Mile Run. It is located along Nine Mile Run at Braddock Avenue.

Together, Outfall 177K001 and its upstream PWSA diversion structures serve approximately 662 acres of residential and commercial property in the East Hills neighborhood within the City of Pittsburgh and the Borough of Penn Hills. The collection and conveyance system consists of about 88,200 linear feet (17 miles) of sewers and 330 manholes. Nearly all of the service area is combined sewer.

3.3.7 Dasher Street Sewersheds

The Dasher Street sewersheds are located in the City of Pittsburgh's North Shore area. Together, they consist of approximately 1,300 acres (total) of residential, business and commercial users that contribute flow to five ALCOSAN diversion structures and outfalls. There are no PWSA-owned diversion structures or outfalls in this area.

O-43, North Shore Drive Sewershed. Outfall 007MO43 conveys overflows from the ALCOSAN diversion structure ADC 007MO43 to the Ohio River. The outfall is located in the City of Pittsburgh near the Carnegie Science Center parking lot (formerly Walker Street). The entire Dasher Street service area includes approximately 709 acres of residential, business and commercial users, and is comprised of approximately 970 manholes and 173,200 linear feet (33 miles) of primarily combined sewers up to 120 inches in size. The O-43 Sewershed is comprised of 20 acres of combined sewers.

A-47, Itasco Street Sewershed. Outfall 008LA47 conveys overflows from diversion structure ACSO 008LA47 to the Allegheny River. The diversion structure and outfall are located along the northern shore of the Allegheny River near PNC Park. The A-47 tributary area includes 15 acres of combined sewers. Together, the A-47 and A-48 sewersheds consist of approximately 550 acres (total) of residential, business and commercial users in Pittsburgh's North Shore area, and contain approximately 966 manholes and 173,000 linear feet (33 miles) of sewer piping of sized up to 120 inches.

A-48, Dasher Street Sewershed. Outfall 008LA48 conveys overflows from diversion structure ACSO 008LA48 to the Allegheny River. The diversion structure and outfall are located along the northern shore of the Allegheny River near PNC Park. The A-48 tributary area includes 508 acres of combined sewers. Together, the A-47 and A-48 sewersheds consist of approximately 550 acres (total) of residential, business and commercial users in Pittsburgh's North Shore area, and contain about 966 manholes and 173,000 linear feet (33 miles) of sewer piping of sized up to 120 inches.

A-49, Federal Street Sewershed. Outfall 008MA49 conveys overflows from diversion structure ACSO 008MA49 to the Allegheny River. The diversion structure and outfall are located on the northern shore of the Allegheny River at Federal Street. Together, the A-49 and A-50 tributary areas consist of 49 acres of combined sewers that service residential, business and commercial users in Pittsburgh's North Shore area. The areas are entirely served by combined sewers.

A-50, Sandusky Street Sewershed. Outfall 008MA50 conveys overflows from diversion structure ACSO 008MA50 to the Allegheny River. The diversion structure and outfall are located on the northern shore of the Allegheny River at Sandusky Street. Together, the A-49 and A-50 tributary areas consist of 49 acres of combined sewers that service residential, business and commercial users in Pittsburgh's North Shore area. The areas are entirely served by combined sewers.

3.3.8 Spring Garden Sewersheds

The Spring Garden sewersheds are located in the City of Pittsburgh's Troy Hill neighborhood. Together, they consist of 1,523 acres (total) of residential, business and commercial users that contribute flow to six ALCOSAN diversion structures/outfalls. There are no PWSA-owned diversion structures or outfalls in this area.

A-60, Spring Garden Avenue Sewershed. Outfall 024RA60 conveys overflows from diversion structure ACSO 024RA60 to the Allegheny River. The diversion structure and outfall are located along River Avenue behind the Heinz Plant. The A-60 tributary area contains 1,280 acres of combined sewers.

A-61, Pindham Street Sewershed. Outfall 024LA61 conveys overflows from diversion structure ACSO 024LA61 to the Allegheny River. The diversion structure and outfall are located along River Avenue behind the Heinz Plant. The A-61 tributary area contains 18 acres of combined sewers.

A-62, McFadden Street Sewershed. Outfall 025AA62 conveys overflows from diversion structure ACSO 025AA62 to the Allegheny River. The diversion structure and outfall are located across the canal from the southern end of Herr's Island. The A-62 tributary area contains 48 acres of combined sewers.

A-64, Rialto Street Sewershed. Outfall 048NA64 conveys overflows from diversion structure ACSO 048NA64 to the Allegheny River. The outfall is located along River Avenue near Herr's Island. The A-64 tributary area contains 67 acres of combined sewers.

A-65, Heckelman Street Sewershed. Outfall 048FA65 conveys overflows from diversion structure ACSO 048FA65 to the Allegheny River. The outfall is located along River Avenue near Herr's Island. The A-65 tributary area contains 25 acres of combined sewers.

A-66, Croft Street Sewershed. Outfall 048FA66 conveys overflows from diversion structure ACSO 048FA66 to the Allegheny River. The outfall is located along River Avenue near Herr's Island. The A-66 tributary area contains 85 acres of combined sewers.

3.3.9 Downtown Monongahela Sewersheds

The Downtown Monongahela sewersheds are located in the City of Pittsburgh's Golden Triangle along the north bank of the Monongahela River. Together, they consist of 478 acres (total) of downtown, residential, business, and commercial users that contribute flow to eight ALCOSAN diversion structures and six ALCOSAN outfalls. There are no PWSA-owned diversion structures or outfalls in this area.

M-01, Commonwealth Place Sewershed. Outfall 001FM01 conveys overflows from the ALCOSAN diversion structure ADC 001GM01 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River at Commonwealth Place. The service area includes approximately 11 acres (total) of commercial property along Commonwealth Place and the Boulevard of the Allies. The collection and conveyance system consists of approximately 1,900 linear feet of sewers and 16 manholes. Nearly all of the service area is combined sewer.

M-02, Stanwix Street Sewershed. Outfall 001LM02 conveys overflows from the ALCOSAN diversion structure ADC 001GM02 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River at Stanwix Street. The service area includes approximately 3 acres (total) of commercial property along Stanwix Street. The collection and conveyance system consists of approximately 1,300 linear feet of sewers and 7 manholes. Nearly all of the service area is combined sewer.

M-03, Wood Street Sewershed. Outfall 001MM03 conveys overflows from the ALCOSAN diversion structure ADC 001MM03 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River at Wood Street. The service area includes approximately 48 acres (total) of commercial and residential property along Wood Street and Smithfield Street. The collection and conveyance system consists of approximately 14,100 linear feet of sewers and 70 manholes. Nearly all of the service area is combined sewer.

M-03A, M-03B, M-03C, Cherry Way Sewershed. Outfall 001MM03A conveys overflows from the ALCOSAN diversion structures ADC 001MM03A, ADC 001MM03B, and ADC 001MM03C to the Monongahela River. The outfall is located along the Monongahela River at Cherry Way, while diversion structures M-03A, M-03B, and M-03C are located near the intersection of Fort Pitt Boulevard and Cherry Way. The service area includes approximately 6 acres (total) of commercial and residential property along Cherry Way. The collection and conveyance system consists of approximately 2,600 linear feet of sewers and 9 manholes. Nearly all of the service area is combined sewer.

M-04, Grant Street Sewershed. Outfall 001SM04 conveys overflows from the ALCOSAN diversion structure ADC 002NM04 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River at Grant Street. The service area includes approximately 10 acres (total) of commercial property along Grant Street. The collection and conveyance system consists of approximately 5,800 linear feet of sewers and 30 manholes. The service area is almost entirely separate sewer; however, flows in dedicated storm sewers are combined with sanitary flows before being regulated by ALCOSAN structure M-04.

M-05, Try Street Sewershed. Outfall 002NM05 conveys overflows from the ALCOSAN diversion structure ADC 002NM05 to the Monongahela River. The outfall and diversion structure are located along the south bank of the Monongahela River at the Liberty Bridge. The service area includes approximately 400 acres (total) of commercial and residential property in the Downtown, Hill District, and Soho neighborhoods. Duquesne University and Mercy Hospital are also located within this sewershed. The collection and conveyance system consists of approximately 99,000 linear feet (19 miles) of sewers and 460 manholes. Nearly all of the service area is combined sewer.

3.3.10 Second Avenue Sewersheds

M-19, Brady Street Sewershed. Outfall 011RM19 conveys overflows from the ALCOSAN diversion structure ADC 011RM19 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River, adjacent to the Birmingham Bridge. The service area includes approximately 570 acres (total) of residential and commercial property of the Upper and Middle Hill District, Bedford Dwellings, and the Terrace Village Housing Complexes. The collection and conveyance system consists of approximately 144,600 linear feet (27 miles) of sewers and 613 manholes. Nearly all of the service area is combined sewer.

The Brady Street Trunk Sewer is the primary conveyance pipeline through the sewershed. The trunk line flows along the Kirkpatrick and Brady Street corridors from the intersection of Centre Avenue and LaPlace Street to the M-19 diversion structure.

M-19A, Maurice Street Sewershed. Outfall 011SM19B conveys overflows from the ALCOSAN diversion structure ADC 011SM19B to the Monongahela River. The outfall is located along the north bank of the Monongahela River at the Technology Center in Oakland, while the diversion structure is located along Second Avenue at Maurice Street. The service area includes approximately 78 acres (total) of residential and commercial property of the South Oakland neighborhood. The collection and conveyance system consists of approximately 19,600 linear feet (3.7 miles) of sewers and 70 manholes. Nearly all of the service area is combined sewer.

The Maurice Street Trunk Sewer is the primary conveyance pipeline through the sewershed.

M-19B, M-19C, and M-19D, Bates Street Sewershed. Outfall 029FM19A conveys overflows from the ALCOSAN diversion structures ADC 029BM19B, ADC 029BM19C, and ADC 029BM19D to the Monongahela River. The outfall is located along the north bank of the Monongahela River at Bates Street, while diversion structures M-19B, M-19C, and M-19D are located along Bates Street near Second Avenue. The service area includes approximately 254 acres (total) of residential and commercial property of Central and South Oakland. The collection and conveyance system consists of approximately 73,300 linear feet (14 miles) of sewers and 324 manholes. Nearly all of the service area is combined sewer.

Two primary trunk sewers serve the sewershed area. These trunk sewers travel along Coltart Street and Bates Street.

3.3.11 Boundary Street Sewershed

M-29, Greenfield Avenue Sewershed. Outfall 029RM29 conveys overflows from the ALCOSAN diversion structure ADC 029SM29 to the Monongahela River. The outfall is located along the north bank of the Monongahela River at Greenfield Avenue, while ALCOSAN diversion structure M-29 is located on Second Avenue at Greenfield Avenue. The service area includes approximately 2,400 acres (total) of residential and commercial property in the Oakland, Squirrel Hill, and Greenfield neighborhoods. The University of Pittsburgh and Carnegie Mellon University are located in this service area. The collection and conveyance system consists of approximately 443,700 linear feet (84 miles) of sewers and 1,560 manholes. Nearly all of the service area is combined sewer.

Four primary trunk sewers provide service in the sewershed: the Panther Hollow Trunk Sewer travels through the Panther Hollow corridor of Schenley Park; the Parkway North Trunk Sewer travels along the Parkway East and Saline Street from the Squirrel Hill Tunnels to Second Avenue; the Squirrel Hill South Trunk Sewer travels through Schenley Park from Wightman Street to Saline Street; and the Squirrel Hill North Trunk Sewer travels through the Carnegie Mellon campus and along Beeler Street, ultimately connecting to the Panther Hollow Trunk Sewer.

3.3.12 Hazelwood Sewersheds

M-31, Rutherglen Street Sewershed. Outfall 030MM31 conveys overflows from the ALCOSAN diversion structure ADC 055EM31 to the Monongahela River. The outfall is located along the north bank of the Monongahela River, while ALCOSAN diversion structure M-31 is located near the intersection of Rutherglen Street and Second Avenue. The service area includes approximately 64 acres (total) of residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of approximately 17,471 linear feet (3.3 miles) of sewers and 60 manholes. Nearly all of the service area is combined sewer.

M-31A, Rutherglen Street Sewershed. Outfall 030MM31A conveys overflows from the ALCOSAN diversion structure ADC 055EM31A to the Monongahela River. The outfall is located along the north bank of the Monongahela River, while ALCOSAN diversion structure M-31A is located near the intersection of Rutherglen Street and Second Avenue. The service area includes approximately 1 acre (total) of residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of approximately 3,300 linear feet of sewers and 12 manholes. All of the service area is regarded as combined sewer.

M-32, Tullymet Street Sewershed. Outfall 031DM32 conveys overflows from the ALCOSAN diversion structure ADC 031DM32 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River west of Tulleymet Street. The service area includes approximately 14 acres (total) of residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of approximately 4,735 linear feet of sewers and 17 manholes. Nearly all of the service area is combined sewer.

M-33, Longworth Street Sewershed. Outfall 031HM33 conveys overflows from the ALCOSAN diversion structure ADC 031HM33 to the Monongahela River. The outfall and diversion structure are located on the north bank of the Monongahela River west of Longworth Street in Hazelwood. The service area includes approximately 33 acres (total) of residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of approximately 1,405 linear feet of sewers and 3 manholes. Nearly all of the service area is combined sewer.

M-35, Hazelwood Avenue Sewershed. Outfall 031HM35 conveys overflows from the ALCOSAN diversion structure ADC 031HM35 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River west of Hazelwood Avenue. The service area includes approximately 170 acres (total) of residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of approximately 38,300 linear feet (7 miles) of sewers and 150 manholes. Nearly all of the service area is combined sewer.

The Hazelwood Avenue Trunk Sewer is the primary conveyance pipeline through the sewershed. This trunks sewer varies in size from 42 inches to 54 inches.

M-36, Tecumseh Street Sewershed. Outfall 031MM36 conveys overflows from the ALCOSAN diversion structure ADC 031MM36 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River west of Tecumseh Street. ALCOSAN diversion structure M-36 is located near the outfall. The service area includes approximately 375 acres (total) of residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of approximately 37,500 linear feet (7 miles) of sewers and 140 manholes. Nearly all of the service area is combined sewer.

M-37, Melanchton Street Sewershed. Outfall 057AM37 conveys overflows from the ALCOSAN diversion structure ADC 057AM37 to the Monongahela River. The outfall is located along the south bank of the Monongahela River, while ALCOSAN diversion structure M-37 is located west of the intersection of Chaplain Way and Melanchton Street at the ALCOSAN ejector pump station. The service area includes approximately 24 acres (total) of residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of approximately 6,100 linear feet (1 mile) of sewers and 27 manholes. Nearly all of the service area is combined sewer.

M-38, Vespucius Street Sewershed. Outfall 057KM38 conveys overflows from the ALCOSAN diversion structure ADC 057KM38 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River at Vespucius Street. The service area includes approximately 5 acres (total) of residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of approximately 2,600 linear feet of sewers and 16 manholes. Nearly all of the service area is combined sewer.

M-39, Renova Street Sewershed. Outfall 057KM39 conveys overflows from the ALCOSAN diversion structure ADC 057KM39 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River southwest of Renova Street. The service area includes approximately 12 acres of residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of approximately 3,711 linear feet of sewers and 9 manholes. Nearly all of the service area is combined sewer.

M-40, Alluvian Street Sewershed. Outfall 057MM40 conveys overflows from the ALCOSAN diversion structure ADC 057MM40 to the Monongahela River. The outfall and diversion structure are located along the north bank of the Monongahela River at the Glenwood Bridge. The service area includes approximately 107 acres residential and commercial property of the Hazelwood neighborhood. The collection and conveyance system consists of about 22,300 linear feet (4 miles) of sewers and 70 manholes. Nearly all of the service area is combined sewer.

3.3.13 Nine Mile Run Sewershed

The Nine Mile Run sewershed consists of nearly 2,200 acres (total, including the Upper Nine Mile Run sewershed) of residential and commercial users in the East Hills, Squirrel Hill, Point Breeze, Regent Square, and Swisshelm Park neighborhoods of the City of Pittsburgh, as well as large upstream areas of Frick Park. The sewershed also receives tributary flow from part of the Borough of Penn Hills.

The sewershed contributes flow to one ALCOSAN diversion structure and outfall. Flows are also regulated by 11 PWSA-owned diversion structures, which discharge through three PWSA-owned outfalls.

M-47, Nine Mile Run Sewershed. Outfall 129NM47 conveys overflows from the ALCOSAN diversion structure ADC 129NM47 to the Monongahela River. The outfall is located along the north bank of the Monongahela River at the confluence with Nine Mile Run. ALCOSAN diversion structure M-47 is located near the Monongahela River at Duck Hollow. Together, Outfall 129NM47 and ALCOSAN structure M-47 directly serve approximately 720 acres (total) of residential and commercial property in the Squirrel Hill, Regent Square, and Swisshelm Park neighborhoods, and indirectly serves the large upstream areas of Frick Park and the Upper Nine Mile Run area.

Note that four of the PWSA-owned diversion structures (DC175G001, DC175G002, DC175L001, and DC175L002) are located in an area commonly called the Upper Nine Mile Run Sewershed. Dry weather flows from this area normally flow north to the Allegheny River through the Negley Run sewershed, while wet weather flows are diverted south to the Monongahela River through the Nine Mile Run sewershed. Descriptions of these four diversion structures are included in the A-42, Negley Run sewershed portion of this Section of this Wet Weather Feasibility Study.

The collection and conveyance system consists of approximately 97,600 linear feet of sewers and 410 manholes. Sewer separation efforts have been undertaken at Summerset at Frick Park and Commercial Street; however, the remaining portion of the sewershed is predominately combined sewer.

DC129B001, Swisshelm Park / Lower Nine Mile Sewershed. Outfall 129B001 conveys overflows from the PWSA diversion structure DC129B001 to Nine Mile Run. The outfall is located along the East Bank of Nine Mile Run at Swisshelm Park. DC129B001 is also located along the East Bank of Nine Mile Run at Swisshelm Park. Together, Outfall 129B001 and PWSA structure DC129B001 serve approximately 23 acres (total) of residential property in the Swisshelm Park neighborhood. The collection and conveyance system consists of approximately 7,100 linear feet of sewers and 27 manholes. Nearly all of the service area is combined sewer.

DC128D001, DC128D002, DC128D003, DC176J001, DC176J002, and DC176J003, Frick Park / Lower Nine Mile Sewershed. Outfall 128R002 conveys overflows from several PWSA diversion structures to Nine Mile Run. The outfall is located along Nine Mile Run at Fern Hollow.

Together, Outfall 128R002 and the diversion structures serve approximately 780 acres (total) of residential and commercial property in the Squirrel Hill, Point Breeze, and Regent Square neighborhoods. The collection and conveyance system consists of approximately 132,000 linear feet (25 miles) of sewers and 440 manholes. Nearly all of the service area is combined sewer; however, only about 450 acres is sewered. The remaining acreage is located within Frick Park.

Two trunk sewers provide service in this sewershed, and both trunk sewers travel through the Fern Hollow corridor within Frick Park. A 54-in sewer conveys overflows from the diversion structures to Nine Mile Run, and a parallel 33-in sewer conveys regulated combined flow from the said regulators to another trunk sewer in the Nine Mile Run drainage basin where additional conveyance and regulation would occur.

3.3.14 Jacks Run and Woods Run Sewersheds

O-25, Farragut Street Sewershed. Outfall OF114J025 conveys overflows from ALCOSAN diversion structure ADC 114JO25 to the Ohio River. The O-25 sewershed consists of approximately 1,470 acres (total) of residential, business and commercial users in the Brighton Heights neighborhood. The outfall and diversion structure are located along Jack's Run near the southern side of Farragut Street. The collection and conveyance system consists of approximately 410 manholes and 82,600 linear feet (16 miles) of sewer piping up to 84 inches in size.

O-26, Verner Avenue Sewershed. Outfall 075AO26 conveys overflows from the ALCOSAN diversion structure ADC 075FO26 to the Ohio River. The outfall is located in the City of Pittsburgh at the ALCOSAN wastewater treatment plant. The tributary area to O-26 is approximately 143 acres (total).

O-27, Westhall Street Sewershed. Outfall 044B027 conveys overflows from the ALCOSAN diversion structure ADC 044B027 to the Ohio River. The outfall is located in the City of Pittsburgh at the end of Westhall Street, approximately 900 feet west of its intersection with Beaver Avenue. The tributary sewershed is called the Woods Run Sewershed and contains 1,250 acres of residential, business, and commercial users. There is one small sanitary sewered area within the Woods Run Sewershed. The Woods Run Sewershed is comprised of approximately 830 manholes and 189,200 linear feet (36 miles) of mostly combined sewer up to 144 inches in size.

3.3.15 Ohio River North Sewersheds

The Ohio River North sewersheds are located along the north shore of the Ohio River, and consist of approximately 1,150 acres (total) of residential, business, and commercial users within the City of Pittsburgh. The sewersheds contribute flow to thirteen (13) ALCOSAN outfalls. These 13 sewersheds are often considered as three sub-groups: the Doerr, Superior, and Island Avenue sewersheds; the Adams Street Sewersheds; and the Pennsylvania Avenue sewersheds.

The Doerr, Superior Avenue, and Island Avenue sewersheds together consist of approximately 345 acres (total) of residential, business, and commercial users that contribute flow to ALCOSAN outfalls O-29 and O-30. The sewersheds are comprised of approximately 260 manholes and 53,600 linear feet (10 miles) of separated sanitary (Doerr and portions of Island and Superior), and combined (portions of Island and Superior) sewer up to 72 inches in size.

The Adams Street sewersheds together consist of approximately 600 acres (total) of residential, business, and commercial users that contribute flows to ALCOSAN outfalls O-31, O-32, O-33, and O-34. The sewersheds contain approximately 710 manholes and 129,900 linear feet (25 miles) of primarily combined sewer up to 100 inches in size.

The Pennsylvania Avenue sewersheds together consist of approximately 205 acres (total) of residential, business, and commercial users that contribute flow to ALCOSAN outfalls O-35, O-36, O-37, O-38, O-39, O-40, and O-41. The sewersheds are comprised of approximately 234 manholes and 42,000 linear feet (8 miles) of mostly combined sewer up to 72 inches in size.

O-29, Superior Street Sewershed. Outfall 044RO29 conveys overflows from ALCOSAN diversion structure ADC 044RO29 to the Ohio River. The outfall is located on the north side of the Ohio River North of Island Avenue. The O-29 tributary area consists of 136 acres of combined sewers.

O-30, Island Avenue Sewershed. Outfall 021DO30 conveys overflows from ALCOSAN diversion structure ADC 021DO30 to the Ohio River. The outfall is located on the north side of the Ohio River near Island Avenue. The O-30 tributary area consists of 140 acres of combined sewers.

O-31, Seymour Street Sewershed. Outfall 021HO31 conveys overflows from ALCOSAN diversion structure ADC 021HO31 to the Ohio River. The outfall is located on the north side of the Ohio River near Seymour Street. The O-31 tributary area consists of 7 acres of combined sewers.

O-32, Branchport Street Sewershed. Outfall 021HO32 conveys overflows from ALCOSAN diversion structure ADC 021HO32 to the Ohio River. The outfall is located on the north side of the Ohio River near Branchport Street. The O-32 tributary area consists of 76 acres of combined sewers.

O-33, **Adams Street Sewershed.** Outfall 021MO33 conveys overflows from ALCOSAN diversion structure ADC 021MO33 to the Ohio River. The outfall is located on the north side of the Ohio River near Adams Street. The O-33 tributary area consists of 327 acres of combined sewers. Portions of the O-33 sewershed are also tributary to one or more neighboring sewersheds.

O-34, Columbus Avenue Sewershed. Outfall 021MO34 conveys overflows from ALCOSAN diversion structure ADC 021MO34 to the Ohio River. The outfall is located on the north side of the Ohio River near Columbus Avenue. The O-34 tributary area consists of 190 acres of combined sewers. Portions of the O-34 sewershed are also tributary to one or more neighboring sewersheds.

O-35, Franklin Street Sewershed. Outfall 021SO35 conveys overflows from ALCOSAN diversion structure ADC 021SO35 to the Ohio River. The outfall is located on the north side of the Ohio River near North Franklin and Oxline Streets. The O-35 tributary area consists of 4 acres of combined sewers.

O-36, Liverpool Street Sewershed. Outfall 021SO36 conveys overflows from ALCOSAN diversion structure ADC 021SO36 to the Ohio River. The outfall is located on the north side of the Ohio River near Liverpool and Oxline Streets. The O-36 tributary area consists of 18 acres of combined sewers.

O-37, Pennsylvania Avenue Sewershed. Outfall 007AO37 conveys overflows from ALCOSAN diversion structure ADC 007AO37 to the Ohio River. The outfall is located on the north side of the Ohio River near Pennsylvania and Preble Avenues. The O-37 tributary area consists of 10 acres of combined sewers.

O-38, W. North Avenue Street Sewershed. Outfall 007AO38 conveys overflows from ALCOSAN diversion structure ADC 007AO38 to the Ohio River. The outfall is located on the north side of the Ohio River near W. North Avenue. The O-38 tributary area consists of 76 acres of combined sewers.

O-39, Kroll Drive Sewershed. Outfall 007EO39 conveys overflows from ALCOSAN diversion structure ADC 007EO39 to the Ohio River. The outfall is located on the north side of the Ohio River near Kroll Drive. The O-39 tributary area consists of 42 acres of combined sewers.

O-40, West End Bridge Sewershed. Outfall 007KO40 conveys overflows from ALCOSAN diversion structure ADC 007FO40 to the Ohio River. The outfall is located on the north side of the Ohio River near the West End Bridge. The O-40 tributary area consists of 20 acres of combined sewers.

O-41, North Point Drive Sewershed. Outfall 007KO41 conveys overflows from ALCOSAN diversion structure ADC 007KO41 to the Ohio River. The outfall is located on the north side of the Ohio River near North Point Drive. The O-41 tributary area consists of 35 acres of combined sewers.

3.3.16 East Street Sewersheds

The East Street sewershed is located in the Main Rivers planning basin. The sewershed is comprised of portions of the Summer Hill, Perry, Northview Heights, Spring Hill, Fineview, and East Allegheny neighborhoods in the City of Pittsburgh and portions of Reserve Township and Ross Township.

The primary East Street trunk sewer system consists of two parallel lines, one owned by PennDOT and one owned by the PWSA. The PWSA line flows in a southward direction beginning at the interchange between I-279 and McKnight Road and runs along the I-279 corridor. At the intersection of East Street and Hazlett Street it begins to follow East Street to the intersection of Progress Way and Madison Way where the size increases to 102-in diameter. This 102-in sewer connects to ALCOSAN diversion chamber ADC009EA58. The PennDOT storm line starts at the Ivory Avenue and McKnight Road intersection, running southward along I-279 until it reaches the PennDOT diversion chamber PADC024A001 near Valette Street. From this diversion chamber, the storm line flows to CSO009E001 as a 120-in by 144-in line.

There are 3 PWSA flow diversion chambers and 21 PWSA flow dividers (redistribute wastewater flows to improve conveyance and reduce the likelihood of overflows) that divert wet weather flow from the Madison Avenue combined sewer systems to the PennDOT storm sewer upstream PennDOT diversion chamber PADC024A001. The 2 PWSA flow diversion structures (DC023D001 and DC023H001) divert wet weather flow from the A-51 combined sewer system to the PennDOT storm sewer downstream of PennDOT diversion chamber PADC024A001. The PennDOT diversion chamber diverts portions of the flows in the PennDOT sewer to the Madison Avenue trunk sewer. These facilities discharge to ALCOSAN POC A-58, ACSO0098EAA58, and CSO009E001.

An approximately 24-acre area in the Troy Hill Road area of the upper portion of the East Street sewershed flows to PWSA diversion chamber DC163L001. Wet weather flows from this structure are diverted from the Madison Avenue trunk sewer system to CSO outfall 163G001.

The Evergreen Pump Station is located within the East Street sewershed on Evergreen Road in the Summer Hill section of the City. The pump station serves a sanitary sewershed area containing approximately 25 residences.

The East Street sewershed encompasses at total of approximately 1,080 acres, consisting of approximately 1,060 acres of the City of Pittsburgh, 17 acres of Ross

Township, and 3 acres of Reserve Township. These areas contribute flow to one PWSA outfall, one PennDOT outfall, and five ALCOSAN outfalls.

DC163L001, Troy Hill Road Sewershed. Outfall 163G001 conveys overflows from PWSA diversion structure DC163L001 to the Girty's Run. The tributary area is approximately 24 acres (total) of the upper portion of the East Street sewershed near Evergreen Rd and Ivory Avenue.

PADC024A001, PennDOT Sewershed. Outfall 009E001 is a 120-in by 144-in permitted stormwater outfall maintained by PennDOT that conveys overflows to the Allegheny River. These overflows are generated by PennDOT diversion structure PADC024A001, PWSA diversion structures DC023D001 and DC023H001, and the 21 PWSA flow dividers (redistribute wastewater flows to improve conveyance and reduce the likelihood of overflows) that divert wet weather flow from the PWSA (Madison Avenue) combined sewer systems to the PennDOT storm sewer upstream of PennDOT diversion chamber PADC024A001.

A-51, Anderson Street Sewershed. Outfall 008MA51 conveys overflows from diversion structure ADC 008MA51 to the Allegheny River. The diversion structure and outfall are located on the northern shore of the Allegheny River at Anderson Street. The A-51 tributary area consists of 105 acres of combined sewers that service residential, business and commercial users in Pittsburgh's North Shore area.

A-56, Goodrich Street Sewershed. Outfall 009EA56 conveys overflows from diversion structure ADC 009EA56 to the Allegheny River. The diversion structure and outfall are located along River Avenue at Goodrich Street. The A-56 tributary area consists of 19 acres of combined sewers. Together, the A-56, A-58, A-59, and A-59A sewersheds consist of approximately 1,230 (total) acres of residential, business, and commercial users in the East Allegheny neighborhood near the Heinz Plant, and consist of approximately 1,250 manholes and 244,200 linear feet (46 miles) of sewer piping up to 102 inches in size.

A-58, Madison Avenue Sewershed. Outfall 009EA58 conveys overflows from diversion structure ADC 009EA58 to the Allegheny River. The diversion structure and outfall are located along River Avenue at Madison Avenue. The A-58 tributary area consists of 1,079 acres of combined sewers. Together, the A-56, A-58, A-59, and A-59A sewersheds consist of approximately 1,230 (total) acres of residential, business, and commercial users in the East Allegheny neighborhood near the Heinz

Plant, and consist of approximately 1,250 manholes and 244,200 linear feet (46 miles) of sewer piping up to 102 inches in size.

A-59, Warfield Street Sewershed. Outfall 009BA59 conveys overflows from diversion structure ADC 009BA59 to the Allegheny River. The diversion structure and outfall are located along River Avenue at Warfield Street. The A-59 tributary area consists of 13 acres of combined sewers. Together, the A-56, A-58, A-59, and A-59A sewersheds consist of approximately 1,230 (total) acres of residential, business, and commercial users in the East Allegheny neighborhood near the Heinz Plant, and consist of approximately 1,250 manholes and 244,200 linear feet (46 miles) of sewer piping up to 102 inches in size.

A-59A, 16th Street Sewershed. Outfall 009BA59A conveys overflows from diversion structure ADC 009BA59A to the Allegheny River. The diversion structure and outfall are located along River Avenue adjacent to the 16th Street Bridge. The A-59A tributary area consists of 11 acres of combined sewers. Together, the A-56, A-58, A-59, and A-59A sewersheds consist of approximately 1,230 (total) acres of residential, business, and commercial users in the East Allegheny neighborhood near the Heinz Plant, and consist of approximately 1,250 manholes and 244,200 linear feet (46 miles) of sewer piping up to 102 inches in size.

3.3.17 Lower Chartiers Creek Sewersheds

The Lower Chartiers Creek sewersheds are located in the Chartiers Creek planning basin, and consist of approximately 954 acres of residential, business, and commercial users that contribute flow to ten ALCOSAN outfalls. In total, these sewersheds are comprised of approximately 158,400 linear feet (30 miles) of mostly combined sewer.

C-2, Stanhope and West Carson Street Sewershed. Outfall 043SC02 conveys overflows from ALCOSAN diversion structure ADC 043SC02 to Chartiers Creek. The outfall is located along Chartiers Creek near the bridge on West Carson Street. The C-2 tributary area consists of approximately 3 acres of combined sewers.

C-3, Stanhope and Sloan Street Sewershed. Outfall 043RC03 conveys overflows from ALCOSAN diversion structure ADC 043RC03 to Chartiers Creek. The outfall is located along Chartiers Creek near Stanhope Street. The C-3 tributary area consists of 6 acres of combined sewers.

C-5, Stafford Street Sewershed. Outfall 043RC05 conveys overflows from ALCOSAN diversion structure CSO 043RC05 to Chartiers Creek. The outfall is located along Chartiers Creek near Stafford Street. The C-5 tributary area consists of 85 acres of combined sewers.

C-5A, Stanhope Street Sewershed. Outfall 043RC05A conveys overflows from ALCOSAN diversion structure ADC 043RC05A to Chartiers Creek. The outfall is located along Chartiers Creek near Chartiers Avenue. The C-5A tributary area consists of 31 acres of combined sewers.

C-7, Allendale Circle Sewershed. Outfall 043PC07 conveys overflows from ALCOSAN diversion structure ADC 043PC07 to Chartiers Creek. The outfall is located along Chartiers Creek near West Carson Street. The C-7 tributary area consists of 120 acres of combined sewers.

C-11, Centralia Street Sewershed. Outfall 071CC11 conveys overflows from ALCOSAN diversion structure ADC 071CC11 to Chartiers Creek. The outfall is located along Chartiers Creek near Centralia Street. The C-11 tributary area consists of 226 acres of combined sewers.

C-12, Middletown Road Sewershed. Outfall 071CC12 conveys overflows from ALCOSAN diversion structure ADC 071CC12 to Chartiers Creek. The outfall is located along Chartiers Creek near Middletown Road. The C-12 tributary area consists of 82 acres of combined sewers.

C-13A, Youghiogheny Sewershed. Outfall 072RC13A conveys overflows from ALCOSAN diversion structure ADC 072PC13A to Chartiers Creek. The outfall is located along Chartiers Creek near Youghiogheny Street. The C-13A tributary area consists of 18 acres of combined sewers.

C-14, Fairwood Street Sewershed. Outfall 107GC14 conveys overflows from ALCOSAN diversion structure ADC 107GC14 to Chartiers Creek. The outfall is located along Chartiers Creek near Beechnut Drive. The C-14 tributary area consists of 219 acres of combined sewers.

C-15, Broadhead Fording Road Sewershed. Outfall 107SC15 conveys overflows from ALCOSAN diversion structure ADC 107SC15 to Chartiers Creek. The outfall is located along Chartiers Creek near Broadhead Fording Road. The C-15 tributary area consists of 164 acres of combined sewers.

3.3.18 Upper Chartiers Creek Sewersheds

The following sewersheds are sometimes referred to as the Upper Chartiers Creek sewersheds. They consist of approximately 300 acres of combined sewers that contribute flow to four ALCOSAN outfalls, and are comprised of approximately 54 manholes and 12,900 linear feet (2.4 miles) of sewer up to 39 inches in size.

C-26A, Idlewood Road Sewershed. Outfall 079FC26A conveys overflows from ALCOSAN diversion structure ADC 079FC26A to Chartiers Creek. The outfall is located along Chartiers Creek near Idlewood Road. The C-26A tributary area consists of approximately 9 acres of residential, business, and commercial users.

C-27, Pringle Way Sewershed. Outfall 067FC27 conveys overflows from ALCOSAN diversion structure ADC 067FC27 to Chartiers Creek. The outfall is located along Chartiers Creek near Weirton Street. The C-27 tributary area consists of 3 acres of residential, business, and commercial users.

C-28, Moffat Way Sewershed. Outfall 067KC28 conveys overflows from ALCOSAN diversion structure ADC 067KC28 to Chartiers Creek. The outfall is located along Chartiers Creek near Moffat Way. The C-28 tributary area consists of 54 acres of residential, business, and commercial users.

C-29, Woodkirk Street Sewershed. Outfall 067KC29 conveys overflows from ALCOSAN diversion structure ADC 067KC29 to Chartiers Creek. The outfall is located along Chartiers Creek near Woodkirk Street. The C-29 tributary area consists of 298 acres of residential, business, and commercial users.

3.3.19 Bells Run Sewersheds

The Bells Run sewersheds are located in portions of East Carnegie, Oakwood, and Westwood sections in the City of Pittsburgh, and in Crafton Borough and Green Tree Borough. The Bells Run Sewershed consists of approximately 726 acres of residential, business, and commercial users that contribute flow to one ALCOSAN outfall and five PWSA outfalls. It is comprised of approximately 300 manholes and 66,300 linear feet (13 miles) of sewer up to 66 inches in size.

C-25, Bells Run/Angora Road Sewershed. Outfall 104HC25 conveys flow from ALCOSAN diversion structure 104HC25 to Northeast side of Chartiers Creek near

Angora Road. The C-25 sewershed consists of approximately 380 acres, or approximately 50% of the total Bells Run service area.

DC039E001, Oakwood Road Sewershed. Outfall 039E001 conveys flow from PWSA diversion structure DC039E001 to Bells Run. The outfall is located along Oakwood Rd. near Pensdale Street. Combined, the DC039E001, DC039J001, DC068H001, and DC068H002 tributary areas make up 57 acres within the Bells Run sewershed.

DC039J001, Steen Street Sewershed. Outfall 039J001 conveys flow from PWSA diversion structure DC039J001 to Bells Run. The outfall is located along Pensdale Street near Baldwick Road. Combined, the DC039E001, DC039J001, DC068H001, and DC068H002 tributary areas make up 57 acres within the Bells Run sewershed.

DC068H001, Balver Avenue Sewershed. Outfall 068H001 conveys flow from PWSA diversion structure DC068H001 to Bells Run. The outfall is located along the West Busway near Balver Street. Combined, the DC039E001, DC039J001, DC068H001, and DC068H002 tributary areas make up 57 acres within the Bells Run sewershed.

DC068H002, Oakwood Road Sewershed. Outfall 068H002 conveys flow from PWSA diversion structure DC068H002 to Bells Run. The outfall is located along Oakwood Road near Chartiers Avenue. Combined, the DC039E001, DC039J001, DC068H001, and DC068H002 tributary areas make up 57 acres within the Bells Run sewershed.

DC039L001, DC039M001, DC039M002, DC040R001, and DC040R002, Baldwick Road Sewershed. Outfall 039K001 conveys overflows from the PWSA diversion structures DC039L001, DC039M001, DC039M002, DC040R001, and DC040R002 to a storm sewer that discharges to Bells Run at Balwick Road. The outfall is located along Bells Run, near Keever Avenue and Brett Street. The Baldwick Road sewershed consists of 321 acres, or approximately 44% of the Bells Run service area.

3.3.20 Glen Mawr Sewersheds

The Glen Mawr sewersheds are located entirely in the City of Pittsburgh, and are comprised of approximately 540 manholes and 135,700 linear feet (26 miles) of mostly combined sewer up to 120 inches in size. The Glen Mawr sewersheds consist of approximately 806 acres of combined sewers that contribute flow to five ALCOSAN outfalls.

O-8, Bixby Way and West Carson Street Sewershed. Outfall 043SO08 conveys overflows from ALCOSAN diversion structure ADC 043SO08 to the Ohio River. The outfall is located along east of West Carson Street south of Corks Run in the City of Pittsburgh. The outfall is located approximately 200 feet east of West Carson Street. The tributary sewershed is 19 acres (total) of residential, business, and commercial users.

O-9, West Carson and Frustrum Streets Sewershed. Outfall 042DO09 conveys overflows from ALCOSAN diversion structure ADC 042DO09 to the Ohio River. The outfall is located along West Carson Street south of Corks Run in the City of Pittsburgh. The outfall is located approximately 200 feet east of West Carson Street. The tributary sewershed is 15 acres (total) of residential, business, and commercial users.

O-10, Earl and West Carson Streets Sewershed. Outfall 021AO10 conveys overflows from ALCOSAN diversion structure ADC 021AO10 to the Ohio River. The outfall is located along West Carson Street south of Corks Run in the City of Pittsburgh. The outfall is located approximately 200 feet east of West Carson Street. The tributary sewershed is 7 acres (total) of residential, business, and commercial users.

O-11, West Carson Street Ejector Station Sewershed. Outfall 021KO11 conveys overflows from ALCOSAN diversion structure ADC 021KO11 to the Ohio River. The O-11 tributary area consists of 52 acres (total) of residential, business, and commercial users.

O-13, Corks Road Sewershed. Outfall 021RO13 conveys overflows from ALCOSAN diversion structure ADC 021RO13 to the Ohio River. The O-13 tributary area consists of 713 acres (total) of residential, business, and commercial users.

3.3.21 Saw Mill Run Interceptor Sewersheds

The Saw Mill Run Interceptor Sewersheds are located in portions of Beechview, Beltzhoover, Bon Air, Brookline, Carrick, Duquesne Heights, Elliott, Mount Washington, Ridgemont, South Shore, and West End sections in the City of

Pittsburgh, and Baldwin Township, the Municipality of Bethel Park, Castle Shannon Borough, the Municipality of Mount Lebanon, and Whitehall Borough. The Saw Mill Run Interceptor sewersheds include approximately 4,734 acres (total) of residential, business, and commercial users. The Saw Mill Run Interceptor sewersheds are comprised of approximately 1,590 manholes and 354,000 linear feet (67 miles) of combined, sanitary, and storm sewer up to 72 inches in size.

S-18, Steuben Street and Sawmill Run Boulevard Sewershed. Outfall 095PS18 conveys overflows from ALCOSAN diversion structure ADC 095PS18 to Saw Mill Run. The outfall is located along Saw Mill Run adjacent to Saw Mill Run Boulevard near Overbrook Boulevard in the City of Pittsburgh. The S-18 sewershed consists of 235 acres, or approximately 5% of the Saw Mill Run Interceptor sewershed service area.

S-28, Bausman Street and Sawmill Run Boulevard Sewershed. Outfall 034LS28 conveys overflows from ALCOSAN diversion structure ADC 034LS28 to Saw Mill Run. The outfall is located along Saw Mill Run adjacent to Saw Mill Run Boulevard near Bausman Street in the City of Pittsburgh.

S-46, South Main Street Sewershed. Outfall 006AS46 conveys overflows from ALCOSAN diversion structure ADC 019DS46 to Saw Mill Run. The outfall is located along Saw Mill Run near the intersection of Main Street and Sanctus Street in the West End section of the City of Pittsburgh. The S-46 sewershed consists of 135 acres, or approximately 3% of the Saw Mill Run Interceptor sewershed service area.

O-14, Sawmill Run Boulevard Sewershed. Outfall 007NO14B conveys overflows from ALCOSAN diversion structure O-14 to the Ohio River. The outfall is located along the Ohio River at the end of Saw Mill Run. The O-14 sewershed consists of 4,070 acres of combined sewers. In total, the O-14 and O-14B sewersheds include approximately 12,984 acres of residential, business, and commercial users.

O-14B, Advent Street Sewershed. Outfall 007NO14B conveys overflows from ALCOSAN diversion structure O-14B to the Ohio River. The outfall is located along the Ohio River at the end of Saw Mill Run. The O-14B sewershed consists of 14 acres of combined sewers. In total, the O-14 and O-14B sewersheds include approximately 12,984 acres of residential, business, and commercial users.

S-23, Edgebrook Street Sewershed. Outfall 061DS23 conveys overflows from ALCOSAN diversion structure S-23 to Saw Mill Run. It is located in the Brook, Bausman and Warrington sewershed. The S-23 tributary area consists of 177 acres of combined sewers.

S-24, Sawmill Run Sewershed. Outfall 061DS24 conveys overflows from ALCOSAN diversion structure S-24 to Saw Mill Run. It is located in the Edgebrook sewershed. The S-24 tributary area consists of 311 acres of combined sewers.

S-29, Bausman and Sawmill Run Sewershed. Outfall 034GS29 conveys overflows from ALCOSAN diversion structure S-29 to Saw Mill Run. The outfall is located along Saw Mill Run adjacent to Saw Mill Run Boulevard near Timberland Avenue in the City of Pittsburgh. The S-29 sewershed consists of 211 acres, or approximately 5% of the Saw Mill Run Interceptor sewershed service area.

S-30, Sawmill Run Boulevard by West Liberty Avenue Sewershed. Outfall 034B001 conveys overflows from ALCOSAN diversion structure ADC034BS30 to Saw Mill Run. The outfall is located along Saw Mill Run near the Liberty Tunnel and Buffington Avenue. The S-30 sewershed consists of 4.8 acres of combined sewers.

S-32, Warrington and Sawmill Run Sewershed. Outfall 015PS32 conveys overflows from the ALCOSAN diversion structure 015PS32 to Saw Mill Run, and ultimately into the Ohio River. The outfall is located along Saw Mill Run, near the intersection of Warrington Avenue and Saw Mill Run Boulevard. The Bausman, Brook, and Warrington Street sewersheds are located in portions of Allentown, Beltzhoover, Bon Air, Carrick, Knoxville, and Mount Washington sections in the City of Pittsburgh. The Bausman and Brook Street sewersheds also include portions of Mount Oliver Borough. These sewersheds include approximately 871 acres of residential, business, and commercial users. The 015PS32 sewershed (Warrington Ave.) consists of 376 acres, or approximately 44% of the total service area. The Bausman, Brook, and Warrington sewersheds are comprised of approximately 751 manholes and 219,457 linear feet (41.6 miles) of mostly combined sewer up to 72 inches in diameter.

S-33, Crane Avenue Sewershed. Outfall 015JS33 conveys overflows from ALCOSAN diversion structure 015JS33 to Saw Mill Run, and ultimately into the Ohio River. The outfall is located along Saw Mill Run, near Saw Mill Run Boulevard and Crane Avenue. The S-33 sewershed consists of 80 acres, or approximately 2% of the Saw Mill Run Interceptor sewershed service area.

S-34, Crane Avenue and Sawmill Run Boulevard Sewershed. Outfall 015JS34 conveys overflows from ALCOSAN diversion structure S-34 to Saw Mill Run. The outfall is located along Saw Mill Run adjacent to Saw Mill Run Boulevard near Crane Avenue in the City of Pittsburgh.

S-35, Woodruff Street and Sawmill Run Boulevard Sewershed. Outfall 015ES35 conveys overflows from ALCOSAN diversion structure S-35 to Saw Mill Run, and ultimately into the Ohio River. The outfall is located along Saw Mill Run, near Saw Mill Run Boulevard. The S-35 sewershed consists of 33 acres, or approximately 1% of the Saw Mill Run Interceptor sewershed service area.

S-36, Sawmill Run Boulevard Sewershed. Outfall 015AS36 conveys overflows from ALCOSAN diversion structure S-36 to Saw Mill Run, and ultimately into the Ohio River. The outfall is located along Saw Mill Run, near Saw Mill Run Boulevard. The S-36 sewershed consists of 37 acres, or approximately 1% of the Saw Mill Run Interceptor sewershed service area.

S-42A and S-42, Greentree Road and McCartney Run Sewershed (MH-11). Outfall 019M001 conveys overflows from the PWSA diversion structures 019J001, 019K001, 019L001, 019S001, 040M001, and 040M002, and ALCOSAN diversion structure S-42A to Saw Mill Run. These sewersheds are located in portions of Crafton Heights, Elliott, Ridgemont, West End, and West Wood sections in the City of Pittsburgh, and in portions of Green Tree Borough. Outfall 019M001 is located along McCartney Run near the intersection of Wabash Street and Greentree Road in the City of Pittsburgh. The McCartney Run sewershed, including the ALCOSAN diversion structure S-42 area (ADC 019MS42), includes approximately 595 acres of residential, business, and commercial users. The outfall 019M001 sewershed consists of 583 acres, or approximately 98% of the total service area. The McCartney Run sewershed, including the S-42 area, is comprised of approximately 380 manholes and 83,000 linear feet (16 miles) of mostly combined sewer up to 48 inches in diameter.

3.3.22 Olympia, Shaler, and Woodruff Sewersheds

The service area is called the Olympia, Shaler, and Woodruff Sewershed and consists of 422 acres of residential, business, and commercial users. The Olympia, Shaler and Woodruff sewersheds are comprised of approximately 316 manholes and 85,300 linear feet (16 miles) of mostly combined sewer up to 48 inches in size.

S-37, Woodruff Street and Sawmill Run Boulevard Sewershed. Outfall 005R001 conveys overflows from the PWSA diversion structure 005R001 to Saw Mill Run. The outfall is located along Saw Mill Run adjacent to Saw Mill Run Boulevard near Woodruff Street in the City of Pittsburgh. The 005R001 sewershed (Woodruff St.) consists of 169 acres, or approximately 40% of the total Olympia, Shaler, and Woodruff sewershed service area.

S-39, Sawmill Run Boulevard Sewershed. Outfall 005LS39 conveys overflows from ALCOSAN diversion structure S-39 to Saw Mill Run. The outfall is located along Saw Mill Run, north of Woodruff Street. The 005LS39 Sewershed (Olympia St.) consists of 102 acres, or approximately 24% of the total Olympia, Shaler, and Woodruff sewershed service area.

S-40, Unnamed Sewershed. Outfall 005F001 conveys overflows from ALCOSAN diversion structure ADC 005F001 to Saw Mill Run. The outfall is located along Saw Mill Run adjacent to the PennDOT maintenance facility near the outbound exit from the Fort Pitt Tunnels in the City of Pittsburgh. The 005F001 sewershed (Banksville Road) consists of 79 acres, or approximately 19% of the total Olympia, Shaler, and Woodruff sewershed service area.

S-41, Shaler and McKnight Streets Sewershed. Outfall S-41 conveys overflows from ALCOSAN diversion structure S-41 to Saw Mill Run. The outfall is located along Saw Mill Run adjacent to Shaler Street near the bridge to Woodville Avenue, in the City of Pittsburgh. The S-41 sewershed (Shaler St.) consists of 106 acres, or approximately 25% of the total Olympia, Shaler, and Woodruff sewershed service area.

S-31, Sawmill Run Boulevard Sewershed. Outfall 015PS31 conveys overflows from ALCOSAN diversion structure S-31 to Saw Mill Run. The outfall is located along Saw Mill Run, near the Liberty Tunnels and Saw Mill Run Boulevard, in an area now or formerly owned by Gilbert Auto Wreckers. The S-31 sewershed (Boggston

Ave.) consists of 45 acres, or approximately 11% of the total Olympia, Shaler, and Woodruff sewershed service area.

3.3.23 Little Saw Mill Run Sewersheds

The Little Sawmill Run sewersheds (MH-18) are located in portions of Banksville, Beechview, and Ridgemont sections in the City of Pittsburgh, and in portions of Dormont Borough, Green Tree Borough, the Municipality of Mount Lebanon, and Scott Township. They include approximately 1,820 acres of residential, business, and commercial users. The Little Sawmill Run sewersheds are comprised of approximately 850 manholes and 188,900 linear feet (36 miles) of sewers up to 156 inches in size.

DC016N001, Crane Avenue and Banksville Road Sewershed. Outfall 016A001 conveys overflows from DC016N001 to Little Saw Mill Run, a tributary of Saw Mill Run. The combined tributary area for DC016N001, DC016A001, DC035A001, DC035E001, and DC036M001 is approximately 207 acres. The NPDES permit location corresponds to a combination of individual outfalls that connect to an open channel portion of stream or locations where a culverted portion of the stream daylights. Nearly all of the service area is combined sewer.

DC016A001, Shadycrest Road Sewershed. Outfall 016A002 conveys overflows from DC016A001 to Little Saw Mill Run, a tributary of Saw Mill Run. The combined tributary area for DC016N001, DC016A001, DC035A001, DC035E001, and DC036M001 is approximately 207 acres. The NPDES permit location corresponds to a combination of individual outfalls that connect to an open channel portion of stream or locations where a culverted portion of the stream daylights. Nearly all of the service area is combined sewer.

DC035A001, Goldstorm Avenue and Banksville Road Sewershed. Outfall 035A001 conveys overflows from DC035A001 to Little Saw Mill Run, a tributary of Saw Mill Run. The combined tributary area for DC016N001, DC016A001, DC035A001, DC035E001, and DC036M001 is approximately 207 acres. The NPDES permit location corresponds to a combination of individual outfalls that connect to an open channel portion of stream or locations where a culverted portion of the stream daylights. Nearly all of the service area is combined sewer.

DC035E001, Coast Avenue Sewershed. Outfall 035E001 conveys overflows from DC035E001 to Little Saw Mill Run, a tributary of Saw Mill Run. The combined tributary area for DC016N001, DC016A001, DC035A001, DC035E001, and DC036M001 is approximately 207 acres. The NPDES permit location corresponds to a combination of individual outfalls that connect to an open channel portion of stream or locations where a culverted portion of the stream daylights. Nearly all of the service area is combined sewer.

DC036M001, Wenzell Avenue Sewershed. Outfall 035J001 conveys overflows from DC036M001 to Little Saw Mill Run, a tributary of Saw Mill Run. The combined tributary area for DC016N001, DC016A001, DC035A001, DC035E001, and DC036M001 is approximately 207 acres. The NPDES permit location corresponds to a combination of individual outfalls that connect to an open channel portion of stream or locations where a culverted portion of the stream daylights. Nearly all of the service area is combined sewer.

DC036P001, DC036R001, DC063B001, DC063B002, DC063F001, Banksville Road Sewershed. Outfall 036R001 conveys overflows from five PWSA diversion structures to Little Saw Mill Run, a tributary of Saw Mill Run. The area tributary to outfall 036R001 is 428 acres, of which approximately 303 acres are tributary to the individual PWSA diversion structures and the remaining area is stormwater drainage tributary to outfall 036R001.

The individual diversion structures overflow to Little Saw Mill Run, a tributary of Saw Mill Run, and the NPDES permit applies to the location where the culvert daylights. Nearly all of the service area is combined sewer.

3.3.24 Miscellaneous Saw Mill Run Sewersheds

The Miscellaneous Saw Mill Run sewersheds include four relative small sewersheds in the Saw Mill Run planning basin that contain PWSA combined sewer diversion structures and outfalls. For the purposes of this discussion, these sewersheds are referred to as the Brook Street, Brookline Boulevard, Timberland Street, and Englert Street sewersheds. There are seven PWSA diversion structures within these sewersheds that discharge non-diverted combined flows to the sewage trunk sewer and wet weather combined sewer overflow discharges to the storm sewer. The sewage trunk sewer is owned and operated by PWSA. The Miscellaneous Saw Mill

Run sewersheds encompass at total of approximately 500 acres, all of which lie within the City of Pittsburgh.

S-23, Brook Street Sewershed. Outfall 060A001 conveys overflows from the PWSA diversion structure 060A001 to a tributary of Saw Mill Run. The outfall is located along Brook Street in the City of Pittsburgh. The Brook Street sewershed also includes portions of Mount Oliver Borough.

DC096B001, DC096B002, DC096C001, DC096C002, and DC096H001, Brookline Boulevard Sewershed (MH-77). Outfall 095E001 conveys overflows from PWSA diversion structures DC096B001, DC096B002, DC096C001, DC096C002, and DC096H001 to a storm sewer, and ultimately into Saw Mill Run.

DC034R001, Timberland Street Sewershed (MH-55). Outfall 034R001 conveys overflows from PWSA diversion structure DC034R001 to a storm sewer, and ultimately into Saw Mill Run.

DC095K001, Englert Street Sewershed (MH-80). Outfall 095J001 conveys overflows from PWSA diversion structure DC095K001 to a storm sewer, and ultimately into Saw Mill Run.

CSO 095E001 and CSO 095J001, Brookline Boulevard and Englert Street Sewersheds. These outfalls are included in the Brookline Boulevard sewershed and the Englert sewershed. CSO095E001 is in the Brookline Boulevard sewershed, which is located in portions of Brookline and Overbrook sections in the City of Pittsburgh. This sewershed includes approximately 196 acres of residential, business, and commercial users, of which approximately 84 acres are located upstream of the PWSA diversion structures. CSO095J001 is in the Englert sewershed, which is located in portions of Carrick and Overbrook sections in the City of Pittsburgh and in portions of Brentwood Borough, Castle Shannon Borough, and Whitehall Borough. This sewershed consists of 49 acres of residential, business, and commercial users, of which approximately 5 acres are located upstream of the PWSA diversion structure. Outfalls CSO095E001 and CSO095J001 currently convey overflows from each of the respective PWSA diversion structures to tributaries of Saw Mill Run.

3.3.25 Plummer's Run Sewershed

The Plummer's Run sewershed is located in the Saw Mill Run planning basin. The main trunk sewer facilities consist of two parallel pipes that flow in a northeasterly direction to Saw Mill Run. One line is a storm sewer that conveys storm water and wet weather-diverted combined sewage to a point of discharge into Saw Mill Run. This sewer ranges to 30-in diameter at the upstream end to a 66-in by 120-in cross section pipe at the downstream end.

Sanitary sewage and combined wet weather flows that are not diverted to the storm sewer are conveyed through a sewage trunk sewer to the ALCOSAN interceptor at ALCOSAN POC SMRE-40. This sewage trunk sewer ranges in size from 12 inches to 24 inches in diameter.

There are ten PWSA diversion structures within this sewershed. These structures currently discharge diverted wet weather flows into the storm sewer and sanitary sewage and non-diverted combined wet weather flows to the sewage trunk sewer. The sewage trunk sewer is owned and operated by PWSA. The sewershed encompasses approximately 611 acres (576 acres of the City of Pittsburgh and 35 acres of Dormont Borough). It is comprised of approximately 742 manholes and 168,000 linear feet (32 miles) of sanitary, combined, and storm sewers.

DC034E001, DC035N001, DC035M001, DC035P001, DC035S001, DC062C001, DC062C002, DC062D001, DC062K001, and DC062K002, West Liberty Avenue and Sawmill Run Boulevard Sewershed. Outfall 015P001 conveys overflows from DC034E001, DC039N001, DC035M001, DC035P001, DC035S001, DC062C001, DC062C002, DC062D001, DC062K001, and DC062K002 to a storm sewer, and ultimately into Saw Mill Run. The outfall is located in the City of Pittsburgh at Saw Mill Run near the Liberty Tunnels. The tributary sewershed is made up of residential, commercial, and business users.

3.3.26 McDonough's / McNeilly Run Sewershed

The McDonough's Run Sewershed (also known as the NcNeilly Road Sewershed) is located in the Saw Mill Run planning basin. It is served by one main trunk sewer that flows in a northwesterly direction along McNeilly Road from near Dewalt Drive within Baldwin Township to POC S-15 at the ALCOSAN Saw Mill Run interceptor sewer. The trunk sewer ranges in size from 15-in to 20-in diameter.

There are seven PWSA CSO diversion chambers and six outfalls in the sewershed. The McDonough's Run sewershed encompasses approximately 1,068 acres of residential, business, and commercial users as follows: 334 acres of the City of Pittsburgh, 175 acres of Baldwin Township, 222 acres of Dormont Borough, and 337 acres of the Municipality of Mt. Lebanon.

The McDonough's Run sewershed is comprised of approximately 410 manholes and 105,300 linear feet (20 miles) of mostly combined sewer up to 54 inches in size.

DC097L001, Dorchester Avenue Sewershed. Outfall 097L001 conveys overflows from PWSA diversion structure 097L001 to McDonough's Run. The outfall is located along McDonough's Run off Queensboro Avenue. The tributary sewershed is encompasses 51 acres, or 5% of total McDonough's Run sewershed.

DC096K001, DC139B001, McNeilly Avenue Sewershed. Outfall 139B002 conveys overflows from PWSA diversion structures DC096K001 and DC139B001 to McDonough's Run. The outfall is located on McDonough's Run near McNeilly Avenue. The tributary area consists of 52 acres of combined sewers.

DC096N001, McNeilly Avenue and Sussex Avenue Sewershed. Outfall 139A001 conveys overflows from PWSA diversion structure DC096N001 to McDonough's Run. The outfall is located on McDonough's Run near the intersection of McNeilly and Sussex Avenues. The tributary area consists of 228 acres of combined sewers.

DC139A001, Rockford Avenue near McNeilly Avenue Sewershed. Outfall 139B001 conveys overflows from PWSA diversion structure DC139A001 to McDonough's Run. The outfall is located on McDonough's Run, on Rockford Avenue near McNeilly Avenue. The tributary area consists of 18 acres of combined sewers.

DC139B002, Seaton Avenue and Creedmore Avenue Sewershed. Outfall 139F001 conveys overflows from PWSA diversion structure DC139B002 to McDonough's Run. The outfall is located on McDonough's Run, near Seaton Street and Creedmore Place.

DC139B003, Creedmore and McNeilly Avenue Sewershed. Outfall 139B003 conveys overflows from PWSA diversion structure DC139B003 to McDonough's Run. The outfall is located on McDonough's Run, near McNeilly Avenue and Creedmore Place.

3.3.27 Arlington through 25th Street Sewersheds

The Arlington through 25th Street sewersheds are located in portions of Allentown, Arlington, Arlington Heights, Mount Washington, South Shore, Southside Flats, and Southside Slopes sections in the City of Pittsburgh. These sewersheds include approximately 1,370 acres (total) of residential, business, and commercial users that contribute flow to 22 ALCOSAN outfalls. The Arlington through 25th Street sewersheds are comprised of approximately 1,180 manholes and 269,700 linear feet (51 miles) of sewer of up to 90 inches in size.

M-6, South First Street Sewershed. Outfall 003AM06 conveys overflows from ALCOSAN diversion structure ADC 004DM06 to the Monongahela River. The outfall is located on the Monongahela River at South First Street. The M-6 tributary area consists of approximately 56 acres of combined sewers.

M-7, South Fourth Street Sewershed. Outfall 003BM07 conveys overflows from ALCOSAN diversion structure ADC003BM07 to the Monongahela River. The outfall is located on the Monongahela River at South Fourth Street. The M-7 tributary area consists of 12 acres of combined sewers.

M-8, South Sixth Street Sewershed. Outfall 003BM08 conveys overflows from ALCOSAN diversion structure ADC003BM08 to the Monongahela River. The outfall is located on the Monongahela River at South Sixth Street. The M-8 tributary area consists of 15 acres of combined sewers.

M-10, South Eighth Street Sewershed. Outfall 003CM10 conveys overflows from ALCOSAN diversion structure ADC003CM10 to the Monongahela River. The outfall is located on the Monongahela River at South Eighth Street. The M-10 tributary area consists of 170 acres of combined sewers.

M-11, South Tenth Street Sewershed. Outfall 003CM11 conveys overflows from ALCOSAN diversion structure ADC003CM11 to the Monongahela River. The outfall is located on the Monongahela River at South Tenth Street. The M-11 tributary area consists of 16 acres of combined sewers.

M-11A, South 11th Street Sewershed. Outfall 003CM11A conveys overflows from ALCOSAN diversion structure ADC003CM11A to the Monongahela River. The outfall is located on the Monongahela River at South 11th Street.

M-12, South 13th Street Sewershed. Outfall 003DM12 conveys overflows from ALCOSAN diversion structure ADC003DM12 to the Monongahela River. The outfall is located on the Monongahela River at South 13th Street. The M-12 tributary area consists of 26 acres of combined sewers.

M-13, South 15th Street Sewershed. Outfall 003DM13 conveys overflows from ALCOSAN diversion structure ADC003DM13 to the Monongahela River. The outfall is located on the Monongahela River at South 15th Street. The M-13 tributary area consists of 13 acres of combined sewers

M-14, South 17th Street Sewershed. Outfall 012AM14 conveys overflows from ALCOSAN diversion structure ADC012AM14 to the Monongahela River. The outfall is located on the Monongahela River at South 17th Street. The M-14 tributary area consists of 16 acres of combined sewers

M-14A, South 18th Street Sewershed. Outfall 012AM14A conveys overflows from ALCOSAN diversion structure ADC012AM14A to the Monongahela River. The outfall is located on the Monongahela River at South 18th Street. The M-14A tributary area consists of 17 acres of combined sewers

M-15, South 19th Street Sewershed. Outfall 012AM15 conveys overflows from ALCOSAN diversion structure ADC012AM15 to the Monongahela River. The outfall is located on the Monongahela River at South 19th Street. The M-15 tributary area consists of 6 acres of combined sewers

M-16, South 20th Street Sewershed. Outfall 012BM16 conveys overflows from ALCOSAN diversion structure ADC012BM16 to the Monongahela River. The outfall is located on the Monongahela River at South 20th Street. The M-16 tributary area consists of 301 acres of combined sewers

M-17, South 21st Street Sewershed. Outfall 012BM17 conveys overflows from ALCOSAN diversion structure ADC012BM17 to the Monongahela River. The outfall is located on the Monongahela River at South 21st Street. The M-17 tributary area consists of 8 acres of combined sewers

M-18, South 22nd Street Sewershed. Outfall 012CM18 conveys overflows from ALCOSAN diversion structure ADC012CM18 to the Monongahela River. The outfall is located on the Monongahela River at South 22nd Street. The M-18 tributary area consists of 15 acres of combined sewers.

M-20, South 23rd Street Sewershed. Outfall 012CM20 conveys overflows from ALCOSAN diversion structure ADC012CM20 to the Monongahela River. The outfall is located on the Monongahela River at South 23rd Street. The M-20 tributary area consists of 16 acres of combined sewers.

M-21, South 24th Street Sewershed. Outfall 012DM21 conveys overflows from ALCOSAN diversion structure ADC012DM21 to the Monongahela River. The outfall is located on the Monongahela River at South 24th Street. The M-21 tributary area consists of 68 acres of combined sewers.

M-22, South 25th Street Sewershed. Outfall 012DM22 conveys overflows from ALCOSAN diversion structure ADC012HM22 to the Monongahela River. The outfall is located on the Monongahela River at South 25th Street. The M-22 tributary area consists of 117 acres of combined sewers.

M-23, South 26th Street Sewershed. Outfall 012HM23 conveys overflows from ALCOSAN diversion structure ADC012HM23 to the Monongahela River. The outfall is located on the Monongahela River at South 26th Street. The M-23 tributary area consists of 26 acres of combined sewers.

M-24, Hot Metal Street Sewershed. Outfall 029KM24 conveys overflows from ALCOSAN diversion structure ADC029KM24 to the Monongahela River. The outfall is located on the Monongahela River at Hot Metal Street. The M-24 tributary area consists of 38 acres of combined sewers.

M-26, South 30th Street Sewershed. Outfall 029KM26 conveys overflows from ALCOSAN diversion structure ADC029KM26 to the Monongahela River. The outfall is located on the Monongahela River at South 30th Street. The M-26 tributary area consists of 41 acres of combined sewers.

M-27, South 33rd Street Sewershed. Outfall 029PM27 conveys overflows from ALCOSAN diversion structure ADC029PM27 to the Monongahela River. The outfall is located on the Monongahela River at South 33rd Street. The M-27 tributary area consists of 123 acres of combined sewers.

M-28, South 34th Street Sewershed. Outfall 030CM28 conveys overflows from ALCOSAN diversion structure ADC030CM28 to the Monongahela River. The outfall is located on the Monongahela River at South 34th Street. The M-28 tributary area consists of 67 acres of combined sewers.

3.3.28 Becks Run Sewersheds

The Becks Run sewershed is located in the Upper Monongahela River planning basin. The Becks Run interceptor sewer flows in a northeasterly direction along Becks Run Road from Wagner Street to ALCOSAN POC M-34. This sewer ranges in size from 12 inches to 4 feet in diameter.

There are two significant trunk sewers that drain to the Becks Run interceptor sewer. One trunk sewer connects to the Becks Run interceptor sewer near Parkwood Road. The other connects to the interceptor at Wagner Street. There are both combined and separate sanitary sewers in the sewershed.

There are three PWSA diversion structures within this sewershed that discharge non-diverted combined flows to the trunk sewers and wet weather combined sewer overflow discharges to local streams. The Becks Run sewershed encompasses approximately 1,635 acres of residential, business, and commercial users as follows: 1,190 acres of the City of Pittsburgh, 254 acres of Baldwin Borough, and 191 acres of Mt. Oliver Borough.

There is one ALCOSAN diversion structure within this sewershed that discharges to the Monongahela River.

The Becks Run sewershed is comprised of approximately 1,350 manholes and 231,100 linear feet (44 miles) of sewer.

M-34, Becks Run Road and East Carson Street Sewershed. Outfall 031GM34 conveys overflows from the ALCOSAN diversion structure M-34 to the Monongahela River. The outfall is located near the intersection of Becks Run Road and East Carson Street in the City of Pittsburgh. The sewershed is located in portions of Arlington, Arlington Heights, Carrick, Hays, Mount Oliver, and St. Clair portions of the City of Pittsburgh and Baldwin Borough.

DC030N001, Devlin Street Sewershed. Outfall 030N001 conveys overflows from the PWSA diversion structure DC030N001 to a tributary to Becks Run. The outfall is located near Devlin Street in the City of Pittsburgh.

DC032P001, Wagner Street Sewershed. Outfall 032P001 conveys overflows from the PWSA diversion structure DC032P001 to a tributary to Becks Run. The outfall is located near Wagner Street in the City of Pittsburgh. Referenced in SWMM model as DC032P002.

DC030N002, Mountain Avenue Sewershed. Outfall 032N001 conveys overflows from the PWSA diversion structure DC030N002 to a tributary to Becks Run. The outfall is located near Mountain Avenue in the City of Pittsburgh. The tributary area for this outfall is approximately 44 acres.

3.3.29 Streets Run Sewershed

The Streets Run sewershed is located in the Upper Monongahela River planning basin, and is served by the Streets Run Interceptor sewer that flows in a northerly direction along West Baldwin Road, Calea Street, Baldwin Road, and West Mifflin Road to ALCOSAN POC M-42 at the Monongahela River.

There two pump stations in the Streets Run sewershed, the PWSA's Mifflin Road and Rodgers Street Pump Station. There are three PWSA CSO diversion chambers in the sewershed. There is one separate sanitary sewer (SSO) overflow point in the Streets Run sewer system. This SSO is on the Baldwin Borough sewer system and is located on Brentwood Road immediately adjacent to Baldwin Borough's boundary with Brentwood Borough. The Streets Run sewershed consists of 6,521 acres of residential, business, and commercial users. The Streets Run Sewershed is comprised of approximately 663 manholes and 125,500 linear feet (24 miles) of storm, sanitary, and combined sewers up to 60 inches in size.

There is one ALCOSAN diversion structure within this sewershed that discharges to Streets Run, and ultimately to the Monongahela River.

M-42, Carson Street / Glennwood Bridge Interchange Sewershed. Outfall 091AM42 conveys overflows from ALCOSAN diversion structure M-42 to Streets Run, and ultimately to the Monongahela River. The outfall is located along Streets Run, east of the Glenwood Bridge interchange, near the existing Sandcastle water park. The M-42 Service Area encompasses approximately 99% of the Streets Run sewershed service area, and includes portions of Baldwin Borough, Brentwood Borough, Pleasant Hills Borough, and West Mifflin Borough, as well as the City of Pittsburgh.

DC184E001 Oakleaf Drive Sewershed. Outfall 084E001 conveys overflows from PWSA diversion structure DC184E001 to a tributary of Streets Run. The outfall is located along a tributary to Streets Run, near Oakleaf Drive and Mifflin Road. The DC184E001 sewershed has an area of 22 acres, or 0.3% of the total Streets Run service area.

DC185H001, Glenhurst and Mifflin Roads Sewershed. Outfall 185H001 conveys overflows from PWSA diversion structure DC185H001 to a tributary of Streets Run. The outfall is located near Glenhurst Road and Mifflin Road. The DC185H001 sewershed has an area of 35 acres, or 0.5% the total Streets Run service area.

DC134A001, Hilburn Street Sewershed. Outfall 134A001 conveys overflows from PWSA diversion structure 134A001 to Streets Run. The outfall is located along Streets Run, north of Hilburn Street, adjacent to a neighborhood playground area. The Hilburn Street sewershed consists of 9 acres, or approximately 0.1% of the total Streets Run service area.

3.3.30 Weymans Run Sewershed (MH-89)

CSO 138K001, Odette Street Tributary to Weyman Run Sewersheds. Outfall 138K001 conveys overflows from PWSA diversion structure DC138K001 to Weyman Run. The outfall is located along Weyman Run near Odette Street and is part of the

Weyman Run Sewershed. This sewershed consists of a total of 170.12 acres of primarily separate sewers.

DC138J001, Homehurst Avenue and Hillview Street Sewershed. Outfall 138J001 conveys overflows from DC138J001 to a tributary to Weyman Run. The Homehurst Avenue and Hillview Street include the areas tributary to DC138J001 and DC138P001. The sewershed is comprised of approximately 300 manholes and 54,500 linear feet (10 miles) of combined, sanitary, and storm sewer up to 36 inches in size.

DC138P001, Arcata Street Sewershed. Outfall 138PJ001 conveys overflows from DC138P001 to a tributary to Weyman Run. The Arcata Street sewershed includes the areas tributary to DC138J001 and DC138P001. The sewershed is comprised of approximately 300 manholes and 54,500 linear feet (10 miles) of combined, sanitary, and storm sewer up to 36 inches in size.

3.4 MULTI-MUNICIPAL SYSTEMS AND COMPLEX SEWERSHEDS

There are some ALCOSAN points of connection (POCs) that receive flow from more than one municipality. These are considered to be “multi-municipal” systems because more than one municipality contributes flow, and a solution for managing flow would have to consider each of the contributing municipalities. There are over 100 such multi-municipal sewersheds contributing to ALCOSAN POCs. Some of these multi-municipal systems are more complex than others and, as such, were defined by ALCOSAN as “complex sewersheds.” There are 48 complex sewersheds in the ALCOSAN system.

ALCOSAN sent letters, dated November 7, 2011, to each municipality in the complex sewersheds requesting that one comprehensive feasibility study, designated by POC, be submitted for each complex sewershed. PWSA received the letters and maps from ALCOSAN recognizing 20 POCs as complex. PWSA is proposing improvements in nine of the 20 ALCOSAN-designated complex sewersheds. Proposed improvements in two of the 20 “complex” sheds are being handled by other municipalities because PWSA is the minor flow contributor. PWSA has identified nine sewersheds as “no action,” in which no improvements are being proposed, and thus no action is being taken in regards to CSO management. ALCOSAN also requested that each complex sewershed feasibility study be submitted with a “resolution” from the governing bodies of the participating municipalities. The resolution should acknowledge the joint effort of the participating municipalities and authorize the release of the feasibility study to ALCOSAN for planning and review purposes. Information regarding the development and evaluation of the recommended alternative for the municipal area that is tributary to the complex/multi-municipal sewershed(s) can be found in the POC Reports which are attached to this document in Appendix A.

3.5 POC REPORTS

Based on the complexity and size of PWSA's system as well as potential required coordination with upstream municipalities and the downstream treatment provider ALCOSAN, PWSA has developed a total of 14 POC reports, one for each of the sewersheds in which improvements are being proposed. Ten of these sewersheds are multi-municipal, two with very minor tributary area contribution (A-51 and MH-11). A list of the POC reports, which are included in the Wet Weather Feasibility Study (Appendix A), is as follows:

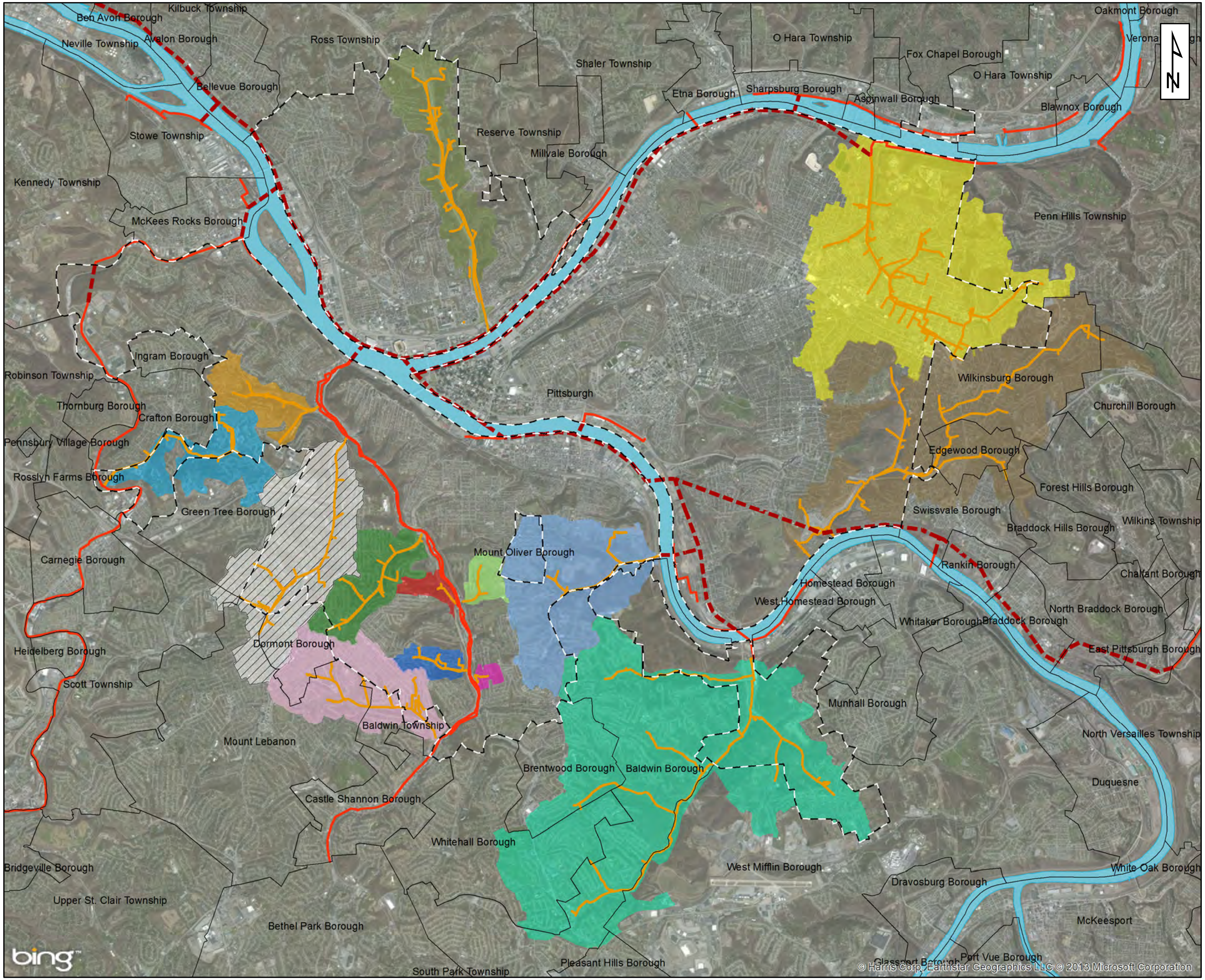
1.	A-42	Negley Run
2.	A-51	East Street
3.	C-25	Bells Run
4.	M-34	Becks Run
5.	M-42	Streets Run
6.	M-47	Nine Mile Run
7.	MH-11	McCartney Run
8.	MH-18	Little Saw Mill Run
9.	MH-55	Timberland Street
10.	MH-77	Brookline Boulevard
11.	MH-80	Englert Street
12.	S-15	McNeilly / McDonough's Run
13.	S-23	Brook Street
14.	SMRE-40	Plummer's Run

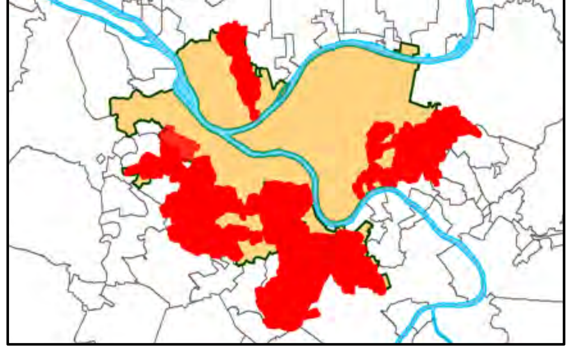
Note: For reference purposes, the POC report for MH-89 Weyman's Run, prepared by Gateway Engineers, Inc., is included as an attachment to Appendix A of the Wet Weather Feasibility Study.

Figure 3-4 shows the location of each of the 14 POC sewersheds relative to PWSA's service area.

Refer to Wet Weather Feasibility Study (Appendix A) and the individual POC reports for the Development and Evaluation of the Recommended Alternatives.

ATTACHMENT B





PWSA Service Area Overview

Legend

- — Trunk Sewer
- ┅ PWSA Service Area Boundary
- ▭ Municipal Boundary
- 🟫 M-47 Sewershed Boundary
- 🟪 S-15 Sewershed Boundary
- 🟩 S-23 Sewershed Boundary
- 🟥 MH-55 Sewershed Boundary
- 🟦 MH-77 Sewershed Boundary
- 🟪 MH-80 Sewershed Boundary
- 🟨 A-42 Sewershed Boundary
- 🟦 M-34 Sewershed Boundary
- 🟧 MH-11 Sewershed Boundary
- 🟩 M-42 Sewershed Boundary
- 🟦 C-25 Sewershed Boundary
- 🟩 A-51 Sewershed Boundary
- ▨ MH-18 Sewershed Boundary
- 🟩 SMRE-40 Sewershed Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ╍ Deep Tunnel
- — Shallow Cut

6,000 3,000 0 6,000 Feet

Figure 3 - 4: POC Sewersheds

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\POC SEWERSHED MAP.mxd

3.6 CURRENT FLOW MANAGEMENT AGREEMENTS [3]

The City of Pittsburgh currently operates under a municipal service contract (“Standard Municipal Agreement”) with ALCOSAN, the wastewater treatment/ disposal service provider. The Standard Municipal Agreement was executed in 1955 when the original interceptor system was first constructed. In the 1950s “The Upper Allegheny Agreement” was executed allowing the extension of service to municipalities on the Allegheny River. Both contracts provide for uniform sewer charges throughout the service area based upon metered or estimated water consumption. Individual flow metering of each point of connection (POC) to the ALCOSAN system was determined not viable due to the excessive number of points and other contributing factors such as I/I. There is no clear definition of sewage in the agreement, which is significant in sanitary sewered areas. This may not sound like a significant issue for PWSA or the City since they are predominately a combined system, however the City’s agreement includes provisions for the Upper Allegheny Interceptor system and that municipalities covered by the Upper Allegheny Agreement have sanitary sewers.

3.6.1 Z- Agreements

As documented in the Upper Allegheny Agreement, the term “Project Z” shall mean the project contemplated by the City under its agreement of August 1, 1949 with ALCOSAN for the collection, treatment, and disposal of the sewage of the City and certain adjacent municipalities by a single system at uniform rates[4].

3.6.2 Inter-municipal Agreements

Details regarding past, current, future/pending inter-municipal agreements can be found in the individual POC Reports presented in the Wet Weather Feasibility Study Appendix A, Section 6.2.

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[3] Information from *Comprehensive Sanitary Sewage Management Plan Allegheny County, Pennsylvania* (November, 1999).

[4] Information from *Upper Allegheny System Agreement* (February 17, 1953).

3.7 DIRECT STREAM INFLOWS

The Pittsburgh Water and Sewer Authority completed an evaluation of the cost effectiveness of disconnecting direct stream inflow (DSI) connections from their sewage conveyance system. The evaluation was conducted in accordance with Paragraph 8.a.ii of the Consent Order and Agreement (dated January 29, 2004) between the City of Pittsburgh, the PWSA, PaDEP, and the ACHD. The COA requires the removal of all streams and springs connected to the sanitary sewers. Paragraphs 8.b.ii and 8.c.ii require the elimination of the conveyance of streams by the sewer system based upon a cost-effectiveness analysis to be submitted to the agencies for review and approval.

PWSA's policy is to exclude stream connections from its separate sanitary sewers and to remove such connections should they be discovered. There is, however, several significant stream flow connections to the PWSA's combined sewer system that were constructed in the past. These points of connections and the downstream combined sewers that convey the stream flows have served as the local stormwater drainage system for many generations. Under the requirements of the COA, PWSA has completed an analysis of the cost-effectiveness of removing the identified significant stream flow connections from the combined sewer system.

3.7.1 General Approach

The general approach that was employed in order to complete the cost-effectiveness analysis included the following steps:

- Stream inflow connections to the PWSA sewer system were identified.
- Potentially feasible methods of removing the identified stream flow connections were developed, along with the estimated cost of constructing and operating the facilities required to accomplish the stream removals.
- The amount of flow that would be removed through the elimination of the identified stream inflows was estimated, as was the potential cost that would be realized through the removal of the identified stream connections.
- The costs of stream removals were compared to the resulting cost savings as the basis for assessing cost-effectiveness.

3.7.2 Identifying Stream Connections

Available information regarding stream connections to the PWSA system was investigated for the purpose of identifying connection points to be evaluated. Sources of information included existing facilities mapping, institutional knowledge, stream connection information obtained from the ALCOSAN from previous studies and its ongoing ALCOSAN Basin Facilities Planning Studies, investigations presented in the document entitled, *Stream Restoration and Daylighting: Opportunities in the Pittsburgh Region* (Studio for Creative Inquiry, Carnegie Mellon University, 2002), and field reconnaissance. This investigation verified the existence of significant stream inflows at the locations listed below and shown in Figure 3-5:

- Discharge from Panther Hollow Lake and the tributary stream in the Four Mile Run drainage area, tributary to ALCOSAN CSO structure M-29 (Location 1 on Figure 3-5).
- Multiple locations in the Woods Run drainage area, tributary to ALCOSAN CSO structure O-27 (Location 2 on Figure 3-5).
- Stream inflow into the Spring Garden drainage area in Reserve Township, tributary to ALCOSAN CSO structure A-60 (Location 3 on Figure 3-5).
- Stream inflow from the Corks Run drainage area, tributary to ALCOSAN CSO O-13 (Location 4 on Figure 3-5).
- Stream inflow in Sheraden Park, tributary to ALCOSAN CSO C-07. This DSI is being eliminated through an ongoing stream removal project that is being sponsored by the PWSA and partially funded and constructed by the US Army Corps of Engineers. Therefore, this stream flow connection point is not considered in this analysis.
- Stream inflow into the storm sewer system in the vicinity of Freid and Reineman Streets, tributary to ALCOSAN CSO A-66. This DSI connection occurs outside of the City of Pittsburgh and is not tributary to sewers owned by PWSA. In addition, PennDOT's Route 28 reconstruction work will eliminate sanitary sewer connections to the affected sewers, effectively separating this connection. Therefore, this stream flow connection point is not considered in this analysis.

The first three stream connections identified above are located within the ALCOSAN Main Rivers Basin. The Existing Conditions Report for this basin also lists Lake Elizabeth as a stream point of connection. Field investigations at Lake Elizabeth determined this a man-made water feature that is not fed by a stream. The Corks Run location lies within the ALCOSAN Chartiers Creek Basin Planning Area.

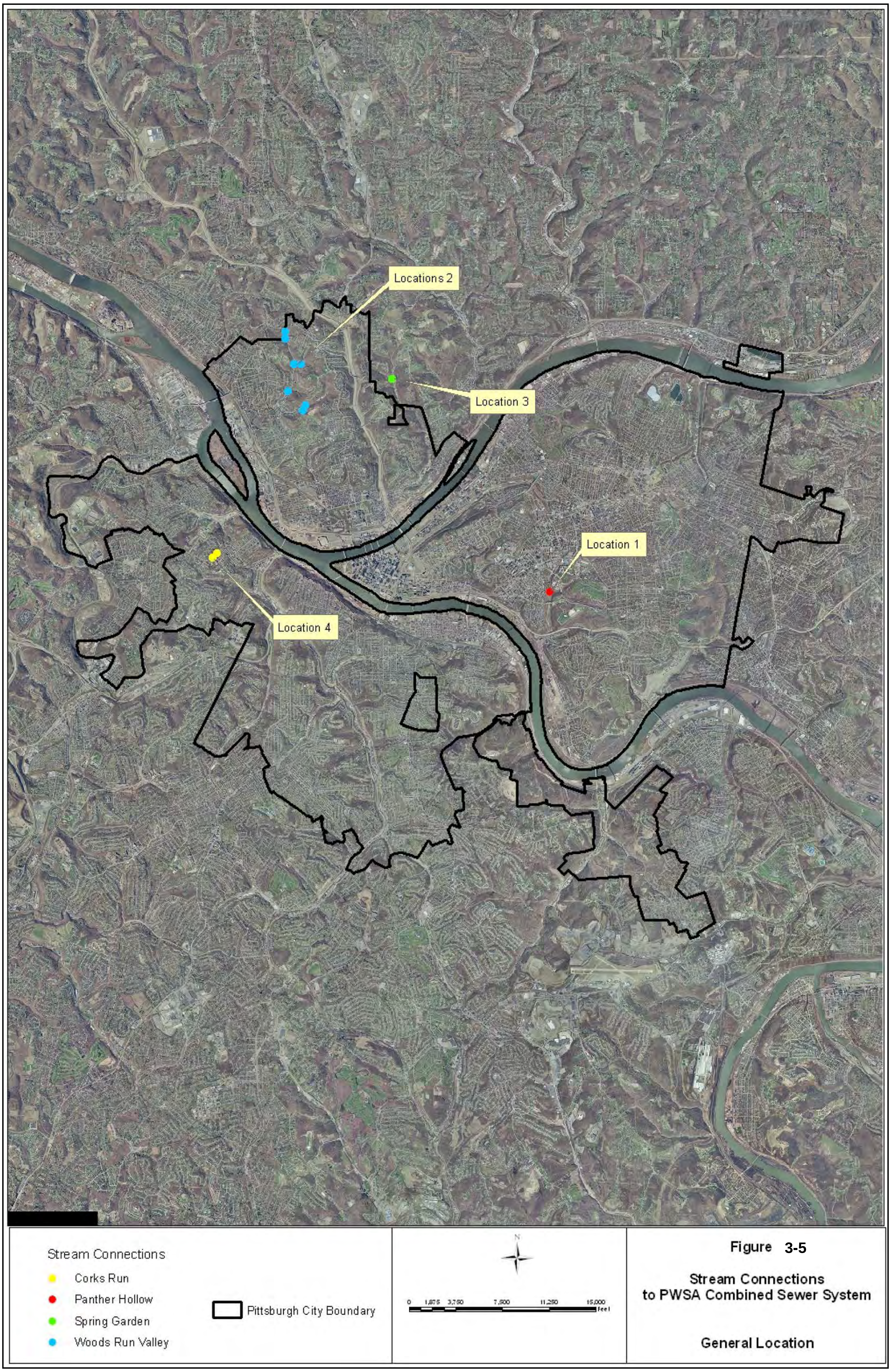


Figure 3-5
Stream Connections to PWSA Combined Sewer System

General Location

3.7.3 Estimating the Cost of Removing the Stream Connections

Conceptual approaches to the removal of the identified stream connections were developed as potentially feasible methods for removing the stream connections from the PWSA's combined sewers and the ALCOSAN system. The term "potentially feasible" is used because of the large sizes of the facilities that are required to convey the redirected stream flows from the current points of connection to suitable discharge points and the distances and the densely developed, urban nature of the areas between the points of connection and suitable discharge points. For these reasons, the construction of any required facilities will be difficult and will be hampered by available space and the prevalence of utility interferences. Also, for these reasons, construction of the required projects will produce extensive disruptions of the communities and securing public support will be problematic. The analysis assumes that these impediments can be overcome. However, more detailed site and preliminary design investigations would be required to produce layouts and designs capable of resolving the large number of utility and street, road, and railroad interferences that exist.

Conceptual facilities layouts were developed based upon PWSA GIS mapping and record drawing information. Sizing of facilities was accomplished using the PWSA's Hydraulic and Hydrologic (H&H) model of the sewerage system. Sizing of separate storm sewer systems was completed using 5-year design storm conditions. The 5-year design storm used in the PWSA H&H model consists of 2.85 inches of rain distributed over a 24-hour period in accordance with the SCS Type II design storm rainfall distribution. This produces a peak, 15-minute rainfall intensity equal to 3.48 inches/hour. Sizing of new separate sanitary sewer facilities was based upon the 10-year design storm. The 10-year design storm used in the PWSA H&H model consists of 3.27 inches of rain distributed over a 24-hour period in accordance with the SCS Type II design storm rainfall distribution. This produces a peak, 15-minute rainfall intensity equal to 3.92 inches/hour.

Estimates of the cost of the facilities required to disconnect stream inflows from the PWSA and ALCOSAN systems were developed using the ALCOSAN Alternatives Costing Tool (ACT). The ACT is an EXCEL workbook-based program that was developed by ALCOSAN and the Philadelphia Water Department and has been made available to the ALCOSAN communities. This costing tool provides estimates of the capital and operation and maintenance (O&M) costs of wet-weather conveyance, storage, and treatment facilities based upon costing algorithms developed from national, ALCOSAN, and other regional capital and O&M cost data. The ALCOSAN publication *Alternatives Costing Tool (ACT) User Reference Manual* (Version 2.0, March 2010) provides a complete description of the tool and its use.

For this analysis, facility sizes and quantities required for stream removal were estimated based upon the conceptual layouts and sizing. This information was input into the ACT costing spreadsheets. The ACT calculated estimates for project capital costs (current year), annual operation and maintenance costs (current year), and the total present worth costs of the projects.

Stream Removals. The removal of stream inflows into the PWSA and ALCOSAN systems offer potential cost savings associated with: 1) the cost of constructing and operating wet weather combined sewer overflow (CSO) control facilities, and 2) the operating costs associated with treating the stream flows that reach the ALCOSAN wastewater treatment plant.

CSO Control Facilities. If the volumes and peak rates of flow associated with the stream inflows are reduced, the potential exists for reducing the size and, therefore, the cost of constructing and operating affected CSO control facilities. The ALCOSAN Main Rivers Planning Basin and Chartiers Creek Planning Basin Storm Water Management Models (SWMM) were used to estimate the reductions in peak overflow rates and volumes that would occur should the stream inflows be eliminated from the tributary sewers. This was accomplished by first running the SWMM models under the existing configuration conditions, i.e., with the stream inflow connections in place. The SWMM models were run using the typical year conditions as delivered with the models. The baseline typical year CSO statistics generated by these model runs were compiled for the ten largest events as measured by CSO peak flow rates and volumes.

The input files for the SWMM models were then modified to simulate the removal of the stream flow connections. This was done by editing the hydrologic properties of the subcatchment areas that drain to the stream inflow points of connection in order to reduce the areas of these subcatchments to near zero. This simulated the elimination of stream flows from the appropriate locations without otherwise affecting the baseline conditions. The typical year simulations were completed for these "stream disconnected" conditions and the resulting CSO statistics were compiled.

The typical year CSO statistics for the “baseline” and “stream disconnected” conditions were compared and the reductions in overflow peak flow rates and volumes were computed. Any cost savings that are associated with these reductions in flow rate and volumes represent the cost savings relative to CSO control facilities offered by the stream disconnections. For the purpose of this analysis, it is assumed that the CSO control facilities will be designed for a control level of four overflow events per year, requiring sizing of the facilities for the fifth largest events during the typical year.

At the present time, no determinations have been made relative to the CSO control facilities that will be constructed. ALCOSAN is currently performing the Basin Planning activities that are designed to make those determinations. Preliminary analyses performed by PWSA during the development of its Draft Feasibility Study indicate that deep tunnels may ultimately be selected by ALCOSAN as its recommended method of CSO control for the CSOs associated with the stream connections. Therefore, for the purpose of this analysis, the cost of CSO control will be based upon the construction and operation of tunnel storage facilities.

The ALCOSAN Alternatives Cost Estimating Tool, the ALCOSAN CSO Tunnel Capital Cost Estimating Work Sheet, and ALCOSAN CSO Tunnel and Dewatering O&M Cost Estimating Worksheet were used to estimate the costs associated with tunnel storage. The following components of a deep tunnel system were included in this cost analysis.

- **Deep/Rock Tunnel.** The ALCOSAN CSO Tunnel Capital Cost Estimating Work Sheet was used to estimate the construction cost of deep tunnels. The cost of tunnels is primarily dependent upon the volume of the tunnels, expressed in terms of length and diameter. Preliminary, conceptual sizing of tunnels indicated by the PWSA Draft Feasibility Study analyses suggest a 40,000-foot long, 20-foot diameter tunnel for the Ohio and Monongahela CSOs (including O-27 and M-29); a 15,000-foot long, 20.5-foot diameter tunnel for the Allegheny River north CSOs (including A-60), and a 25,000-foot long, 12.5-foot diameter tunnel for the Chartiers Creek CSOs (including O-13). The default assumptions contained in the worksheet were used with the exception of tunnel diameter and length. Separate cost estimates were developed for three tunnels using the estimated dimensions for the Ohio/Monongahela Tunnel, Allegheny River North Tunnel, and Chartiers Creek Tunnel. The estimates assume the use of segmental lining construction.

The ALCOSAN CSO Tunnel and Dewatering O&M Cost Estimating Work Sheet represents the basis for estimating the cost of operating and maintaining the tunnel structures. The default values for contained in the work sheet as delivered were used to estimate tunnel operation and maintenance costs, with the exception of tunnel lengths (the lengths listed above were used) and then number and duration of events per year (an estimate of an average of 60, 12-hour events per year was used).

- **CSO and Secondary Structures.** The ALCOSAN CSO Tunnel Capital Cost Estimating Work Sheet contains provisions for estimating the cost of constructing ancillary CSO and secondary structures associated with storage tunnels. These structures include new diversion structures and drop shaft facilities. According to the methodology contained in the worksheet, the primary factors affecting the cost of the structures are the sizes and lengths of consolidation sewers and the diameters of the drop shafts. No consolidation sewers are currently anticipated for the CSOs included in this analysis. Cost estimates for drop shaft facilities are provided for three categories of sizes of drop shafts depending upon the peak flow. The ranges of peak flow rates are sufficiently broad so that the changes in peak flows resulting from stream disconnection would not influence facilities sizing and costing. Therefore, the costs of CSO and Secondary Structures are not included in the analysis.
- **Dewatering Pump Station.** The ALCOSAN ACT was used to estimate the capital and operation and maintenance costs associated with the tunnel dewatering pump station. The ACT uses the rated capacity of the pump station as the primary factor in estimating costs. Using this tool and the assumed volumes for the three tunnels included in this analysis, capital and operation and maintenance cost estimates for dewatering pump stations associated with the tunnel facilities were developed.

The ACT was used to compute the present worth values of the capital costs and operation and maintenance costs for the three tunnel systems affected by the identified stream connections. The estimated unit present worth costs for the three tunnel systems were computed in terms of dollars per gallon of storage capacity ($/gallon). This information is summarized in Table 3-1.

TABLE 3-1. ESTIMATED COST OF CSO CONTROL FACILITIES

Item	Capacity		Estimated Costs (Current Costs)			Present Worth Values			Total Present Worth Cost Per Overflow Volume ($/gallon)
			Probable Installed Construction Cost	Estimated Project Cost	Estimated Capital Cost	Present Value Capital Costs	Present Value O&M Costs	Total Present Worth	
Ohio and Monongahela Tunnel									
Tunnel	94	Mgal	$265,822,000	$431,961,000	$518,000,000	$518,000,000	$3,827,000	$521,827,000	
Dewatering Pump Station	94	mgd	$82,771,000	$36,419,000	$119,190,000	$119,190,000	$910,000	$120,100,000	
Total			$348,593,000	$468,380,000	$637,190,000	$637,190,000	$4,737,000	$641,927,000	**$6.83**
Allegheny River North Tunnel									
Tunnel	37	Mgal	$136,077,000	$128,923,000	$265,000,000	$265,000,000	$1,701,000	$266,701,000	
Dewatering Pump Station	37	mgd	$34,388,000	$15,131,000	$49,519,000	$49,519,000	$469,000	$49,988,000	
Total			$170,465,000	$144,054,000	$314,519,000	$314,519,000	$2,170,000	$316,689,000	**$8.56**
Chartiers Creek Tunnel									
Chartiers Creek Tunnel	23	Mgal	$124,029,000	$117,971,000	$242,000,000	$242,000,000	$2,551,000	$244,551,000	
Dewatering Pump Station	23	mgd	$21,973,000	$9,668,000	$31,641,000	$31,641,000	$360,000	$32,001,000	
Total			$146,002,000	$127,639,000	$273,641,000	$273,641,000	$2,911,000	$276,552,000	**$12.02**

Estimated Potential Cost Savings – Treatment Costs. Another potential cost saving associated with removing stream connections from the PWSA and ALCOSAN systems is related to the cost of treating the stream flows at the ALCOSAN wastewater treatment facility.

Estimates of the reductions in total annual flows to each of the points of connections affected by the identified stream connections were developed using the typical year SWMM models as described above. In this case, the model results were queried to compute the average daily flow rates to each of the points of connection. The differences in computed average daily flows between the baseline conditions and the stream separated conditions were determined to represent the reduction in total flows (dry and wet weather) resulting from the elimination of the stream connections.

A request was made to ALCOSAN for information to be used to compute the approximate cost of treatment at the ALCOSAN wastewater treatment facility as the basis for estimating the potential treatment cost saving associated with stream removals. A document, *Sewer System Rate Study (October, 2007)*, was provided that contains actual operating data for 2006. This information was used to estimate the operating costs attributable to wastewater treatment. This was accomplished by including 100% of the expenses under Expense Categories VI-Plant Operations and VIII-Plant Maintenance in the estimated cost of treatment. Portions of expenses under Expense Categories I-Administration and IX-Employee Benefits were included in the cost of treatment based upon the ratio of the sum of Categories VI and VIII to the Total Expenses. The result of this process for estimating treatment costs is presented in Table 3-2. The present worth of the estimated cost of treatment was computed using the same procedures and assumptions in the ALCOSAN ACT.

TABLE 3-2. ESTIMATED COST OF TREATMENT

No.	Expense Category	2006 Actual Operating Expenses*	Estimated 2006 Treatment Operating Expenses
I	Administration and Eng.	$3,023,698	$1,671,850
II	Management Info. Systems	1,255,780	
III	Customer Service and Billing	2,062,132	
IV	Environmental Compliance	2,491,610	
V	Interceptor System	2,297,148	
VI	Plant Operations	18,740,008	18,740,008
VII	Professional Services	696,104	
VIII	Plant Maintenance	5,070,047	5,070,047
IX	Employee Benefits	7,426,193	4,106,059
	Total Expenses	$43,062,720	$29,587,964
	2006 Average Daily Flow = 182.4 million gallons per day ** 2006 Total Flow = 66,576 million gallons/year 2006 Cost of Treatment = $0.44/1,000 gallons/year Present Worth Cost of Treatment =$1.87 /1,000/gallons/year		

* Source: Sewer System Rate Study Allegheny County Sanitary Authority, October 2007
** Source: Allegheny County Wasteload Management Report, March 2008

It is recognized that this approach for estimating the cost of treatment is approximate for the following reasons:

- The data used are now several years old.
- Operating costs do not include amortized capital costs associated with the construction of existing and required future treatment facilities.
- The operating costs include cost elements that are not flow dependent (for example solids handling and disposal).

Despite these limitations, the computed cost of treatment provides at least an order of magnitude estimate of potential cost savings associated with stream flow removals. The analysis can be refined as additional information is made available.

Cost-Effectiveness of Stream Removals. The total present worth costs of removing the identified stream connections were compared to the estimated cost savings to be realized by such removals in order to assess the cost-effectiveness of stream removals. If the estimated cost savings exceed the costs of stream disconnection, stream disconnection is considered to be potentially cost-effective. Otherwise, the cost of stream disconnection cannot be economically justified.

3.7.4 Panther Hollow Lake and Creek Stream Connection

Existing Conditions and Stream Removal Options. A connection of surface water flows from Panther Hollow Lake and Panther Hollow Creek to the PWSA combined sewer system is located in the Boundary Street (M-29) drainage area. A general location map of this area is provided in Figure 3-6. The connection is made to the existing trunk sewer near the outlet from Panther Hollow Lake via two 36-inch wide by 72-inch high culverts. The existing trunk sewer is actually one of two parallel trunk sewers that are oriented along the Panther Hollow corridor. These trunk sewers collect sanitary sewage and surface runoff from the Oakland area, including Schenley Park. The eastern-most trunk sewer receives flows from Panther Hollow Lake. This sewer begins as a 30-inch diameter sewer near the intersection of South Neville Street and Boundary Street and flows in a southerly direction. The size of the sewer increases along its length to a 96-inch wide by 91-inch high trunk sewer at the Panther Hollow point of connection, and then to a 155-inch wide by 168-inch high arch sewer at the M-29 diversion structure.

The “East” Trunk Sewer receives combined sewer flows upstream of the Panther Hollow connection from multiple sources, which include:

- The area north of Joncaire Street.
- A flow divider located near Yarrow Way.
- An 18-inch combined sewer from the area of Phipps Conservatory.
- An 18-inch combined sewer that connects to the Panther Hollow Lake outlet piping.
- A separate storm sewer that drains a portion of Schenley Park.

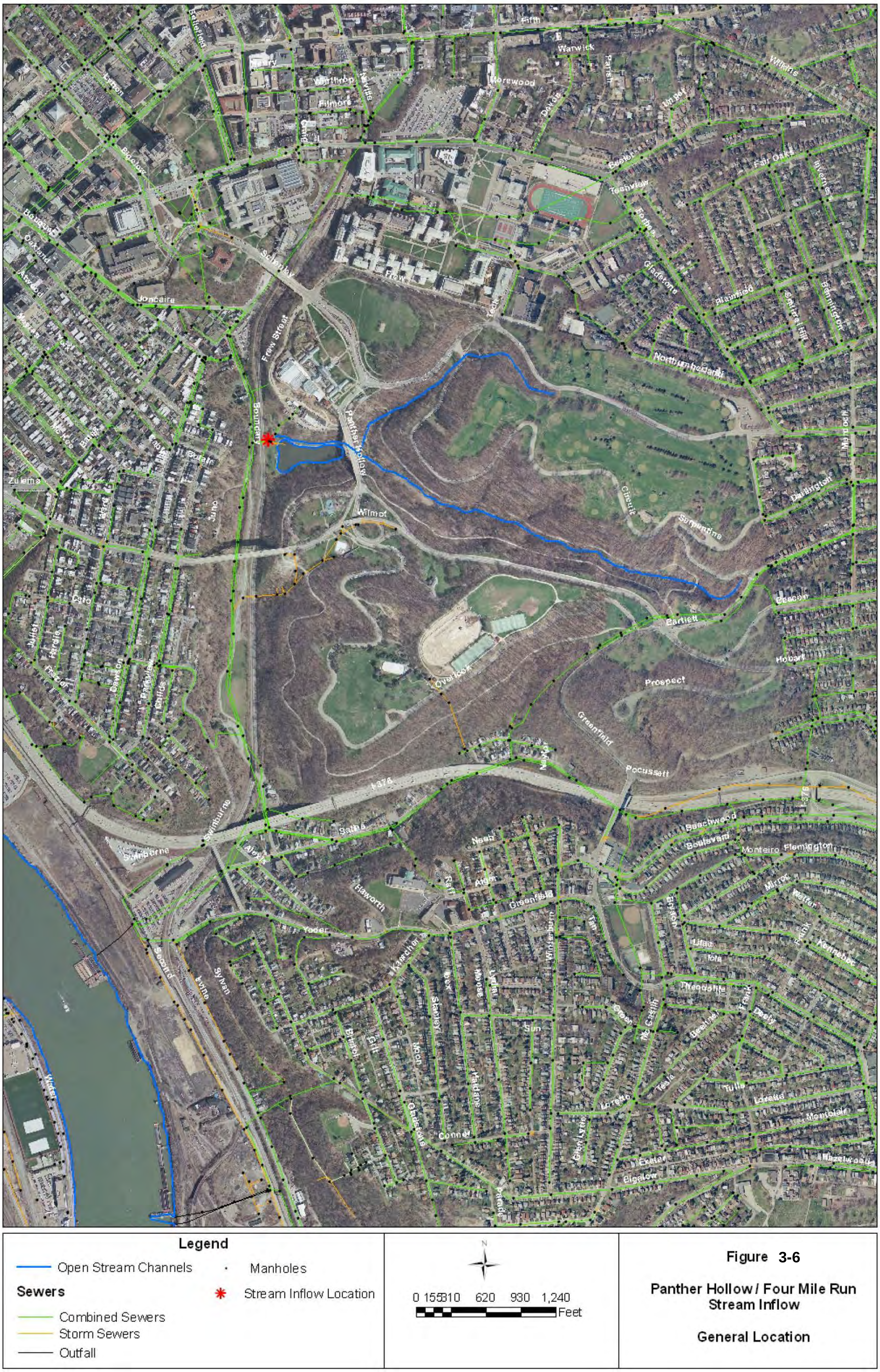


Figure 3-6

Panther Hollow / Four Mile Run Stream Inflow

General Location

- The southeast portion of the drainage area via connections near Four Mile Run Road and Saline Street.

The second trunk sewer is situated west of, and essentially parallels, the East Trunk Sewer described above. This “West” Trunk Sewer originates as a 30-inch sewer near the intersection of Fifth Avenue and Lytton Avenue, increases in size to 75 inches near Panther Hollow Lake, and reaches 108-inch in diameter at the M-29 diversion structure. Combined sewage flows enter this trunk sewer through numerous connections from areas north of Diulius Street and through a connection near the intersection of Adrian Street and Boundary Street.

The apparent best option for eliminating Panther Hollow Lake and Panther Hollow Creek flows from the PWSA combined sewer system is to convert the West Trunk Sewer to a separate storm sewer system and divert the lake and stream flows, as well as the flows from the Schenley Park storm sewers, immediately downstream to the West Trunk Sewer. All combined sewage flows would be directed to the East Trunk Sewer. This would require the following specific actions:

- Construct a connection between the East and West Trunk Sewers immediately upstream of the Panther Hollow Lake connection to divert all of the combined flows generated upstream of this location to the East Trunk Sewer. No flows upstream of this location would be permitted to enter the West Trunk Sewer. This is required in order to convert the West Trunk Sewer to a storm sewer.
- Disconnect the two 36-inch wide by 72-inch high culverts draining Panther Hollow from the East Trunk sewer and connect them to the West Trunk Sewer. This will divert all of the surface water from Panther Hollow from the East Trunk Sewer to the West Trunk Sewer.
- Remove the combined sewer connection that drains the Phipps Conservatory area from the Panther Hollow culverts and move the connection to the East Trunk Sewer. This is required in order to eliminate combined sewage flows into the West Trunk Sewer.
- Disconnect the 36-inch Schenley Park storm sewer from the East Trunk Sewer and move the connection to the West Trunk Sewer.
- Remove the 18-inch combined sewer connection to the West Trunk Sewer at Adrian Street and Boundary Street and move the connection to the East Trunk Sewer. This is required in order to operate the West Trunk Sewer as a separate storm sewer.

- Redirect the West Trunk Sewer (now a storm sewer) around the M-29 diversion structure and connect it to the outfall sewer downstream of the diversion structure. This is required in order to eliminate all of the storm flows in the West Trunk Sewer from the ALCOSAN system.

The locations of existing sewers required to be redirected to either the East Trunk Sewer or the West Trunk Sewer are illustrated in Figure 3-7.

The impact that the diversion of the flows will have on the performance of the trunk sewer was evaluated using the PWSA H&H model. The model was used to simulate the performance of the system under 5-year return frequency design storm conditions. Free discharge conditions at the M-29 diversion structure and ALCOSAN point of connection were modeled for the existing system configuration and the modified system as described previously.

The results of the modeling, expressed as computed peak flow rates in sewer segments and computed full flow conduit capacities, are presented in Figure 3-8 for both the current system configuration and redirection of flows as described above.

As is indicated in Figure 3-8, redirecting the combined sewer flows into the East Trunk Sewer, and the Panther Hollow and Schenley Park separate storm sewers into the West Trunk sewer will not significantly change the peak rates of flows through the two trunk sewers. Under the modeled 10-year design storm conditions, the redirection reduces the peak flow at the base of the West Trunk Sewer by approximately 18 percent as compared to the existing configuration, and increases the peak flow at the base of the East trunk sewer by approximately 4 percent as compared to the existing configuration.

As is also indicated in Figure 3-8, the 5-year design storm peak rates of flow exceed the full flow capacities of several sections of the directly affected trunk sewers. This occurs under both the existing and redirected conditions. The hydraulic profiles contained in Figures 3-9 through 3-12 are provided in order to evaluate the relative effects of the storm water redirection on flow levels in the directly affected trunk sewer segments. These hydraulic profiles were produced by simulating system performance with the ALCOSAN diversion and chamber in place under the more severe 10-year design storm conditions. A comparison of the profiles of the two trunk sewers for the existing and redirected flows configurations illustrates that no significant changes in current hydraulic performance should be expected.

Figure 3-7

Panther Hollow / Four Mile Run Stream Inflow

Conceptual Layout of Piping Improvements to Achieve Stream Removal

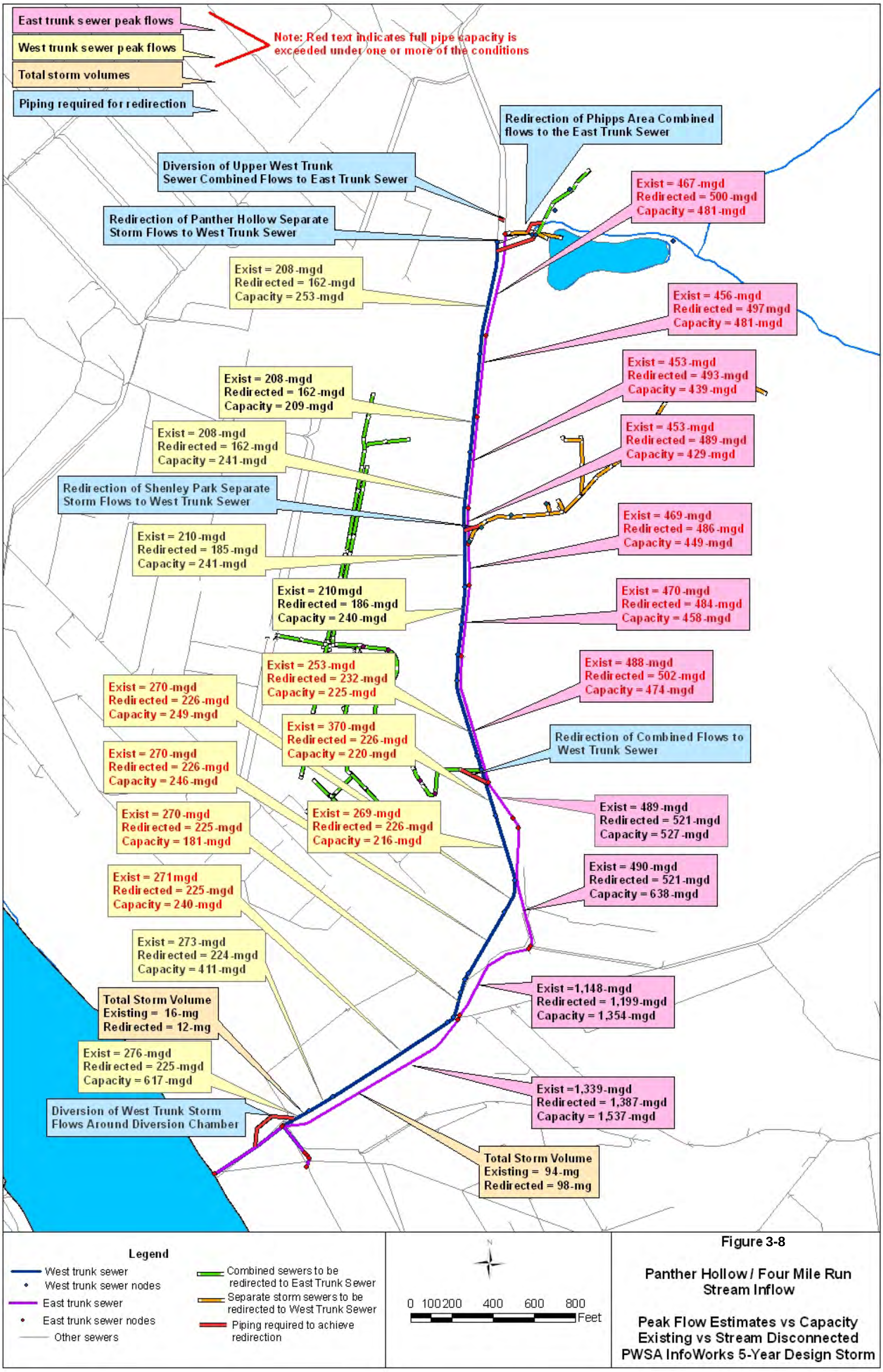


Figure 3-8

Panther Hollow / Four Mile Run Stream Inflow

Peak Flow Estimates vs Capacity
Existing vs Stream Disconnected
PWSA InfoWorks 5-Year Design Storm

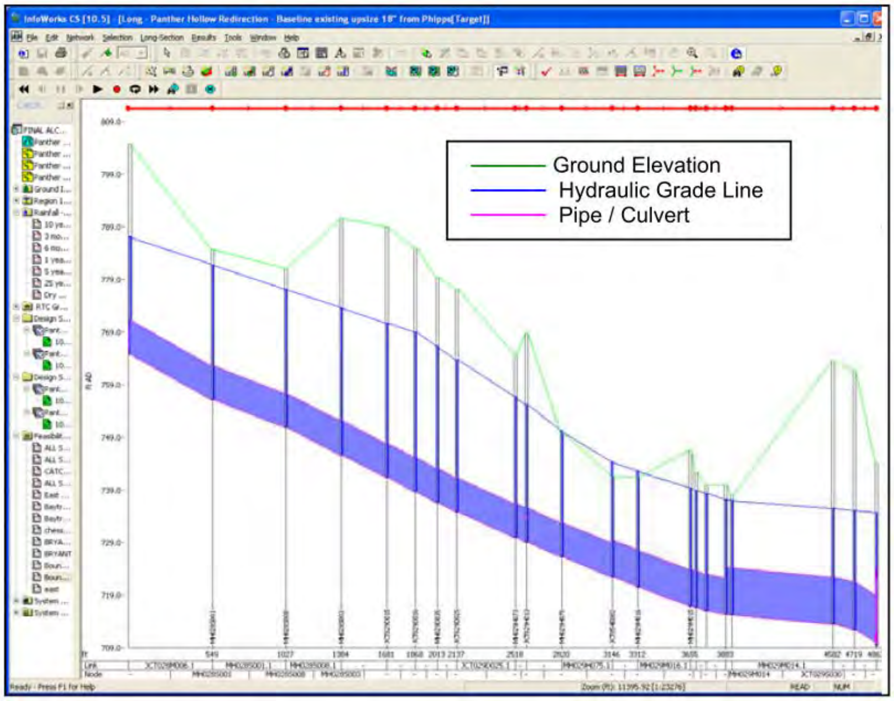


FIGURE 3-9. WEST TRUNK SEWER – EXISTING CONDITIONS, 10-YEAR DESIGN STORM

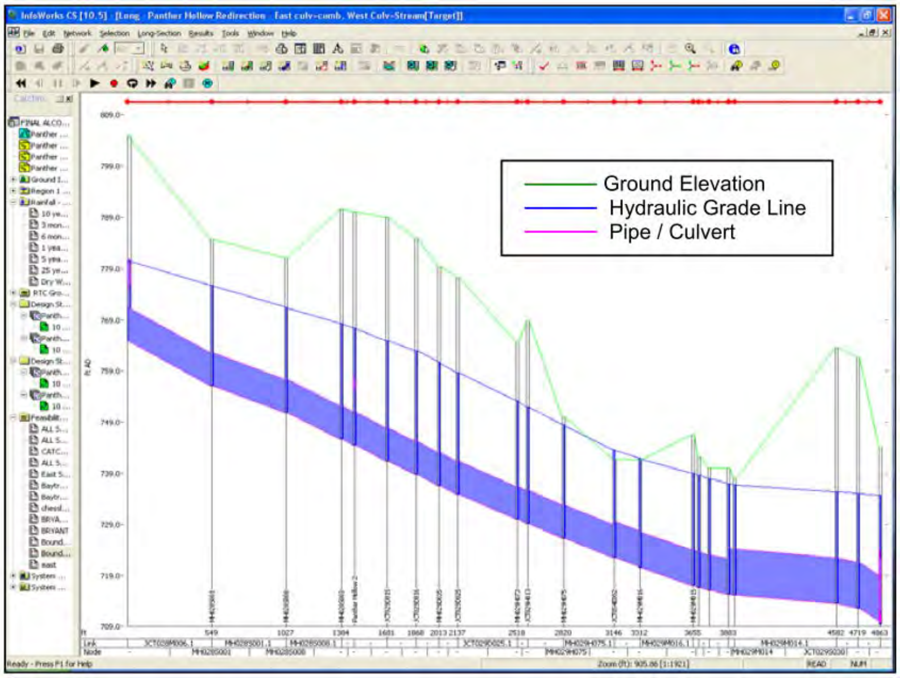


FIGURE 3-10. WEST TRUNK SEWER – REDIRECTED FLOW CONDITIONS, 10-YEAR DESIGN STORM

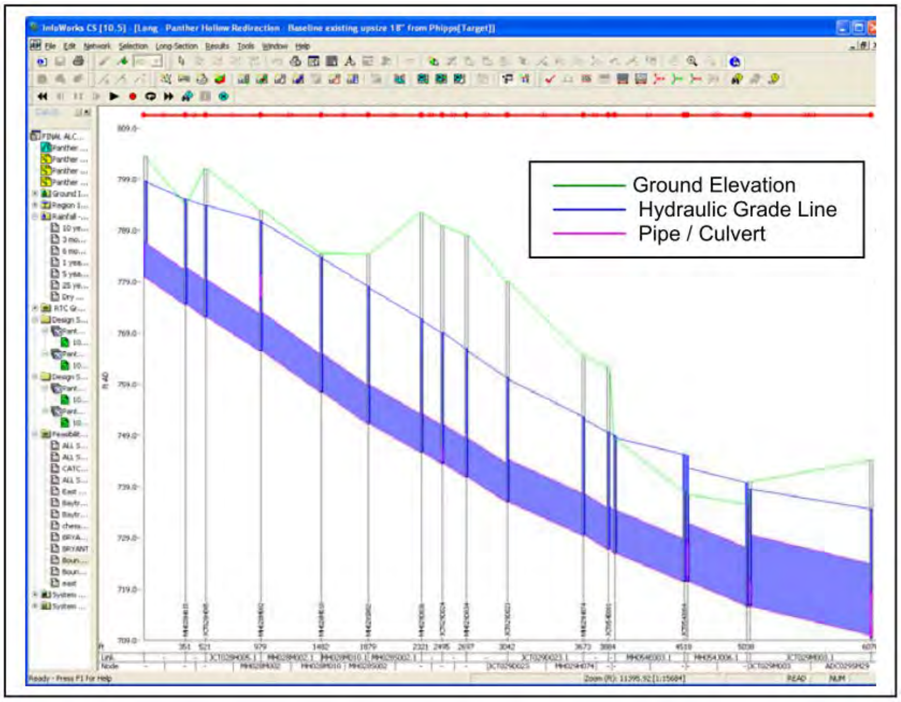


FIGURE 3-11. EAST TRUNK SEWER – EXISTING CONDITIONS, 10-YEAR DESIGN STORM

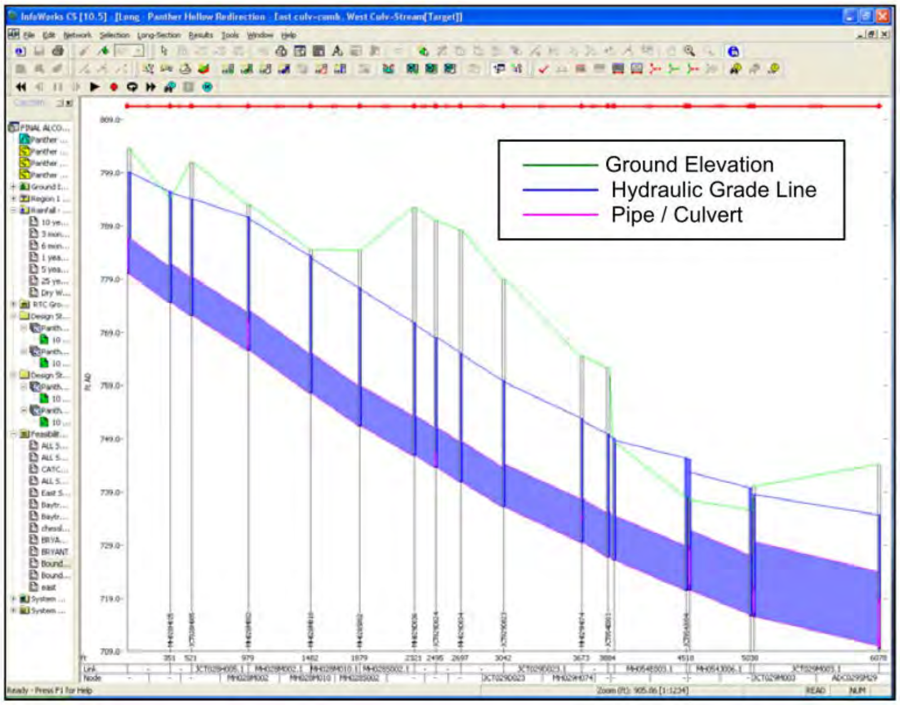


FIGURE 3-12. EAST TRUNK SEWER – REDIRECTED FLOW CONDITIONS, 10-YEAR DESIGN STORM

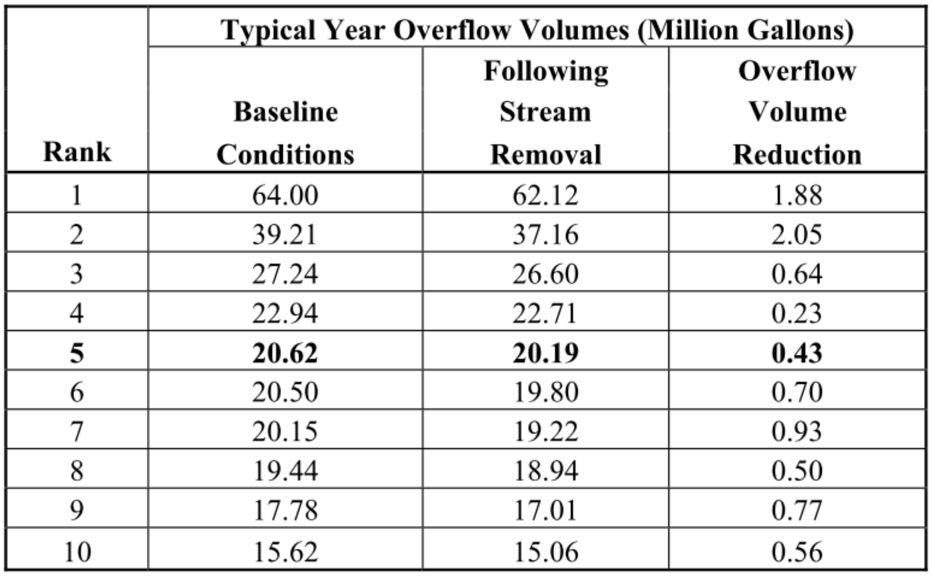
Cost of Stream Removal. The estimated costs of the facilities required to disconnect the Panther Hollow stream flows from the PWSA combined sewers and ALCOSAN's system are presented in Table 3-3. The estimates presented in this table reflect quantity takeoffs based upon the conceptual approach and layout described in the preceding subsection.

TABLE 3-3. ESTIMATED COST OF STREAM DISCONNECTION (PANTHER HOLLOW SYSTEM)

			Estimated Costs (Current Costs)			Present Worth Values		
Item	**Quantity**		**Probable Installed Construction Cost**	**Estimated Project Cost**	**Estimated Capital Cost**	**Present Value Capital Costs**	**Present Value O&M Costs**	**Total Present Worth**
18-inch sewer redirection of combined sewers	250	LF	$82,000	$41,000	$123,000			
48-inch sewer redirection of storm sewer	100	LF	$104,000	$52,000	$156,000			
72-inch sewer tunneled Panther Hollow redirection	100	LF	$829,000	$414,500	$1,243,500			
72-inch sewer from Panther Hollow Lake to tunnel redirection	200	LF	$220,000	$110,000	$330,000			
78-inch sewer to redirect upstream West Trunk to East Trunk	125	LF	$614,000	$307,000	$921,000			
108-inch West Trunk tunneled across 2nd Ave.	150	LF	$1,459,000	$729,500	$2,188,500			
108-inch sewer from tunneled crossing to outfall	200	LF	$1,196,000	$598,000	$1,794,000			
Totals			$4,504,000	$2,252,000	$6,756,000	$6,756,000	$28,000	$6,784,000

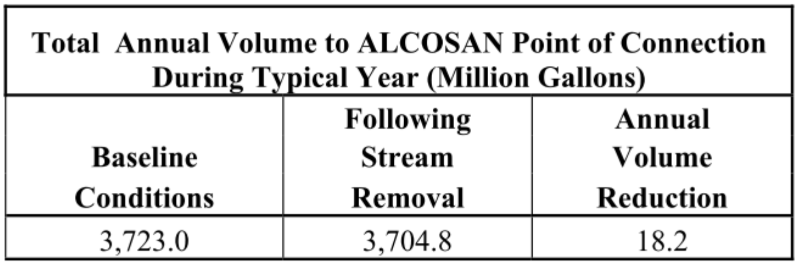
Impacts of Stream Removal on Flows. The difference between the existing conditions and "streams removed" model flow volumes represent the estimated reductions associated with the stream and storm sewer flow reductions. This information is summarized in Tables 3-4 and 3-5. The CSO overflow volumes required to be controlled in order to achieve a CSO level of control level of four CSO overflow events during the typical year equate to the overflow volumes for the fifth largest overflow event. As is indicated in Table 4, removal of the Panther Hollow stream flows would reduce this volume by approximately 0.43 million gallons. As indicated in Table 3-5, the Panther Hollow stream flow removal project would reduce total annual flow volumes to the ALCOSAN system by approximately 18.2 million gallons per year.

TABLE 3-4. PANTHER HOLLOW (M-29) ESTIMATED CSO VOLUME REDUCTIONS



Rank	Typical Year Overflow Volumes (Million Gallons) Baseline Conditions	Following Stream Removal	Overflow Volume Reduction
1	64.00	62.12	1.88
2	39.21	37.16	2.05
3	27.24	26.60	0.64
4	22.94	22.71	0.23
5	**20.62**	**20.19**	**0.43**
6	20.50	19.80	0.70
7	20.15	19.22	0.93
8	19.44	18.94	0.50
9	17.78	17.01	0.77
10	15.62	15.06	0.56

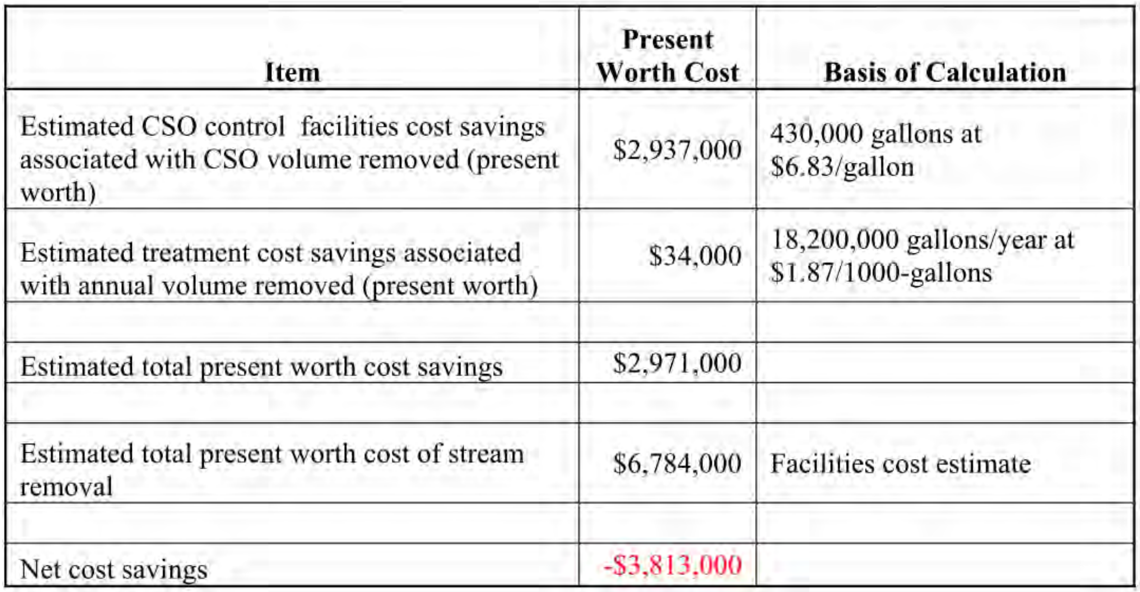
TABLE 3-5. PANTHER HOLLOW (M-29) ESTIMATED ANNUAL FLOW VOLUME REDUCTIONS



Total Annual Volume to ALCOSAN Point of Connection During Typical Year (Million Gallons) Baseline Conditions	Following Stream Removal	Annual Volume Reduction
3,723.0	3,704.8	18.2

Cost Effectiveness of Stream Removal. Table 3-6 contains a summary of the cost-effectiveness analysis of the removal of the Panther Hollow stream connection. As was previously indicated in Table 3-3, the present worth value of the estimated cost of removing the connection is $6,784,000. The estimated present worth value of the cost savings associated with the flow volume reductions is $6.83/gallon of CSO volume reduction plus $1.87/1,000 gallons of annual flow volume reduction. The cost savings of $6.83/gallon reflects the computed CSO control costs associated with an Ohio-Monongahela storage tunnel to which M-29 would be tributary. Based upon the volumes presented in Tables 3-4 and 3-5, the present worth value of the potential cost savings associated with removing the Panther Hollow stream connection is $2,971,000. Since the present worth value of the cost of accomplishing the stream removal exceeds the computed potential cost savings by approximately $3,813,000, removal of the Panther Hollow stream connection is not cost-effective.

TABLE 3-6. PANTHER HOLLOW (M-29) SUMMARY OF COST-EFFECTIVENESS ANALYSIS



Item	Present Worth Cost	Basis of Calculation
Estimated CSO control facilities cost savings associated with CSO volume removed (present worth)	$2,937,000	430,000 gallons at $6.83/gallon
Estimated treatment cost savings associated with annual volume removed (present worth)	$34,000	18,200,000 gallons/year at $1.87/1000-gallons
Estimated total present worth cost savings	$2,971,000	
Estimated total present worth cost of stream removal	$6,784,000	Facilities cost estimate
Net cost savings	-$3,813,000	

3.7.5 Woods Run Stream Connections

Existing Conditions and Stream Removal Options. Eight discernible stream channel points of connection to the PWSA system have been confirmed. The locations of these connections are identified in the general location map provided as Figure 3-9. The areas draining to these locations are primarily located in the City of Pittsburgh, although the two points of connection on Oakdale Street in the far northern portion of the watershed drain an area of Ross Township. Descriptions of each of these points of connection (referencing the identification numbers contained in Figure 3-13) are as follows:

- Points of Connection 1 and 2 are located on Oakdale Street at approximately the boundary line between the City of Pittsburgh and Ross Township. The areas draining to these points of connection are located in Ross Township. The combined sewer at Point of Connection 1 is 24 inches in diameter. The downstream Point of Connection 2 is made to the same combined sewer, which has increased in size to 42 inches in diameter.

- Points of Connection 3 and 4 are located in close proximity to each other on Oakdale Street, approximately 200 feet north of the intersection with Mairdale Avenue. These connections area made to the same combined sewer that drains Points of Connection 1 and 2.
- Point of Connection 5 is located near the intersection of Mairdale Avenue and Woods Run Road. Portions of Riverview Park drain to this point. The stream channel connects to a 36-inch combined sewer. This sewer drains to the same combined sewer that drains Points of Connection 1, 2, 3, and 4. This sewer is 72 inches in diameter at this point.
- Point of Connection 6 is located on a 48-inch combined sewer behind 955 Woods Run Avenue. This sewer connects to the same sewer that drains Points of Connection 1 through 5. At this point the sewer is located on Woods Run Avenue and is 84 inches in diameter. Portions of Riverview Park drain to this location.
- Point of Connection 7 is located approximately 120 feet east of the intersection of Grand Avenue and Bollman Avenue. Portions of Riverview Park and Highwood Cemetery drain to this location. The connection is made to a 42-inch combined sewer on Grand Avenue. This sewer transitions to 60 inches in diameter and flows in a westerly direction until it reaches the combined sewer on Woods Run Avenue. The Woods Run Avenue combined sewer, which is the same sewer that drains Points of Connection 1 through 6, is 96 inches in diameter at this point.
- Point of Connection 8 is located at the intersection of Smithton Avenue and Henley Street. Flows enter a 36-inch combined sewer on Henley Street and flow to the 42-inch sewer on Grand Avenue.

The most direct means of disconnecting these stream channels from the PWSA combined sewer system consists of constructing new separate storm sewers as required to capture each of the eight identified stream inputs before they enter the local combined sewers. The new separate storm sewers would convey the flows to a separate stormwater discharge on the Ohio River. Catch basins and existing separate storm sewers along the route of the new storm sewer would be redirected away from the combined sewer to the new storm sewer.

Figure 3-14 presents a conceptual layout of storm sewers required to redirect stream flows from the combined sewer system. Pipe sizes were developed based upon conveying 5-year design storm flows using the PWSA H&H model.

Figure 3-13

Woods Run Drainage Area

General Location

Figure 3-14

Woods Run

Conceptual Layout of Piping Improvements to Achieve Stream Removal

Cost of Stream Removal. The estimated costs of the facilities required to disconnect the Woods Run stream flows from the PWSA combined sewers and ALCOSAN's system are presented in Table 3-7.

TABLE 3-7. ESTIMATED COST OF STREAM DISCONNECTION (WOODS RUN SYSTEM)

			Estimated Costs (Current Costs)			Present Worth Values		
Item	**Quantity**		**Probable Installed Construction Cost**	**Estimated Project Cost**	**Estimated Capital Cost**	**Present Value Capital Costs**	**Present Value O&M Costs**	**Total Present Worth**
42-inch sewer	3,000	LF	$2,759,000	$1,379,500	$4,138,500			
48-inch sewer	650	LF	$678,000	$339,000	$1,017,000			
60-inch sewer	2,700	LF	$3,197,000	$1,598,500	$4,795,500			
72-inch sewer*	2,100	LF	$2,764,000	$1,382,000	$4,146,000			
96-inch sewer	3,300	LF	$1,300,000	$650,000	$1,950,000			
108-inch sewer	3,500	LF	$7,232,000	$3,616,000	$10,848,000			
12 x 8- foot sewer	2,000	LF	$6,285,000	$3,142,500	$9,427,500			
120-inch sewer tunneled	1,700	LF	$5,042,000	$2,521,000	$7,563,000			
Totals			$29,257,000	$14,628,500	$43,885,500	$43,885,500	$354,000	$44,239,500

Impacts of Stream Removal on Flows. The difference between the existing conditions and "streams removed" model flow volumes represent the estimated reductions associated with the stream and storm sewer flow reductions. This information is summarized in Tables 3-8 and 3-9. The CSO overflow volumes required to be controlled in order to achieve a CSO level of control level of four CSO overflow events during the typical year equate to the overflow volumes for the fifth largest overflow event. As is indicated in Table 3-8, removal of the Woods Run stream flows would reduce this volume by approximately 1.13 million gallons. As is indicated in Table 3-9, the Woods Run stream flow removal project would reduce total annual flow volumes to the ALCOSAN system by approximately 18.3 million gallons per year.

TABLE 3-8. WOODS RUN (O-27) ESTIMATED CSO VOLUME REDUCTIONS

Rank	Typical Year Overflow Volumes (Million Gallons) Baseline Conditions	Following Stream Removal	Overflow Volume Reduction
1	9.45	7.44	2.01
2	8.06	6.82	1.24
3	7.20	5.44	1.76
4	5.72	4.86	0.86
5	**5.63**	**4.50**	**1.13**
6	5.62	4.41	1.21
7	5.23	4.04	1.19
8	5.19	3.75	1.44
9	2.98	2.49	0.49
10	2.69	2.38	0.31

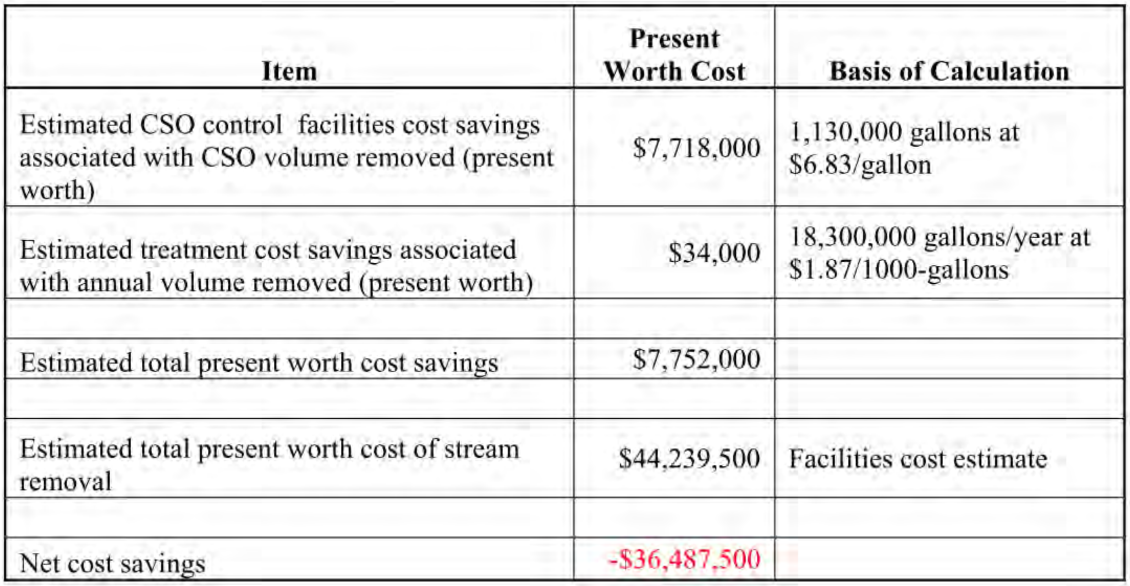
TABLE 3-9. WOODS RUN (O-27) ESTIMATED ANNUAL FLOW VOLUME REDUCTIONS

Total Annual Volume to ALCOSAN Point of Connection During Typical Year (Million Gallons) Baseline Conditions	Following Stream Removal	Annual Volume Reduction
1,427.2	1,408.9	18.3

Cost Effectiveness of Stream Removal. Table 3-10 contains a summary of the cost-effectiveness analysis of the removal of the Woods Run stream connection. As is indicated in Table 3-10, the present worth cost of removing the connection is $44,239,500. The estimated present worth of the cost savings associated with the flow volume reductions is $6.83/gallon of CSO volume reduction plus $1.87/1,000 gallons of annual flow volume reduction. The cost savings of $6.83/gallon reflects the computed CSO control costs associated with an Ohio-Monongahela storage tunnel to which O-27 would be tributary. Based upon the volumes presented in Tables 3-8 and 3-9, the present worth value of the potential cost savings associated with removing the Woods Run stream connections is $7,752,000.

Since the present worth value of the cost of accomplishing the stream removal exceeds the computed potential cost savings by approximately $36,487,000, removal of the Woods Run stream connection is not cost-effective.

TABLE 3-10. WOODS RUN (O-27) SUMMARY OF COST-EFFECTIVENESS ANALYSIS



Item	Present Worth Cost	Basis of Calculation
Estimated CSO control facilities cost savings associated with CSO volume removed (present worth)	$7,718,000	1,130,000 gallons at $6.83/gallon
Estimated treatment cost savings associated with annual volume removed (present worth)	$34,000	18,300,000 gallons/year at $1.87/1000-gallons
Estimated total present worth cost savings	$7,752,000	
Estimated total present worth cost of stream removal	$44,239,500	Facilities cost estimate
Net cost savings	-$36,487,500	

3.7.6 Spring Garden Stream Connection

Existing Conditions and Stream Removal Options. A defined stream connection to the PWSA combined sewer system is located in the Spring Garden (A-60) drainage area. A general location map of this area indicating the point of connection is provided in Figure 3-15. The stream connection is actually located in Reserve Township. The area that drains to this location lies primarily in Reserve Township, although small portions lie in the City of Pittsburgh and Ross Township. The stream enters a 72-inch culvert at the intersection of Wilson Road and Spring Garden Avenue. For the purpose of this discussion, this culvert will be referred to as the "East Trunk Sewer."

The East Trunk Sewer enters the City of Pittsburgh as a 72-inch pipe near the intersection of Williams Road and Spring Garden Avenue. It continues along Spring Garden Avenue, increasing in size to 78 inches just south of the Schubert Street intersection. The East Trunk Sewer then splits into two trunk lines near Borough St.

Figure 3-15

Spring Garden

General Location

The East Trunk Sewer then continues southward on the east side of Spring Garden Avenue as a 66-inch sewer. The East Trunk is paralleled on the west side of Spring Garden Avenue by a 60-inch sewer, which will be referred to as the "West Trunk Sewer."

The East Trunk Sewer continues in a southwesterly direction along Spring Garden Avenue, Welser Way, Basin Street, Voskamp Street, Vinial Street, and Troy Hill Road. The East Trunk increases to 72 inches at the intersection of Spring Garden Avenue and Lager Street, and then to 78 inches at Basin Street. The East Trunk reconnects to the West Trunk at Troy Hill Road, where it transitions to a 9-foot by 8-foot box culvert. The culvert then crosses East Ohio Street enters ALCOSAN diversion structure A-60.The West Trunk Sewer begins as a 60-inch sewer near Borough Street and proceeds in a southwesterly direction along Spring Garden Avenue, Welser Way, and Ahlers Way until it reconnects to the East Trunk Sewer at Troy Hill Road. The West Trunk increases in size to 66 inches at Wicklines Lane, 72 inches near the intersection of Basin Street and Welser Way, 84 inches at Ahlers Way, and 9-foot by 8-foot culvert at Wettach Street.

There is an interconnection between the East Trunk Sewer and West Trunk Sewer at the intersection of Basin Street and Welser Way. There are several combined sewer connections to both the East and West Trunk Sewers. The first connection is a 48-inch wet weather discharge sewer from PWSA Flow Divider DC078F001. The flow divider structure is located approximately 250 feet upstream of the intersection of Williams Road and Spring Garden Avenue,

The most potentially feasible means of removing the direct stream connection from the PWSA combined sewer system is by modifying the system to use one of the trunk sewers to only convey the stream flow and other separate stormwater runoff to a point of discharge to the Allegheny River. The other trunk sewer would convey combined and sanitary sewage to ALCOSAN diversion structure A-60. This can most efficiently be accomplished by redirecting combined sewer flows from the East Trunk Sewer to the West Trunk Sewer. Using the East Trunk Sewer as the separate storm sewer would require the redirection of ten combined sewer connections from the East Trunk Sewer to the West Trunk Sewer. In contrast, using the West Trunk Sewer as the separate storm sewer would require the redirection of 20 combined sewer connections from the West Trunk Sewer to the East Trunk Sewer. Because of the large sizes, similar elevations, and the parallel nature of the two trunk sewers, it is anticipated that redirection of these connections will require the construction of a system of local collection/consolidation sewers and inverted siphons. Therefore, it is important to minimize the number of redirections and the conversion of the East Trunk Sewer to a separate storm sewer to convey the stream flows has been selected as the better alternative.

Figure 3-16 illustrates the system modifications that are required to eliminate combined sewer flows from the East Trunk Sewer and use this sewer to convey the stream flows to a point of discharge to the Allegheny River. The components of these improvements are listed below:

- Construction of a relief sewer to capture flows from PWSA Flow Divider DC078F001. Redirection of combined sewer connections at Lopella Street, and Schubert Street and conveyance of those flows to the West Trunk Sewer. (48 to 66 inches).
- Disconnection of the East Trunk Sewer and West Trunk Sewer at Borough Street.
- Construction of local collection/consolidation sewers between Mauch Street and Lager Street and a siphon redirection connection at Lager Street (24 inch). Construction of local collection/consolidation sewers between Lager Street and Basin Street and a siphon redirection connection at Basin Street (24 inch).
- Construction of local collector sewers along Voskamp Street and Vinial Street to eliminate direct service connections to the East Trunk Sewer (15 inch).
- Disconnection the existing connection between the East Trunk Sewer and the West Trunk Sewer at Basin Street.
- Separation of the East Trunk Sewer and West Trunk Sewer at the point of reconnection at Troy Hill Road. Construction of a separate redirected West Trunk Sewer between East Ohio Street and the ALCOSAN A-60 diversion structure (96 inch).
- Construction of piping and an outfall to diver the existing influent piping around the A-60 diversion structure.
- Construction of a West Trunk Sewer relief sewer between approximately 1035 Spring Garden Avenue and Wettach Avenue. The need for this relief sewer was established by computer modeling that indicates that the capacity of the affected segment of the West Trunk Sewer would be exceeded under 5-year design storm conditions.

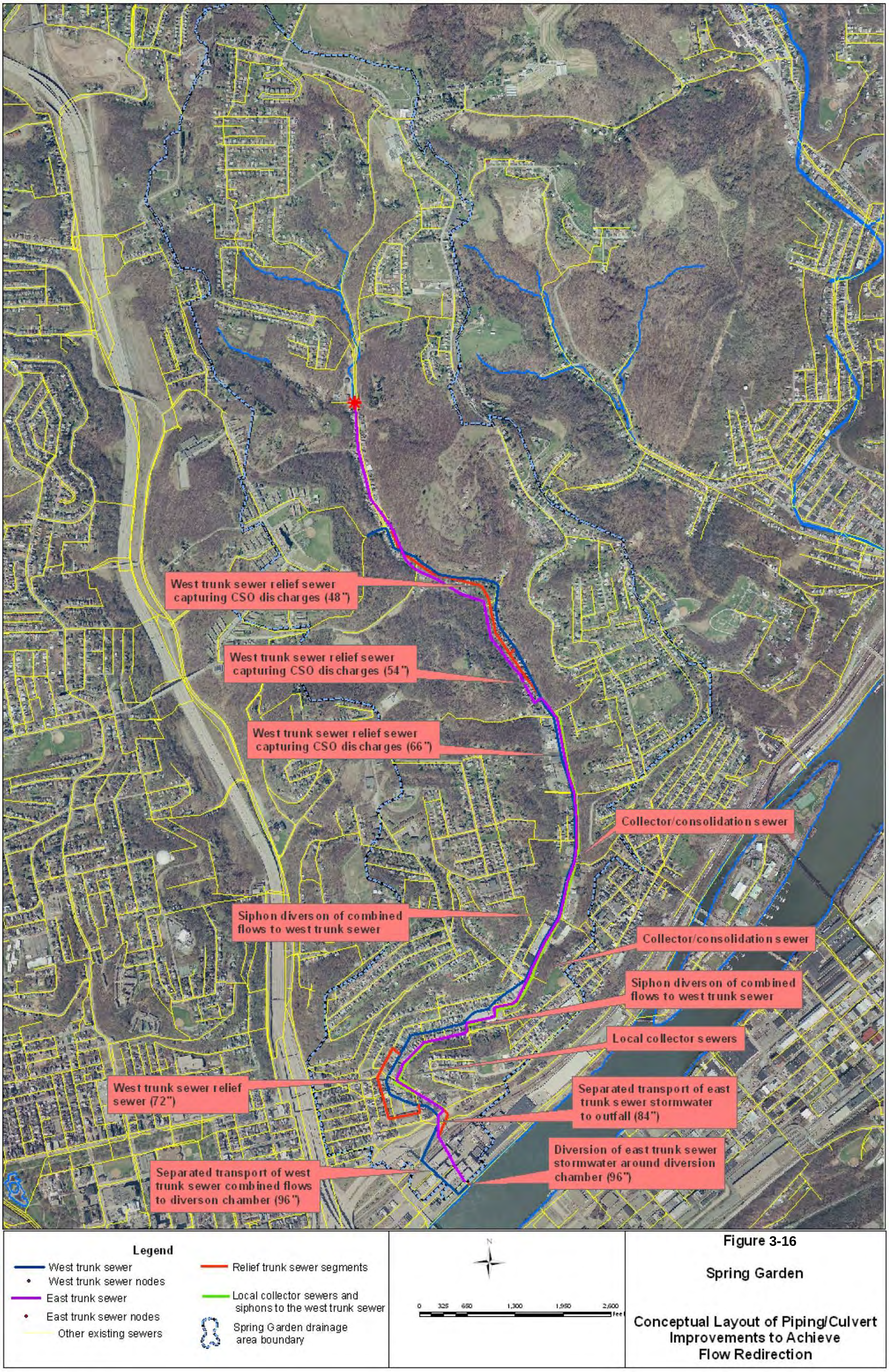


Figure 3-16

Spring Garden

Conceptual Layout of Piping/Culvert Improvements to Achieve Flow Redirection

The impact that the proposed diversion of the flows will have on the performance of the trunk sewer was evaluated using the H&H model. The model was used to simulate the performance of the system under 5-year return frequency design storm conditions. Free discharge was assumed at the A-60 diversion structure and ALCOSAN point of connection. Conditions were modeled for the existing system configuration and the modified, "streams removed" system as described above.

The results of the modeling, expressed as computed peak flow rates in sewer segments and computed full flow conduit capacities, are presented in Figure 3-17 for both the current system configuration and the redirection of flows and associated improvements as described above. The construction of the relief sewer to capture and convey the combined flows that are currently diverted to the East Trunk Sewer would improve existing flow restrictions in the upper reaches of the trunk sewer system and would result in the conveyance of higher peak flows downstream during the severe storm conditions represented by the 5-year design storm. This increases the possibility of downstream flooding in the lower reaches of the East Trunk Sewer and West Trunk Sewers. The West Trunk sewer relief sewer identified above address this situation at that location. However, space limitations at remaining locations appear to preclude the construction of relief interceptors, with the result that an increased potential for flooding and a reduced level of service would result.

The profiles for the 5-year design storm conditions presented in Figures 3-18 through 3-21 are provided in order to illustrate the relative effects of the storm water redirection on flow levels in the directly affected trunk sewer segments.

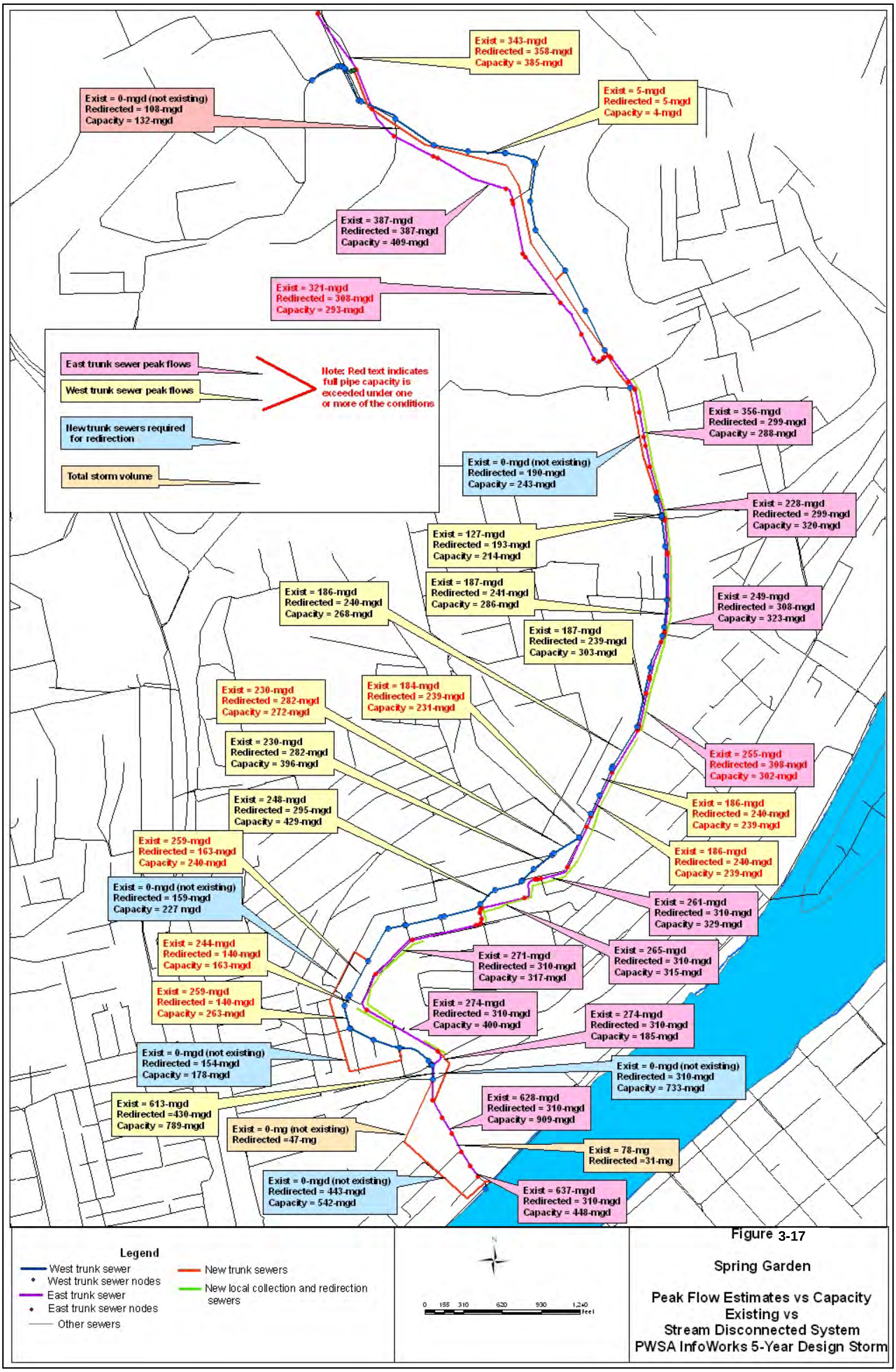


Figure 3-17

Spring Garden

Peak Flow Estimates vs Capacity
Existing vs
Stream Disconnected System
PWSA InfoWorks 5-Year Design Storm

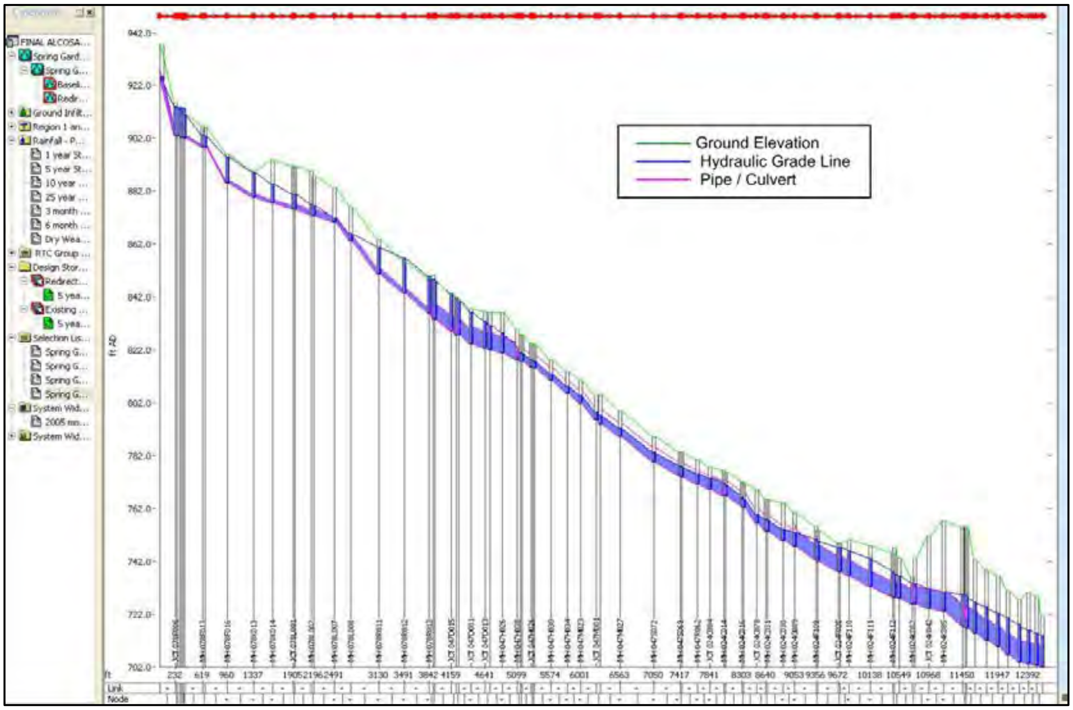


FIGURE 3-18. WEST TRUNK SEWER – EXISTING CONDITIONS, 5-YEAR DESIGN STORM

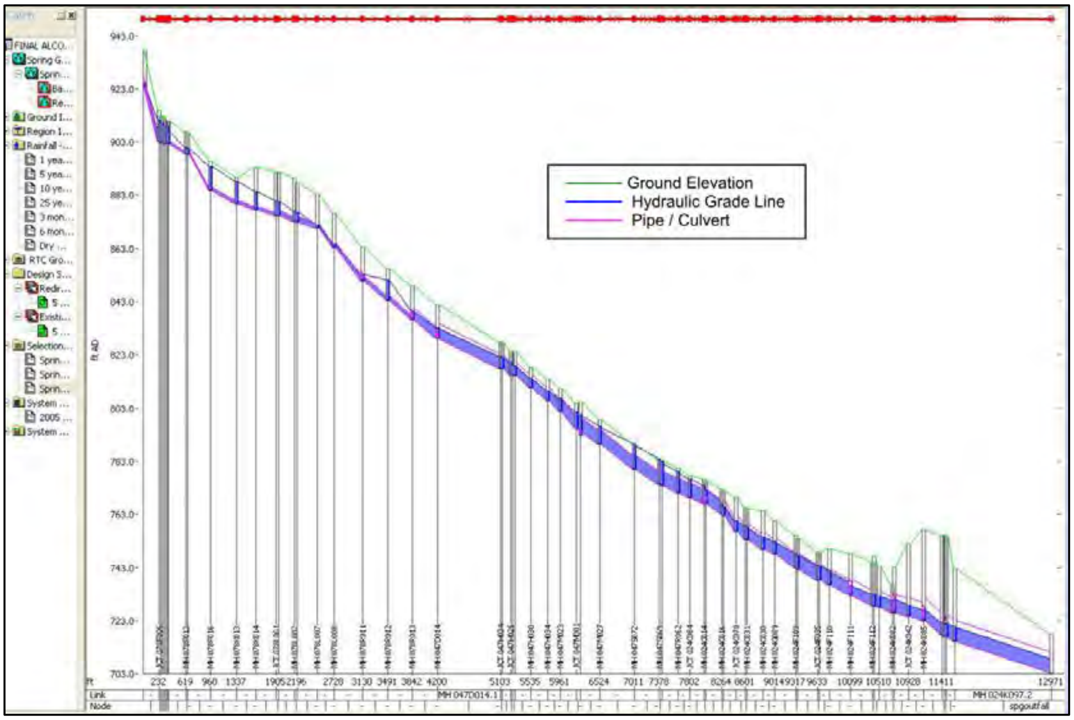


FIGURE 3-19. WEST TRUNK SEWER – REDIRECTED FLOW CONDITIONS, 5-YEAR DESIGN STORM

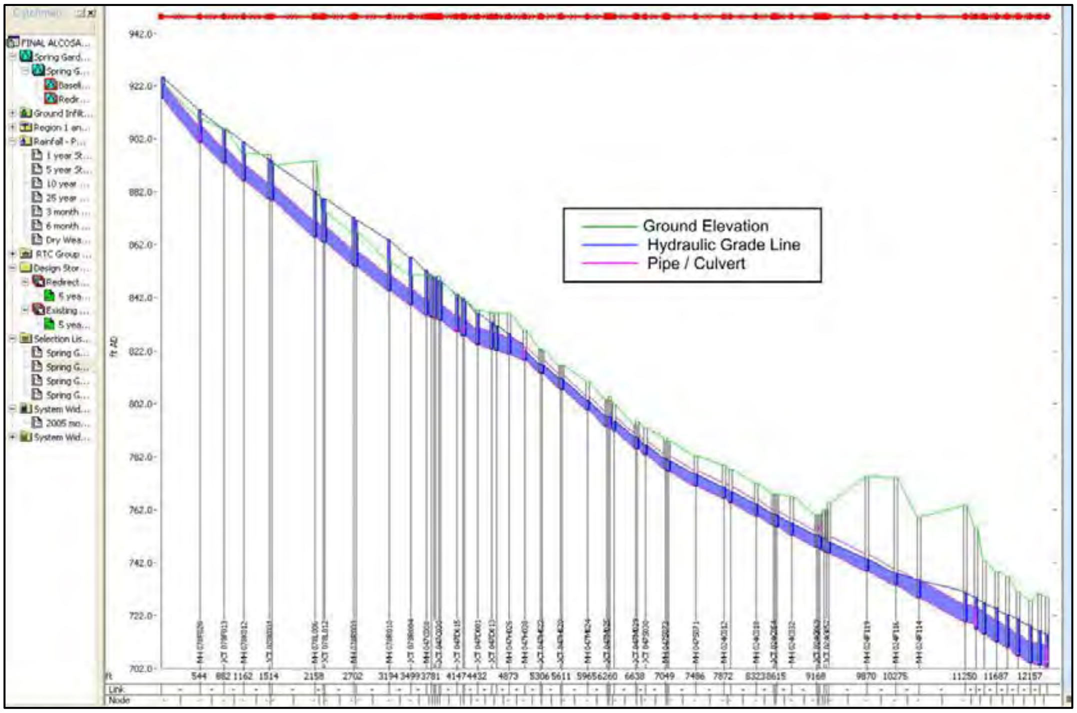


FIGURE 3-20. WEST TRUNK SEWER – EXISTING CONDITIONS, 5-YEAR DESIGN STORM

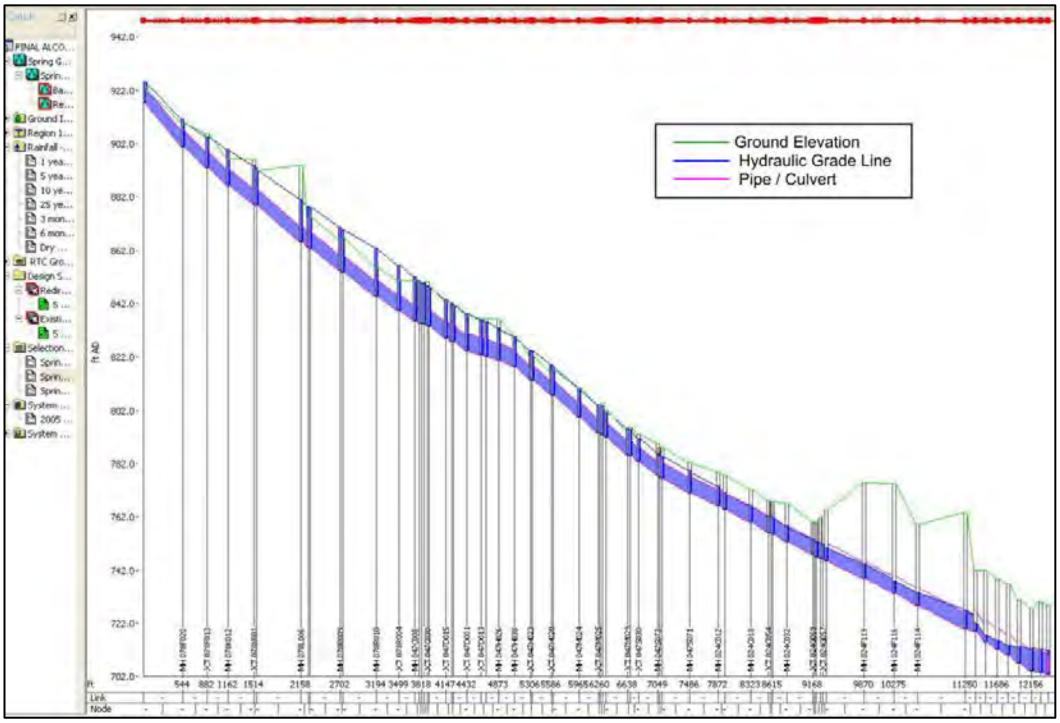


FIGURE 3-21. WEST TRUNK SEWER – REDIRECTED FLOW CONDITIONS, 5-YEAR DESIGN STORM

Cost of Stream Removal. Estimates of the cost of disconnecting the stream inflow from the Spring Garden system as described above were developed using the ALCOSAN Alternatives Costing Tool. The estimated costs of the facilities required to disconnect the Spring Garden stream flows from the PWSA combined sewers and ALCOSAN's system are presented in Table 3-11. The estimates presented in this table reflect quantity takeoffs based upon the conceptual approach and layout described in the preceding section.

TABLE 3-11. ESTIMATED COST OF STREAM DISCONNECTION (SPRING GARDEN SYSTEM)

			Estimated Costs (Current Costs)			Present Worth Values		
Item	Quantity		Probable Installed Construction Cost	Estimated Project Cost	Estimated Capital Cost	Present Value Capital Costs	Present Value O&M Costs	Total Present Worth
15-inch sewer*	1,650	LF	$1,010,000	$505,000	$1,515,000			
24-inch sewer	1,900	LF	$1,491,000	$745,500	$2,236,500			
30-inch sewer	2,100	LF	$1,815,000	$907,500	$2,722,500			
36-inch sewer*	860	LF	$1,025,000	$512,500	$1,537,500			
48-inch sewer	3,300	LF	$3,704,000	$1,852,000	$5,556,000			
54-inch sewer	360	LF	$455,000	$227,500	$682,500			
66-inch sewer	900	LF	$1,258,000	$629,000	$1,887,000			
84-inch sewer	1,700	LF	$2,979,000	$1,489,500	$4,468,500			
96-inch sewer	1,400	LF	$2,708,000	$1,354,000	$4,062,000			
96-inch outfall	300	LF	$684,000	$342,000	$1,026,000			
96-inch crossing of Rt 28	500	LF	$2,142,000	$1,071,000	$3,213,000			
48-inch dual siphons	2	each	$1,489,000	$744,500	$2,233,500			
Totals			$20,760,000	$10,380,000	$31,140,000	$31,140,000	$351,000	$31,491,000
*Includes redirection of existing service connections								

Impacts of Stream Removal on Flows. The difference between the existing conditions and "streams removed" model flow volumes represent the estimated reductions associated with the stream and storm sewer flow reductions. This information is summarized in Tables 3-12 and 3-13. The CSO overflow volumes required to be controlled in order to achieve a CSO level of control level of four CSO overflow events during the typical year equate to the overflow volumes for the fifth largest overflow event. As is indicated in Table 3-12, removal of the Spring Garden stream flows would reduce this volume by approximately 0.50 million gallons. As indicated in Table 3-13, the Spring Garden stream flow removal project would reduce total annual flow volumes to the ALCOSAN system by approximately 18.3 million gallons per year.

TABLE 3-12. SPRING GARDEN (A-60) ESTIMATED CSO VOLUME REDUCTION

Rank	Typical Year Overflow Volumes (Million Gallons)		
	Baseline Conditions	Following Stream Removal	Overflow Volume Reduction
1	20.52	19.20	1.32
2	17.58	16.58	1.00
3	13.50	12.40	1.10
4	11.96	11.22	0.74
5	**11.15**	**10.65**	**0.50**
6	10.70	9.35	1.35
7	9.96	9.02	0.94
8	9.41	8.83	0.58
9	8.56	7.94	0.62
10	6.91	6.76	0.15

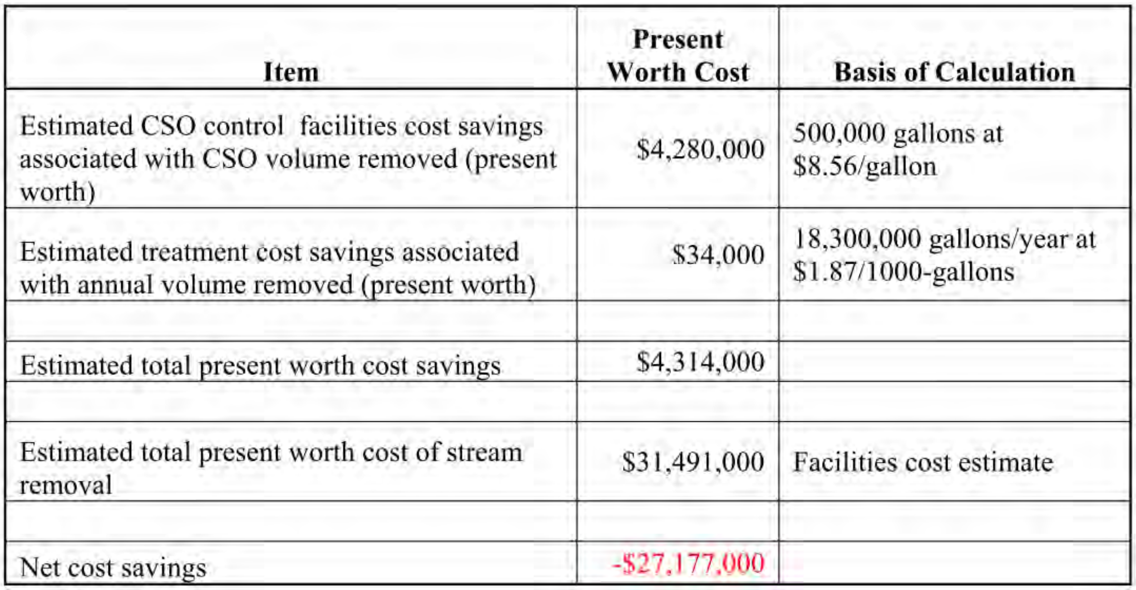
TABLE 3-13. SPRING GARDEN (A-60) ESTIMATED ANNUAL FLOW VOLUME REDUCTION

Total Annual Volume to ALCOSAN Point of Connection During Typical Year (Million Gallons)		
Baseline Conditions	Following Stream Removal	Annual Volume Reduction
2,168.1	2,149.9	18.3

Cost Effectiveness of Stream Removal. Table 3-14 contains a summary of the cost-effectiveness analysis of the removal of the Spring Garden stream connection. As was previously indicated in Table 3-11, the estimated present worth value of the cost of removing the connection is $31,491,000. The estimated present worth value of the cost savings associated with the flow volume reductions is $8.56/gallon of CSO volume reduction plus $1.87/1,000 gallons of annual flow volume reduction. The cost savings of $8.56/gallon reflects the computed CSO control costs associated with an Allegheny River North storage tunnel to which A-60 would be tributary. Based upon the volumes presented in Tables 3-12 and 3-13, the present worth value of the potential cost savings associated with removing the Spring Garden stream connection is $4,314,000.

Since the present worth value of the cost of accomplishing the stream removal exceeds the computed potential cost savings by approximately $27,177,000, removal of the Spring Garden stream connection is not cost-effective.

TABLE 3-14. SPRING GARDEN (A-60) SUMMARY OF COST-EFFECTIVENESS ANALYSIS



Item	Present Worth Cost	Basis of Calculation
Estimated CSO control facilities cost savings associated with CSO volume removed (present worth)	$4,280,000	500,000 gallons at $8.56/gallon
Estimated treatment cost savings associated with annual volume removed (present worth)	$34,000	18,300,000 gallons/year at $1.87/1000-gallons
Estimated total present worth cost savings	$4,314,000	
Estimated total present worth cost of stream removal	$31,491,000	Facilities cost estimate
Net cost savings	-$27,177,000	

3.7.7 Corks Run Stream Connections

Existing Conditions and Stream Removal Options. Defined stream connections to the PWSA combined sewer system are located in the Corks Run drainage area in the Glen Mawr area of the city. The affected sewer system is tributary to ALCOSAN CSO O-13. A general location map of this area indicating the point of connection is provided in Figure 3-22. Surface water runoff in a mapped stream channel enters a 36-inch combined sewer that runs in a northeasterly direction across Crucible Street to a 60-inch combined sewer on Chartiers Avenue and ultimately to ALCOSAN structure O-13.

The most direct means of removing the stream connection from the PWSA combined sewer system is by constructing a separate storm sewer to capture the stream flow at the points of connection and convey the flows to a separate outfall to the Ohio River. A conceptual layout of such a storm sewer is provided in Figure 3-23.

Figure 3-22

Corks Run

General Location

Figure 3-23

Corks Run

Conceptual Layout of Piping Improvements to Achieve Stream Removal

Cost of Stream Removal. Estimates of the cost of disconnecting the stream inflow from the Corks Run system as described above were developed using the ALCOSAN ACT. The estimated costs of the facilities required to disconnect the Corks Run stream flows from the PWSA combined sewer system are presented in Table 3-15. The estimates presented in Table 3-15 reflect quantity takeoffs based upon the conceptual approach and layout described above.

TABLE 3-15. ESTIMATED COST OF STREAM DISCONNECTION (CORKS RUN SYSTEM)

			Estimated Costs (Current Costs)			Present Worth Values		
Item	Quantity		Probable Installed Construction Cost	Estimated Project Cost	Estimated Capital Cost	Present Value Capital Costs	Present Value O&M Costs	Total Present Worth
30-inch sewer	5,000	LF	$4,020,000	$2,010,000	$6,030,000			
30-inch sewer tunneled	500	LF	$946,000	$473,000	$1,419,000			
Totals			$4,966,000	$2,483,000	$7,449,000	$7,449,000	$127,000	$7,576,000

Impacts of Stream Removal on Flows. The difference between the existing conditions and "streams removed" model flow volumes represent the estimated reductions associated with the stream and storm sewer flow reductions. This information is summarized in Tables 3-16 and 3-17. The CSO overflow volumes required to be controlled in order to achieve a CSO level of control level of four CSO overflow events during the typical year equate to the overflow volumes for the fifth largest overflow event. As is indicated in Table 3-16, removal of the Corks Run stream flows would reduce this volume by approximately 0.01 million gallons. As shown in Table 3-17, the Corks Run stream flow removal project would reduce total annual flow volumes to the ALCOSAN system by approximately 1.0 million gallons per year.

TABLE 3-16. CORKS RUN (O-13) ESTIMATED CSO VOLUME REDUCTION

Rank	Typical Year Overflow Volumes (Million Gallons)		
	Baseline Conditions	Following Stream Removal	Overflow Volume Reduction
1	7.92	7.88	0.04
2	5.73	5.52	0.21
3	4.67	4.64	0.03
4	2.36	2.35	0.01
5	**2.18**	**2.17**	**0.01**
6	1.86	1.85	0.01
7	1.86	1.85	0.01
8	1.57	1.56	0.01
9	1.31	1.30	0.01
10	0.61	0.60	0.01

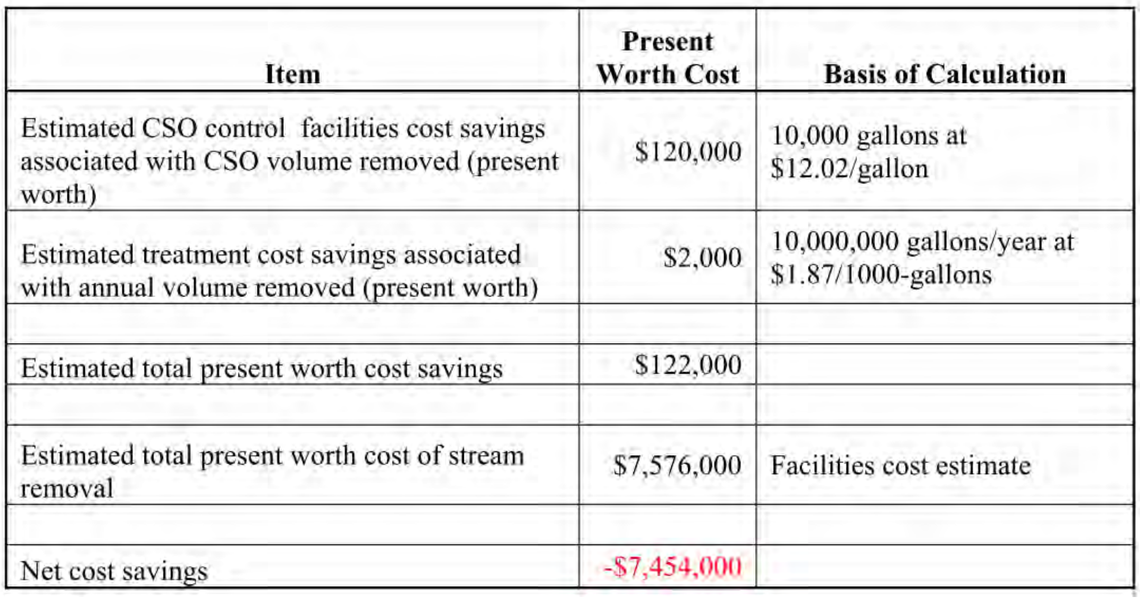
TABLE 3-17. CORKS RUN (O-13) ESTIMATED ANNUAL FLOW VOLUME REDUCTIONS

Total Annual Volume to ALCOSAN Point of Connection During Typical Year (Million Gallons)		
Baseline Conditions	Following Stream Removal	Annual Volume Reduction
666.0	665.0	1.0

Cost Effectiveness of Stream Removal. Table 3-18 contains a summary of the cost-effectiveness analysis of the removal of the Corks Run stream connection. As was previously indicated in Table 3-15, the estimated present worth value of the cost of removing the connection is $7,576,000. The estimated present worth value of the cost savings associated with the flow volume reductions is $12.02/gallon of CSO volume reduction plus $1.87/1,000-gallons of annual flow volume reduction. The cost savings of $12.02/gallon reflects the computed CSO control costs associated with a Chartiers Creek storage tunnel to which O-13 would be tributary. Based upon the volumes presented in Tables 3-16 and 3-17, the present worth value of the potential cost savings associated with removing the Corks Run stream connection is $122,000.

Since the present worth value of the cost of accomplishing the stream removal exceeds the computed potential cost savings by approximately $7,454,000, removal of the Corks Run stream connection is not cost-effective.

TABLE 3-18. CORKS RUN (O-13) SUMMARY OF COST-EFFECTIVENESS ANALYSIS



Item	Present Worth Cost	Basis of Calculation
Estimated CSO control facilities cost savings associated with CSO volume removed (present worth)	$120,000	10,000 gallons at $12.02/gallon
Estimated treatment cost savings associated with annual volume removed (present worth)	$2,000	10,000,000 gallons/year at $1.87/1000-gallons
Estimated total present worth cost savings	$122,000	
Estimated total present worth cost of stream removal	$7,576,000	Facilities cost estimate
Net cost savings	-$7,454,000	

3.7.8 Completed Stream Removal Projects

The following stream removal projects within or directly impacting the PWSA system were either completed or are in the process of being completed.

Sheraden Park Direct Stream Inflow Removal and Stream Restoration. ALCOSAN, the City of Pittsburgh, PWSA, and the U.S. Army Corps of Engineers have and continue to partner in the removal of direct stream inflows into PWSA's combined sewer system in Sheraden Park. PWSA has completed the rerouting of the combined sewer system from the culverted stream. The stream is being daylighted and will flow into Chartiers Creek.

Jack's Run Direct Stream Inflow Removal and Stream Restoration. ALCOSAN, the City of Pittsburgh, PWSA, Ross Township, and Bellevue Borough partnered to remove a major direct stream inflow into ALCOSAN's Lower Ohio River interceptor sewer. The stream was re-routed and the stream bed was reconstructed.

Section 4 Sewer System Characterization

An inventory of the components within PWSA's wastewater collection system was presented in Section 3 of this Wet Weather Feasibility Study. This section, along with Section 5, describes the overall condition of the wastewater collection system both presently and under future baseline conditions. This section also presents the approach utilized to determine existing flows in the sewer system through regional flow monitoring, and outlines the location of the flow monitors. Finally, identification of system defects and repairs is discussed.

4.1 FLOW MONITORING DATA EVALUATION

The background of the PWSA flow monitoring efforts, the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained below.

4.1.1 PWSA Flow Monitoring

In October 2008, the *PWSA Feasibility Study Report* was completed for the existing PWSA collection system. Its objective was to identify and present technologies, costs, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives. For that study, a hydraulic and hydrologic (H&H) model of the PWSA collection system was developed and calibrated; details of this model are further described in the *Hydraulic and Hydrologic Characterization Report* (September 2008).

In support of both the *Collection System Hydraulic and Hydrologic Characterization Report* and the *PWSA Feasibility Study Report,* PWSA embarked on a comprehensive sewer flow monitoring program in 2004. The purpose of the program was to collect sewer flow and rainfall data for the PWSA collection system, including inputs from outlying communities. The main objectives of the flow monitoring program were the following:

- Measure the actual performance of many of the largest or most active CSO structures.
- Measure the performance of the trunks and interceptors.
- Measure the effect of ALCOSAN's deep tunnel interceptor performance on the PWSA CSOs.
- Measure the hydrologic performance of a majority of the combined sewer acreage and basins.

- Collect sufficient flow and rainfall data to calibrate the InfoWorks model.

Potential monitoring sites were investigated between October 2003 and January 2004, and 418 monitors were then installed in selected sites between January and March 2004. Data from those meters were collected from March 2004 to July 2004, at which time 397 of the 418 flow monitors were removed. The remaining 21 flow monitors were left in place and continued to monitor flows through October 2004. A detailed description of the flow monitoring program is provided in the *PWSA CSO Flow Monitoring Report* (2007)[1].

Figure 4-1 shows the flow monitor locations used in the PWSA Flow Monitoring plan.

4.1.2 Regional Flow Monitoring

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was submitted to the PaDEP and the ACHD for review and approval. The purpose of the plan was to comply with the Orders, and to document the efforts expended in developing the plan. The RFMP was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies, and approximately 50 municipalities within the ALCOSAN service area.

Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of the ALCOSAN Consent Decree. In response to the Agencies' comments and provisions of the CD, ALCOSAN developed and delivered a Regional Collection System Flow Monitoring Plan (RCS-FMP) that incorporated most of the provisions of the RFMP and provided comprehensive flow monitoring of both the ALCOSAN system and the municipal collection systems. Implementation of the RCS-FMP by ALCOSAN fulfilled the flow monitoring required by the municipal Orders.

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[1] PWSA CSO Flow Monitoring Report (ADS Environmental Services, 2007 Pittsburgh Water and Sewer Authority CSO Flow Monitoring Program)

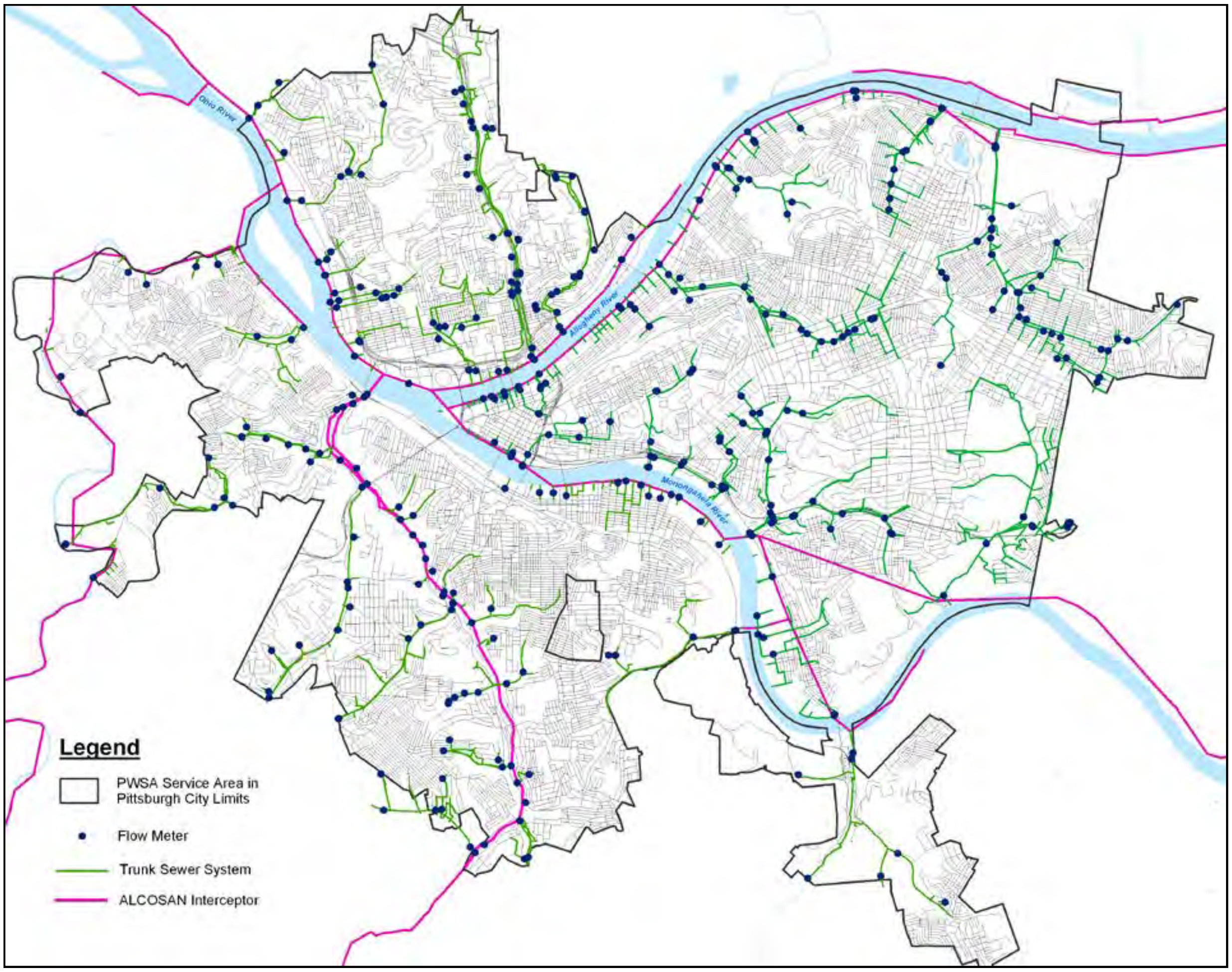

FIGURE 4-1. FLOW MONITORING LOCATIONS

The RFMP contained prior flow monitoring data collected by the municipalities that was used either in lieu of a new monitor or to provide information to inform and refine the subsequent analyses. Likewise, the RCS-FMP contained prior flow monitoring data collected by ALCOSAN that either was used in lieu of a new monitor or augmented data for the RCS-FMP. In both cases, the data was included in the respective plans and is not reproduced in this Wet Weather Feasibility Study.

4.1.3 Regional Flow Monitoring Utilized by PWSA

Provisions of both the ALCOSAN CD and the PWSA COA required that coordination and consistency be maintained between ALCOSAN, PWSA, and municipalities that are tributary to PWSA. To ensure this, PWSA agreed to use the

ALCOSAN H&H Model in their planning process which utilized the RCS-FMP flow monitoring data. As mentioned earlier, much of the PWSA flow monitoring data were utilized in the RFMP and subsequently, the RCS-FMP which was utilized to develop and calibrate the ALCOSAN H&H models.

4.1.4 Flow Monitoring Results

The flow monitors located within the PWSA system that were used to develop and validate the ALCOSAN H&H model used by PWSA are listed in the applicable Basin H&H reports under the ALCOSAN Wet Weather Program. An overview of how the ALCOSAN system-wide flow monitoring program was used in developing and validating the H&H model is explained in the ALCOSAN Draft Wet Weather Plan.

4.2 SEWER SYSTEM EVALUATIONS

Section 7a of the COA states that the Authority shall: 1) complete dye testing of all structures to determine the sources of surface stormwater such as roof leaders, yard drains, and driveway drains, excepting any portion of the sanitary sewer system constructed or reconstructed since January 1, 1995, 2) test all private and municipal catch basins within 100 feet of the sanitary sewer to verify that they are not connected to the sanitary sewer, and 3) document any illegal connections to the sanitary sewer system from structures or catch basins in a GIS map or digital spreadsheet such as Microsoft Excel. Between August 2007 and December 2011, PWSA completed a system-wide dye testing program investigating for illicit inflow connections from catch basins and private properties. This program initially mapped approximately 5,200 properties and more than 100 catch basins suspected of being connected to the sanitary sewer systems.

4.3 SUMMARY OF DEFECT REPAIRS

Under Section 7d, the COA states that by November 1, 2004, the Municipality and the Authority shall (i) institute and enforce an ordinance or regulation prohibiting connections of surface storm water to their sanitary sewer system; and (ii) institute and enforce a sewer use ordinance or regulation which requires at the time of all property sales within the City of Pittsburgh, a visual inspection and dye test of roof leaders, yard drains, and driveway drains to identify any illegal connections. The ordinance or regulation shall require the removal of illegal connections prior to the sale of the property." On April, 12, 2006, the City of Pittsburgh Ordinance No. 3 Code, Title Four: Public Places and Property, Article III: Sewers, added Chapter 433: Illegal Storm Water Connections to be in compliance with Section 7d of the COA.

Section 7.e. states that by November 30, 2007, the Authority shall require corrective actions to ensure the removal of 95% of the number of illegal connections of surface stormwater identified or be diligently prosecuting the responsible parties in a legal or equitable action for the removal of said sources from their sanitary sewer system. Removal of such illegal connection shall be documented in the GIS map, or digital spreadsheet such as Microsoft Excel. Currently, PWSA's records show that approximately 4,200 properties and 50 catch basins remain connected, in part because of affordability issues directly related to public and private conveyance solutions. PWSA is currently in the process removing some of the approximately 50 remaining catch basin connections from the sanitary sewer. The remaining illicitly connected catch basins and properties will be a part of an engineering study to develop storm water drainage plans. A 25-year storm design shall be used to conduct this study. PWSA will use this study to identify systematically, a realistically affordable and constructible way to manage the surface storm water flows and incorporate it into a plan.

During the period from 2006 to 2012, sewers segments were rehabilitated in both the combined and sanitary portions of the collection systems by PWSA through a cured-in- place-pipe (CIPP) lining process. The sewer segments that were relined during this period are shown in Figure 4-2. This is an important step in limiting the opportunities for infiltration to enter the sewer system and rehabbing defects such as fractured, broken, and deformed sections of pipe. Sewer lining has the additional benefit of reducing the number of lateral connections by only reinstating the active laterals.

ATTACHMENT B

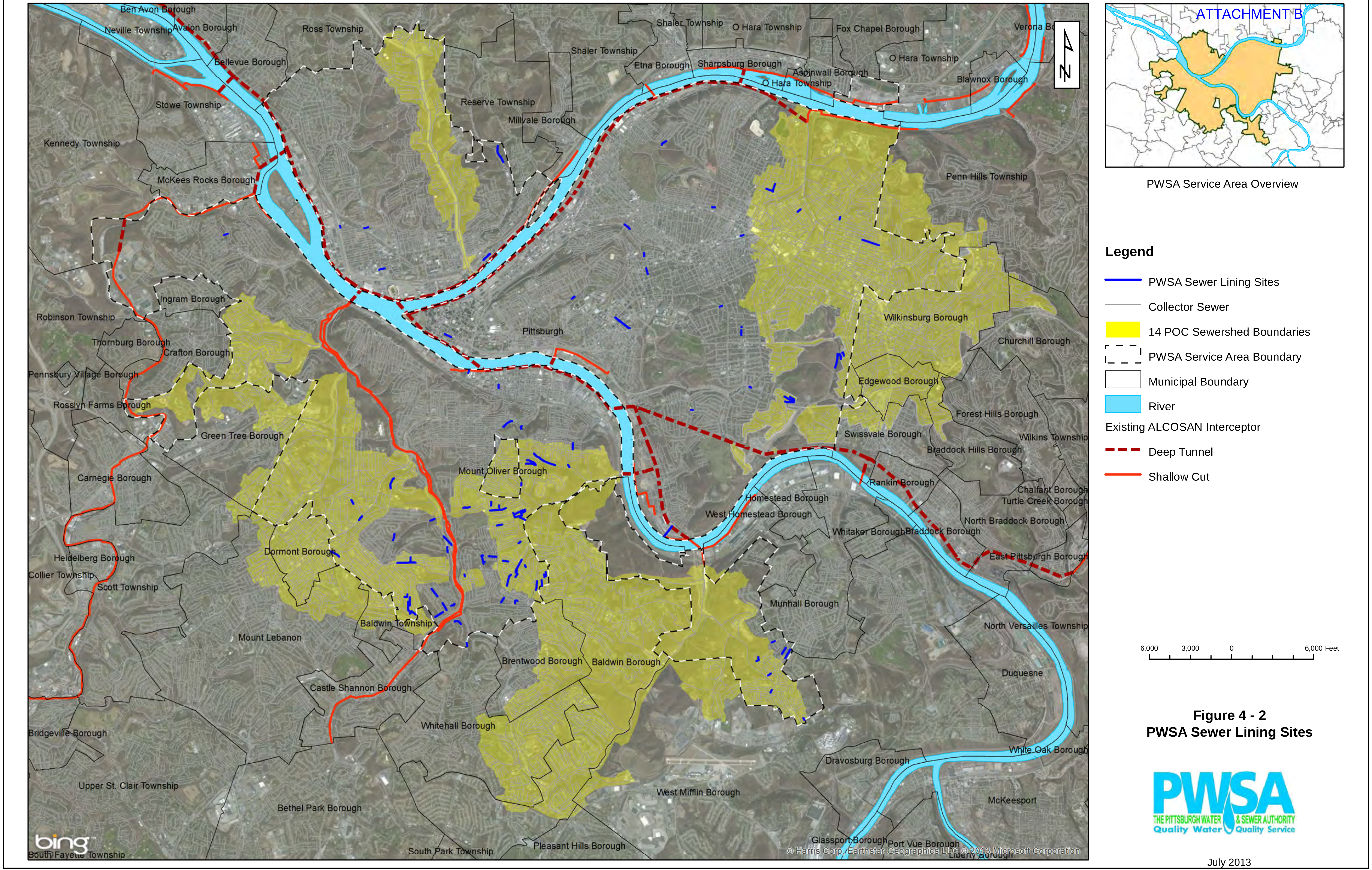

Figure 4 - 2
PWSA Sewer Lining Sites

PWSA THE PITTSBURGH WATER & SEWER AUTHORITY Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\Figure 4-2 Sewr Lining_.mxd

Section 5 Sewer System Capacity Analysis

This portion of the Wet Weather Feasibility Study presents the approach utilized to determine existing and baseline flows in the PWSA sewer using both PWSA and regional flow monitoring results, as well as the review and acceptance of the calibration of the ALCOSAN H&H model developed by the ALCOSAN basin planners, the development of the baseline conditions, capacity limitations in PWSA's sewer system, and the future baseline overflow frequency and volumes.

5.1 DEVELOPMENT AND CALIBRATION / VERIFICATION OF H&H TOOLS

The original 2008 Preliminary Draft Feasibility study was updated for the 2012 Feasibility Study by utilizing the regional H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The ALCOSAN model extends deeper into the municipal systems tributary to the PWSA system, and provides information about the performance and impacts of those tributary systems on the existing PWSA system. PWSA agreed to use the ALCOSAN H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. PWSA performed no calibration or verification of the model before utilization of the model.

5.2 EXISTING AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing planning level information throughout their basin planning process. PWSA's information was used by ALCOSAN and their basin planners to determine a number of conditions which were the basis for the ALCOSAN H&H models. The conditions are the following:

- **Existing Condition.** The state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 mgd (as of the first quarter of 2009).
- **Baseline Condition.** The state of the system and service area in 2008, with any planned ALCOSAN and municipal projects which are certain to be implemented.
- **Future Baseline Condition.** The state of the system and service area in 2046, including changes due to planned development/re-development, but without implementation of the wet weather plan improvements.

- **Future Condition (2046).** The predicted state of the system and the service area 20 years after the implementation of the planned improvements.

The planning horizon date for the H&H models is September 2046.

This section describes the development of the baseline condition and future baseline condition H&H models for predicting existing and 2046 wastewater flow without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008). Between 2008 and 2010, ALCOSAN's basin planners incorporated various portions of PWSA's H&H model into the H&H models. Once completed, PWSA made the decision to adopt the now more detailed and up-to-date ALCOSAN H&H model in order to consistently reflect the existing, baseline and future baseline conditions of the collection system.

The CSO wet weather planning approach utilizes H&H modeling to develop accurate predictions of the average frequency, duration and volume of CSO discharges per year. The ALCOSAN planning effort, and hence the PWSA Feasibility Study, used "typical year" rainfall data based on the year 2003. The H&H model included allowances for near-term planned sewerage projects, population changes, and future development throughout the planning period with the following results:

- **Near-Term Planned Sewerage Projects.** There were no near-term planned ALCOSAN or municipal sewerage projects scheduled for implementation within the PWSA service area at the time these H&H models were developed.
- **Population Changes.** The ALCOSAN basin planning process estimated the population for the future baseline conditions based upon the projected population in the year 2030[1]. Projected populations in this area were anticipated to decline or stagnate after 2030; consequently, the year 2030 was chosen as it represented the highest projected basin population during the planning period.
- **Future Development.** Future development and land use within the PWSA sewersheds was not anticipated to change significantly between existing conditions and future conditions.

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[1] Source: Southwest Planning Commission Cycle 8 Projections.

The impacts on expected dry weather and wet weather flow were derived for each sewershed within PWSA from the baseline conditions and future baseline conditions H&H models. These impacts were included in the various ALCOSAN basin planners' H&H reports and Facility Plan Reports for existing and future conditions, respectively.

5.2.1 Dry Weather Flows (Existing and Future Baseline)

Accurate Dry Weather Flow (DWF) representation in the H&H Models was important to characterize and predict overflow activity within PWSA. As mentioned above, PWSA adopted the ALCOSAN H&H Model with the inherent existing and future DWF representations. The development of the DWF model is documented in the draft ALCOSAN Wet Weather Plan.

The DWF representations include two major components: Base Wastewater Flow (BWWF) and Ground Water Infiltration (GWI). BWWF and GWF are defined as:

- **BWWF.** The residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.
- **GWI.** Groundwater that enters the collection system through defective pipe walls, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The general approach to estimating the DWF in the H&H Model was through hydrograph deconstruction of the actual monitored flow in the Flow Monitoring Program. The DWF was further deconstructed into BWWF and GWI. The following is an excerpt from the *Saw Mill Run Basin Planner's H&H Report* (2009), which is part of the ALCOSAN Wet Weather Program. This excerpt explains the basic deconstruction process utilized by each basin.

> "The analyses performed within the SHAPE (Sewer Hydrograph Analysis Package) program, which was created by Camp, Dresser, & McKee (CDM), for development of the average seasonal diurnal curves were based on deconstruction of the monitored DWF hydrograph. Hydrograph deconstruction is the process of analyzing a total monitored wastewater flow hydrograph and estimating the three individual components of wastewater flow (RDII [rainfall derived inflow and infiltration], GWI and BWWF). The methodology used to represent DWFs was consistent for all modeled areas,

> regardless of the sewer configuration (i.e., separated or combined) (ALCOSAN, 2009).
>
> An initial assumption for hydrograph deconstruction was that GWI was equal to the daily minimum observed DWF, which typically occurs between the hours of 2:00 a.m. and 5:00 a.m. The remaining DWF data were then averaged on a quarterly basis resulting in seasonal dry weather hydrographs. GWI was subtracted from the averaged seasonal dry weather hydrographs to create seasonal BWWF time-series. Using the averaged seasonal BWWF time-series and an averaged seasonal GWI, the DWF flow monitoring data could be decomposed into its BWWF and GWI components. Where the sum of the averaged seasonal BWWF and GWI did not equal the DWF monitoring data, the GWI component of the data was adjusted; thereby creating a continuous time series for GWI.
>
> Using this method of hydrograph decomposition, seasonal BWWF time-series and seasonal GWI time-series were developed for each sub-catchment in the SMR planning basin. It is important to note that GWI and BWWF are not measured directly but rather they are estimated from the observed DWF data."

The results of the DWF, GWI, and BWWF characterizations under baseline conditions are presented in the respective Basin Planner H&H reports under the ALCOSAN Wet Weather Program. These components are also listed in the respective POC specific reports located in Appendix A of this Wet Weather Feasibility Study.

The DWF under future baseline conditions was also determined. The BWWF component was determined by the projected population growth to 2030, which was chosen in lieu of 2046 as mentioned earlier. The GWI was determined based on the expansion of sewer system within a given sewershed to new area. Since no expansions are planned within the PWSA system, the GWI was not projected to change. Therefore, the DWF projections were population driven. DWF under future baseline conditions was determined by applying the per capita proportional rate increases that corresponds to the Southwest Planning Commission Cycle 8 Population Projections. The resulting differences in DWF under baseline and future baseline conditions for each POC are listed in the respective Basin Planner Facility Plans under the ALCOSAN Wet Weather Program and in Table 5-1.

TABLE 5-1. SUMMARY OF DRY WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Average Annual Dry Weather Flow (Typical Year) MGD	Future Baseline Average Annual Dry Weather Flow (Typical Year) MGD	Percent Difference
A-01	0.763	0.764	<1%
A-02	0.127	0.127	<1%
A-03	0.212	0.212	<1%
A-04	2.399	2.402	<1%
A-05	0.614	0.615	<1%
A-06	1.477	1.479	<1%
A-07	0.67	0.672	<1%
A-08	0.221	0.221	<1%
A-09	3.612	3.616	<1%
A-10	1.237	1.239	<1%
A-11	0.596	0.597	<1%
A-12	2.046	2.051	<1%
A-13	1.787	1.788	<1%
A-14	1.796	1.796	<1%
A-14Z	0.152	0.154	<2%
A-15	2.324	2.325	<1%
A-16	0.111	0.113	<2%
A-17	0.483	0.484	<1%
A-18	0.283	0.284	<1%
A-18X	0.087	0.088	<2%
A-18Y	0.028	0.028	<1%
A-18Z	0.017	0.017	<2%
A-19X	0.912	0.908	<1%
A-19Y	0.061	0.063	<3%
A-19Z	0.034	0.034	<1%
A-20	0.205	0.206	<1%
A-20Z	0.005	0.005	<1%
A-21	0.326	0.324	<1%
A-22	15.57	16.03	<3%
A-23	1.576	1.578	<1%
A-25	0.219	0.216	<2%
A-26	0.22	0.214	<3%
A-27	3.141	3.136	<1%
A-27Z	1.254	1.254	<1%

TABLE 5-1. SUMMARY OF DRY WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Average Annual Dry Weather Flow (Typical Year) MGD	Future Baseline Average Annual Dry Weather Flow (Typical Year) MGD	Percent Difference
A-28	1.13	1.119	<1%
A-29	3.149	3.138	<1%
A-29Z	2.681	2.658	<1%
A-30	0.518	0.516	<1%
A-31	0.435	0.433	<1%
A-32	1.208	1.2	<1%
A-33	0.327	0.323	<2%
A-34	0.429	0.424	<2%
A-35	0.16	0.16	0%
A-36	0.03	0.03	0%
A-37	0.01	0.01	0%
A-37Z	0.06	0.06	0%
A-38	0.02	0.02	0%
A-40	0.02	0.02	0%
A-41	1.12	1.12	0%
A-42	5.09	5.49	8%
A-47	1.28	1.282	<1%
A-48	7.301	7.422	<2%
A-49	0.235	0.236	<1%
A-50	0.527	0.532	<2%
A-51	1.05	1.067	<2%
A-55	0	0	-
A-56	0.206	0.207	<1%
A-58	7.561	7.842	3.59%
A-59	0.187	0.188	<1%
A-59Z	0.027	0.029	6.57%
A-60	12.48	12.634	<2%
A-61	0.332	0.335	<1%
A-62-00 (Combined)	0.0194	0.00692	-64.00%
A-62-00 (Sanitary)	0.0476	0.0482	<2%
A-63-00	0.0192	Will be removed	Will be removed
A-64-00	0.251	0.26	3.60%

TABLE 5-1. SUMMARY OF DRY WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Average Annual Dry Weather Flow (Typical Year) MGD	Future Baseline Average Annual Dry Weather Flow (Typical Year) MGD	Percent Difference
A-65-00	0.198	0.327	65.00%
A-66-00	0.218	Will be removed	Will be removed
C-02	0.003	0.004	33
C-03	0.009	0.01	11
C-05	0.2	0.2	<1%
C-05A	0.23	0.24	4.3
C-07*	0.17	0.12	-29
C-11	0.41	0.41	<1%
C-12	0.11	0.11	<1%
C-13-02	0.04	0.04	<1%
C-13-06	0.01	0.01	<1%
C-14	0.01	0.01	<1%
C-14-06	0.02	0.03	50
C-15	0.16	0.16	<1%
C-15-04	0.01	0.01	<1%
C-19	0.67	0.67	<1%
C-24	0.13	0.14	7.7
C-25	0.78	0.81	3.8
C-26A	0.007	0.007	<1%
C-27	0.07	0.07	<1%
C-28	0.18	0.18	<1%
C-29	0.1	0.11	10
C-30	0.59	0.62	5.1
M-01	0.109	0.111	<2%
M-02	0.032	0.033	<2%
M-03	3.942	3.951	<1%
M-04	0.181	0.183	<1%
M-04Z	0.082	0.083	<2%
M-05	4.726	4.756	<1%
M-06	1.48	1.493	<1%
M-07	0.44	0.442	<1%
M-08	0.269	0.271	<1%
M-10	0.681	0.714	4.62%
M-11	0.47	0.472	<1%

TABLE 5-1. SUMMARY OF DRY WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Average Annual Dry Weather Flow (Typical Year) MGD	Future Baseline Average Annual Dry Weather Flow (Typical Year) MGD	Percent Difference
M-12	0.158	0.163	<3%
M-12Z	0.011	0.011	<3%
M-13	0.066	0.067	<3%
M-14	0.108	0.112	3.23%
M-15	0.339	0.341	<1%
M-15Z	0.161	0.161	<1%
M-16	1.045	1.103	5.29%
M-17	0.088	0.089	<2%
M-18	0.083	0.079	-3.90%
M-19	7.219	7.236	<1%
M-19A	5.082	5.103	<1%
M-19B	0.489	0.491	<1%
M-20	0.079	0.081	<3%
M-21	0.613	0.626	<3%
M-22	0.861	0.882	<3%
M-23	0.123	0.126	<3%
M-24	0.263	0.264	<1%
M-26	0.229	0.239	4.10%
M-27	0.483	0.503	4.01%
M-28	0.131	0.131	<1%
M-29	15.54	16.31	4.76%
M-31	0.6757	0.6828	<2%
M-31Z	0.0027	0.0027	<1%
M-32	0.0187	0.0187	<1%
M-33	0.0079	0.0079	<1%
M-34	2.053	2.073	<1%
M-35	1.334	1.34	<1%
M-36	0.7841	0.797	<2%
M-37	0.0559	0.0587	5.1
M-38	0.0163	0.0164	<1%
M-39	0.0177	0.0177	<1%
M-40	0.2332	0.2362	<2%
M-42	5.403	5.483	<2%
M-44	1.831	1.852	<2%

TABLE 5-1. SUMMARY OF DRY WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Average Annual Dry Weather Flow (Typical Year) MGD	Future Baseline Average Annual Dry Weather Flow (Typical Year) MGD	Percent Difference
M-47	5.832	5.918	<2%
MH-03	4.3	4.3	<1%
MH-03A	0.01	0.01	<1%
MH-07_08	0.01	0.01	<1%
MH-09	0.04	0.04	<1%
MH-11	0.82	0.82	<1%
MH-18	3.61	3.64	<1%
MH-21	0.11	0.11	<1%
MH-47	0.11	0.11	<1%
MH-55	0.11	0.12	8%
MH-66	0.22	0.22	<1%
MH-68	0.56	0.57	<2%
MH-70	0.08	0.09	11%
MH-77	0.37	0.37	<1%
MH-80	0.12	0.12	<1%
MH-88	0.18	0.18	<1%
MH-89	3.47	3.46	<1%
MH-99A	0.08	0.08	<1%
MH-N02	0.14	0.14	<1%
MH-N03	0.07	0.07	<1%
O-08	0.02	0.02	<1%
O-09	0.02	0.02	<1%
O-10	0.008	0.008	<1%
O-11	0.04	0.04	<1%
O-13	1.4	1.4	<1%
O-14Z	0.02	0.02	<1%
O-26-00	0.0624	0.0668	7%
O-27	4.548	4.783	5%
O-29	1.319	1.337	<2%
O-30	0.532	0.582	9%
O-31	0.242	0.242	<1%
O-32	0.492	0.502	<3%
O-33	4.949	5.169	4%
O-34	1.127	1.143	<2%

TABLE 5-1. SUMMARY OF DRY WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Average Annual Dry Weather Flow (Typical Year) MGD	Future Baseline Average Annual Dry Weather Flow (Typical Year) MGD	Percent Difference
O-35	0.125	0.125	<1%
O-36	0.59	0.59	<1%
O-37	0.339	0.339	<1%
O-38	0.861	0.872	<2%
O-39	0.614	0.618	<1%
O-40	2.179	2.179	<1%
O-41	1.379	1.38	<1%
O-43	0.887	0.887	<1%
S-15	2.36	2.38	<1%
S-17	0.01	0.01	<1%
S-18	0.57	0.58	<2%
S-23	0.44	0.45	<3%
S-24	0.99	1.01	<3%
S-28	0.18	0.18	<1%
S-29	1.15	1.16	<1%
S-30	0.01	0.01	<1%
S-31	0.11	0.11	<1%
S-32	0.99	1	1%
S-33	0.23	0.24	4%
S-34	0.05	0.05	<1%
S-35	0.12	0.12	<1%
S-36	0.18	0.19	5%
S-37	0.04	0.04	<1%
S-38	0.5	0.51	<2%
S-39	0.3	0.31	3%
S-40	0.3	0.3	<1%
S-41	0.34	0.34	<1%
S-42	0.02	0.02	<1%
S-42A	0.41	0.42	<3%
S-46	0.31	0.31	<1%
SMR45	0.05	0.05	<1%
SMR83	0.16	0.16	<1%
SMRE-40	1.27	1.29	<2%

5.2.2 Wet Weather Flows (Existing and Future Baseline)

Wet Weather Flow (WWF) is total observed monitored flow which includes the DWF components and the third major component: rainfall derived infiltration and inflow (RDII). RDII is the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is used to represent the reaction of the PWSA sewer system during wet weather events so that typical CSO and SSO volumes, flow rates, and durations can be estimated using the H&H model. WWF was represented in SWMM using two different approaches depending on if the sewer is combined or separated. In combined sewered areas, the RDII is primarily associated with direct storm water runoff flowing into the sewer system. The WWFs are accounted for in the ALCOSAN model utilizing the hydrologic portion of SWMM to simulate surface runoff. Input parameters were inputted into the model and simulated WWF hydrographs were produced. These simulated flows were compared to the observed WWFs and the above parameters were adjusted until the simulated WWFs resembled the observed WWFs. For separate sewershed areas, a unit hydrograph curve fitting method (R-T-K method) was used to relate the amount of RDII with precipitation and quantify the RDII entering the contributing area.

The CSO wet weather planning process used by ALCOSAN and ultimately by PWSA requires hydraulic modeling to develop predictions of annual CSO statistics. To accomplish this, spatially distributed "typical year" precipitation was used as the input parameter into the H&H model. The ALCOSAN planning effort developed typical year precipitation that differs from the typical year precipitation that was used in the 2008 PWSA H&H model. As this difference can have an impact on the design of CSO control improvements it is important that a consistent definition of the typical year precipitation characteristics be used regionally. PWSA thus adopted the ALCOSAN regional typical year precipitation to characterize the PWSA future baseline WWFs.

WWFs under future baseline conditions were determined by adding an assumed RDII component to the future DWF estimate based on flow monitoring data. It was assumed that an average of 6 percent of rainfall on new sewershed areas would infiltrate to the sewer system. The peak WWFs under baseline and future baseline conditions for each ALCOSAN POC are presented in the respective Basin Planner

Facility Plans under the ALCOSAN Wet Weather Program and in Table 5-2. Some peak flow rates shown in the table may be limited by restrictions in the system that limits the peak flow rate at the POC which may result in a non-correlation with population projections. Wet weather flow statistics at each applicable PWSA owned diversion structure are presented in each respective POC specific report located in Appendix A of this Wet Weather Feasibility Study.

TABLE 5-2. SUMMARY OF WET WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Peak Wet Weather Flow (Typical Year) MGD	Future Baseline Peak Wet Weather Flow (Typical Year) MGD	Percent Difference
MH-03	4.3	4.3	<1%
MH-03A	0.3	0.2	-50%
MH-07_08	0.5	0.5	<1%
MH-09	0.6	0.6	<1%
MH-11	3.5	3.5	<1%
MH-18	19.8	20.1	<2%
MH-21	0.3	0.4	25%
MH-47	0.4	0.5	20%
MH-55	0.4	0.4	<1%
MH-66	2.4	2.4	<1%
MH-68	5.6	5.6	<1%
MH-70	1	1	<1%
MH-77	5.4	5.4	<1%
MH-80	1	1	<1%
MH-88	2.2	2.2	<1%
MH-89	15.5	15.5	<1%
MH-99A	0.8	0.8	<1%
MH-N02	15.6	15.6	<1%
MH-N03	2.9	2.9	<1%
O-14Z	7.2	7.2	<1%
S-15	10.6	10.6	<1%
S-17	0.4	0.5	20%
S-18	6.3	6.3	<1%
S-23	9.1	9.1	<1%
S-24	78.3	78.4	<1%
S-28	6.1	6.1	<1%
S-29	74.6	74.6	<1%
S-30	1.6	1.6	<1%
S-31	9.2	9.2	<1%
S-32	174.1	173.8	<1%
S-33	62.5	62.5	<1%
S-34	9.7	9.7	<1%
S-35	28	28	<1%
S-36	45.4	45.4	<1%

TABLE 5-2. SUMMARY OF WET WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Peak Wet Weather Flow (Typical Year) MGD	Future Baseline Peak Wet Weather Flow (Typical Year) MGD	Percent Difference
S-37	13.4	13.4	<1%
S-38	74.3	74.3	<1%
S-39	34.3	34.3	<1%
S-40	25.1	25.1	<1%
S-41	18.1	18.1	<1%
S-42	0.8	0.4	-100%
S-42A	19.3	19.3	<1%
S-46	30.1	30.1	<1%
SMR45	0.5	0.5	<1%
SMR83	1.8	1.8	<1%
SMRE-40	22.2	22.2	<1%
A-01	11	11	<1%
A-02	1.9	1.9	<1%
A-03	2.3	2.3	<1%
A-04	26.5	26.5	<1%
A-05	7.6	7.6	<1%
A-06	6.8	6.7	<1%
A-07	8.7	8.7	<1%
A-08	3.7	3.7	<1%
A-09	32.1	32.1	<1%
A-10	15.1	15.1	<1%
A-11	8.3	8.3	<1%
A-12	50.1	50.1	<1%
A-13	8.9	8.9	<1%
A-14	49.5	49.5	<1%
A-14Z	12.1	12.1	<1%
A-15	24.6	24.6	<1%
A-16	27.3	27.3	<1%
A-17	25.5	25.5	<1%
A-18	39.6	39.6	<1%
A-18X	14.2	14.2	<1%
A-18Y	3.9	3.9	<1%
A-18Z	2.5	2.5	<1%
A-19X	41.7	41.7	<1%

TABLE 5-2. SUMMARY OF WET WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Peak Wet Weather Flow (Typical Year) MGD	Future Baseline Peak Wet Weather Flow (Typical Year) MGD	Percent Difference
A-19Y	4.9	4.9	<1%
A-19Z	5.4	5.4	<1%
A-20	52.3	52.3	<1%
A-20Z	0.3	0.3	<1%
A-21	41.4	41.4	<1%
A-22	901.2	901.7	<1%
A-23	130.8	130.8	<1%
A-25	27.6	27.6	<1%
A-26	24.7	24.7	<1%
A-27	27.9	27.9	<1%
A-27Z	17.3	17.3	<1%
A-28	77.7	77.7	<1%
A-29	49.3	49.3	<1%
A-29Z	66.7	66.7	<1%
A-30	10.8	10.8	<1%
A-31	15.5	15.5	<1%
A-32	55.2	55.2	<1%
A-33	17.9	17.9	<1%
A-34	26.2	26.2	<1%
A-47	12.7	12.7	<1%
A-48	177.8	177.9	<1%
A-49	8.2	8.2	<1%
A-50	23.8	23.9	<1%
A-51	50.7	50.7	<1%
A-55	0	0	<1%
A-56	9.9	9.9	<1%
A-58	132.8	133.1	<1%
A-59	15.4	15.4	<1%
A-59Z	7.7	7.7	<1%
A-60	169.1	169.3	<1%
A-61	17.5	17.5	<1%
A-62 (Combined)	11.00	6.00	-45.4%
A-62 (Sanitary)	0.466	0.695	49.1%

TABLE 5-2. SUMMARY OF WET WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Peak Wet Weather Flow (Typical Year) MGD	Future Baseline Peak Wet Weather Flow (Typical Year) MGD	Percent Difference
A-63	4.02	Will be removed	Will be removed
A-64	22.5	20.7	-7.80%
A-65	5.07	6.31	24.5%
A-66	15.0	Will be removed	Will be removed
M-01	11.1	11.1	<1%
M-02	4.5	4.5	<1%
M-03	76.3	76.3	<1%
M-04	6.3	6.3	<1%
M-04Z	2.8	2.8	<1%
M-05	142.4	142.4	<1%
M-06	72.9	72.9	<1%
M-07	13.2	13.2	<1%
M-08	6	6	<1%
M-10	89.9	90	<1%
M-11	8.5	8.5	<1%
M-12	29.6	29.6	<1%
M-12Z	2.1	2.1	<1%
M-13	9.7	9.7	<1%
M-14	8.5	8.5	<1%
M-15	7.6	7.6	<1%
M-15Z	6.2	6.2	<1%
M-16	151.6	151.7	<1%
M-17	8.9	8.9	<1%
M-18	6.4	6.4	<1%
M-19	165.1	165.1	<1%
M-19A	93.5	93.5	<1%
M-19B	52.2	52.2	<1%
M-20	7.9	7.9	<1%
M-21	31.3	31.3	<1%
M-22	17.2	17.2	<1%
M-23	3.8	3.8	<1%
M-24	1.2	1.2	<1%
M-26	28.6	28.6	<1%

TABLE 5-2. SUMMARY OF WET WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Peak Wet Weather Flow (Typical Year) MGD	Future Baseline Peak Wet Weather Flow (Typical Year) MGD	Percent Difference
M-27	43.3	43.4	<1%
M-28	0.8	0.8	<1%
M-29	428.7	429.5	<1%
O-27	234.1	234.3	<1%
O-29	19.8	19.8	<1%
O-30	11.1	11.2	<1%
O-31	6.7	6.7	<1%
O-32	56.9	56.9	<1%
O-33	82.5	82.7	<1%
O-34	102.4	102.4	<1%
O-35	4.2	4.2	<1%
O-36	21.4	21.4	<1%
O-37	10.8	10.8	<1%
O-38	83	83	<1%
O-39	36	36	<1%
O-40	4.2	4.2	<1%
O-41	28	28	<1%
O-43	13.5	13.5	<1%
M-31	12.4	12.4	<1%
M-31Z	0.769	0.77	<1%
M-32	7.38	7.39	<1%
M-33	1.65	1.65	<1%
M-34	26.3	26.3	<1%
M-35	29.9	29.9	<1%
M-36	61	61	<1%
M-37	7.69	7.71	<1%
M-38	12.3	12.3	<1%
M-39	11.1	11.1	<1%
M-40	86	86	<1%
M-42	24.4	24.4	<1%
M-44	9.46	9.45	<1%
M-47	120	119	<1%
A-35	65.25	65.25	<1%
A-36	19.1	19.1	<1%

TABLE 5-2. SUMMARY OF WET WEATHER FLOWS PWSA BY POC

ALCOSAN POC Sewershed	Existing Peak Wet Weather Flow (Typical Year) MGD	Future Baseline Peak Wet Weather Flow (Typical Year) MGD	Percent Difference
A-37	9.31	9.31	<1%
A-37Z	32.89	32.89	<1%
A-38	10.36	10.36	<1%
A-40	12.8	12.8	<1%
A-41	109.16	109.42	<1%
A-42	870.58	866.58	<1%
O-26	42.2	42.2	<1%
C-02	2.9	2.9	<1%
C-03	4	4	<1%
C-05	55	55	<1%
C-05A	8.1	8.1	<1%
C-07*	85	49	-42%
C-11	129	129	<1%
C-12	26	26	<1%
C-13-02	21	21	<1%
C-13-06	0.1	0.07	-30%
C-14	39	39	<1%
C-14-06	0.38	0.39	<3%
C-15	22	22	<1%
C-15-04	1.1	1.1	<1%
C-19	27	27	<1%
C-20	56	56	<1%
C-20-02	0.87	1.1	26%
C-25	54	54	<1%
C-26A	5.6	5.6	<1%
C-27	22	22	<1%
C-28	6.5	6.5	<1%
C-29	19	19	<1%
C-30	5.9	6	<2%
O-08	13	13	<1%
O-09	9.1	9.1	<1%
O-10	5.4	5.4	<1%
O-11	17	17	<1%
O-13	162	162	<1%

5.2.3 Estimation Process for Unmonitored Areas

To account for sub-catchments without an assigned flow monitor, DWF hydrographs were extrapolated from one of the following sources, according to the availability of that data. The sources, presented in descending order of preference, were as follows:

- Data recorded from the same flow monitor during the equivalent period of 2007,
- Data from a downstream flow monitor, or
- Data from another flow monitor with a tributary area comparable in land use and population density.

Most unmonitored subcatchments required the use of data from a monitored subcatchment with similar land use and population density. Regardless of the data source applied to resolve DWF gaps, GWI was extrapolated on an area-weighted basis, and BWWF was extrapolated on a population-weighted basis. To extrapolate DWF hydrographs from either a downstream flow monitor or a flow monitor with a comparable area, it was assumed that GWI correlated to the sewered area of a subcatchment, while BWWF correlated to the population.

For flow monitors where gaps in the flow monitoring data existed for up to three weeks in duration, the corresponding seasonal average DWF hydrograph was applied. For longer periods, DWF hydrographs were extrapolated from data recorded at either the same monitor during an equivalent period in 2007, a downstream flow monitor, or a flow monitor corresponding to a tributary area with comparable land use and population density.

5.3 PWSA SEWER CAPACITY ANALYSIS

The performance of the existing sewerage facilities was also evaluated under the projected future loadings, current diversion structure settings and 2-year, 5-year, and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses.

Modeling was performed for typical year and existing baseline conditions for the 14 sewersheds for which improvements have been proposed. Statistics were generated in terms of number of overflow events, peak flow rates, and total overflow volumes for each event and annual overflow volumes.

There currently are studies in progress in the City of Pittsburgh that are investigating flooding conditions. These studies may recommend other sewer improvements designed for larger storms. It is anticipated that future improvements to the ALCOSAN facilities will increase the capacity of the diversion chambers and downstream piping sufficiently to eliminate backwater effects in the PWSA trunk sewers. Specifically existing conditions modeling of the Negley Run East trunk sewer indicates surcharging and manhole flooding in sections of the sewer along Washington Boulevard during peak typical year flow conditions. Serious flooding has occurred in the Washington Boulevard area during more severe storm conditions. Solutions to this flooding situation are being investigated separately as an urban flooding problem.

5.3.1 Existing Basement Flooding Areas – History and Locations

Typically, a system which experiences surface or basement flooding during these sewer capacity analyses are thereby identified as lacking conveyance capacity for that respective design storm. However, early in the project, it was decided that, given the typical terrain within the City of Pittsburgh's neighborhoods, this evaluation may need to be limited to identifying surcharge levels within various trunk sewers for predetermined design storms. The reasoning is that the terrain in areas tributary to the city are such that most of the major sewers are in valleys. This results in the majority of basement floors being located higher than the ground elevations of the modeled major sewer lines. For this case, the trunk sewers could be surcharged up to ground level at the sewer line without any corresponding basement flooding. To utilize the sewer capacity information to determine potential basement flooding, specific field investigations would be required to determine actual basement elevations throughout the system.

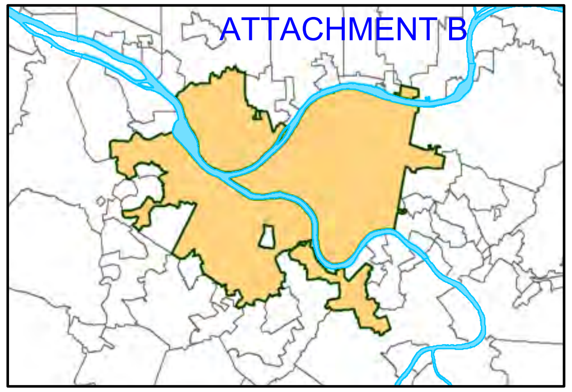
There have been about 144 locations where more than one basement backup complaint between January 1, 2004 and December 31, 2012 was reported through PWSA's complaint/dispatch center. However, there is no conclusive correlation between any of these complaints and capacity constraints. A large majority of the complaints in the record were considered to be unrelated to insufficient capacity in the sewer. The complaint records include brief descriptions of the responses by PWSA operations staff to each report and often identify the apparent causes for the complaint. Typical causes for backups included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In this analysis, addresses for which more than one incident is reported were considered to be potentially caused by public sewer capacity problems. A map showing the distribution of addresses where two or more incidences are reported is presented in Figure 5-1.

5.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

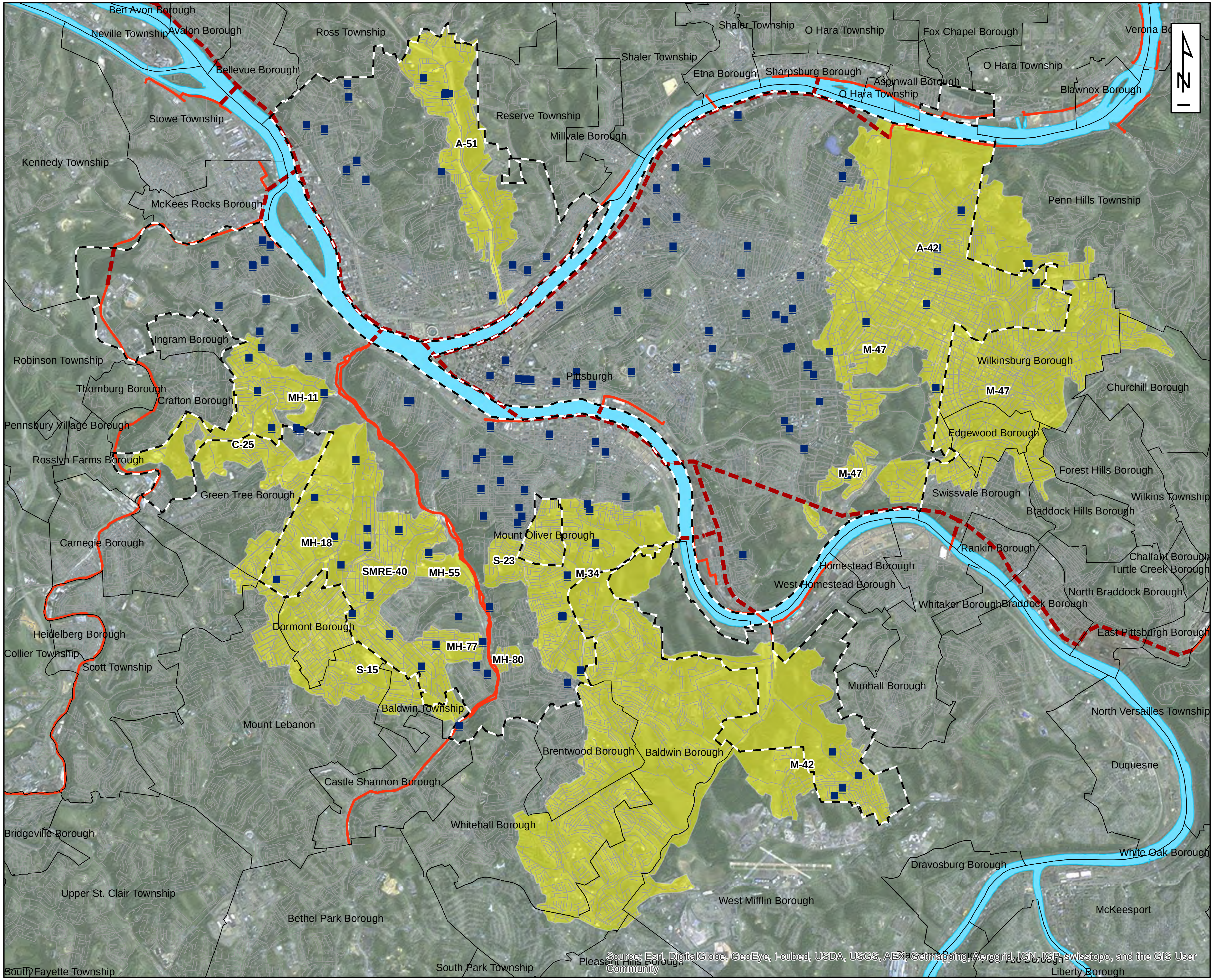
A Level of Service Analysis is used to analyze the sewer system performance in order to identify the capacity limitations of the existing sewers under different simulated design storms. This would determine the level of service a collection system can provide to its tributary service area.

For the PWSA 2008 draft feasibility study, PWSA collection system models for baseline conditions were used. The PWSA model was run under six different design rainfall events for 24-hour durations. These rainfall events were the 3-month, 6-month, 1-year, 5-year, 10-year, and 25-year storms. For each model run, the maximum HGLs for the modeled sewers were examined to quantify the depth of surcharge above the crown of the sewer. Each sewer was then characterized as having no surcharge (maximum depth less than crown of sewer) or surcharge levels of 0 to 3 feet, 3 to 5 feet, 5 to 10 feet, 10 to 15 feet, or greater than 15 feet. A more detailed description and results of the level of service analysis are presented in the *PWSA Collection System Hydraulic and Hydrologic Characterization Report* (September 2008).

ATTACHMENT B



PWSA Service Area Overview



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- ■ Multiple Backup Locations
- ─ Collector Sewer
- 🟨 MH-11 Sewershed Boundary
- ⬚ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ╍ Deep Tunnel
- ─ Shallow Cut

5,900 2,950 0 5,900 Feet

Figure 5 - 1
PWSA Multiple Backup Locations

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 5-1_CHRONIC BACKUP LOCATION.mxd

As was discussed previously, the ALCOSAN regional model was adopted for use in the updated draft feasibility study in 2012 and beyond. Modeling was performed to assess the ability of the existing trunk sewer systems that receive flows from PWSA's permitted CSO diversion structures to convey the flows to the ALCOSAN POCs at the 2-year, 5-year, and 10-year storms or the typical year peak flow condition. This analysis was performed for the 14 sewersheds for which improvements are proposed. The analysis and results are described in detail in Section 2.3.2 of the specific POC reports located in Appendix A of this Wet Weather Feasibility Study. The results of these analyses were used to identify the need for improvements necessary to supplement the capacity of the existing trunk sewer system in order to convey future flows without manhole surcharging

5.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the 14 sewersheds that contain PWSA permitted CSO structures was performed by PWSA. This modeling produced computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (MG). The statistics are shown in Section 2-4 of the POC-specific reports located in Appendix A of this Wet Weather Feasibility Study.

Section 6 CSO Control Goals

Water quality issues are the driving force behind PWSA's and other municipalities' COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that their CSOs and SSOs will not prevent attainment of those water quality criteria.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA. It discusses the information needed to understand the evolution of PWSA's Wet Weather Feasibility Study (FS) and outlines PWSA's approach to selecting and meeting appropriate wet weather control level requirements. It also describes how PWSA coordinated its control goal approach with ALCOSAN's *Wet Weather Plan* (WWP).

6.1 BACKGROUND

The regulatory "climate" for wet weather control for municipalities within the Pittsburgh region has been evolving. As described in earlier sections, the 83 municipalities that are tributary to ALCOSAN have negotiated Orders with PaDEP and ACHD. While those municipal negotiations were still underway, ALCOSAN was negotiating its Consent Decree (CD) with the Department of Justice, USEPA, PaDEP, and ACHD. The municipal negotiations concluded in January 2004 and the communities, including PWSA, received a signed Order from PaDEP or ACHD which contained a variety of requirements. The main intent of the orders was to outline basic requirements and processes the municipalities must follow, culminating in the development of a feasibility study by each affected municipality. For combined sewer systems, the requirements included the following:

- Physical survey/visual inspection of prescribed portions of the collection system
- Sewer line CCTV internal inspection of the sewer system
- Sewer system mapping
- Sewer system dye testing and enforcement
- Sewer system deficiency corrections
- System hydraulic characterization
- Nine minimum controls (NMC)

- Flow monitoring
- Feasibility study

Prior to negotiation of its COA, PWSA undertook significant planning efforts, intending to develop a wet weather Long Term Control Plan (LTCP). These efforts included existing system data collection, sewer system map development, model development, and flow monitoring for Hydrologic and Hydraulic (H&H) model calibration. PWSA completed a significant flow monitoring program in early 2004. Following completion of the flow monitoring program, PWSA completed H&H model development and calibration in 2006, and then began the CSO control alternative development and evaluation process. The initial date to complete the LTCP was set for September 1, 2007. However, by May 31, 2007, ALCOSAN's CD had been lodged and was made available for public comment. Since the PWSA, ALCOSAN, and other municipal sewer systems are physically and hydraulically interrelated, these requirements had a significant impact on the PWSA planning process.

With the requirements for ALCOSAN explicitly stated in an enforceable legal document, PWSA decided in late 2007 to modify its approach to completing the LTCP project. The following course of action was taken:

- Change the title of the final report from "Long Term Control Plan" to "Feasibility Study." This change ensured that PWSA could use aspects of the report to meet its Order as well as work with ALCOSAN in the development of ALCOSAN's Wet Weather Plan required by January 2013.
- Use four overflows per year as a default level of CSO control. This allowed PWSA to work with ALCOSAN as they determined a "regional" level of control.
- Evaluate an additional alternative that provides additional capacity to transport PWSA's overflows to the ALCOSAN connection points. The additional sewer pipes were sized for the "zero overflows" flow rate derived from the 2005 typical year.

In addition to the Order discussed above, other requirements for wet weather compliance are stated in the PWSA NPDES Permit and in PaDEP and USEPA CSO Control Policies. These documents require the PWSA to control CSOs with the goal of protecting water quality, and the PWSA must comply with both the PaDEP and USEPA CSO Control Policies in order to achieve that goal.

It should be noted that PWSA and ALCOSAN share compliance responsibilities for numerous permitted CSOs. Most of the outfalls that are in this category are located close to an ALCOSAN interceptor and discharge flows that originate in the PWSA and/or upstream municipal systems. In addition to these shared responsibilities, PWSA has existing sewage flow delivery contracts with ALCOSAN that impact how the remaining PWSA outfalls will be addressed.

6.1.1 Compliance with USEPA CSO Policy

The USEPA, with extensive input from numerous state, municipal, and environmental stakeholder organizations in an open participatory process, published its final CSO Control Policy in April 1994. The policy requires implementation of the NMC technologies and establishes a planning and implementation process for developing an LTCP by evaluating a range of CSO control alternatives that comply with Water Quality Standards (WQS) and protect designated uses. The CSO Policy was codified in 2000 and is now part of the Clean Water Act. The intent of the CSO Policy is to control CSOs to the appropriate level so that Water Quality Standards can be met.

PWSA submitted its NMC report to PaDEP on November 30, 2005. General requirements for developing an LTCP in conformance with the federal policy are as follows:

- Characterizing, monitoring, and modeling the combined sewer system
- Promoting public participation
- Ensuring that the protection of sensitive receiving waters is a priority
- Evaluating alternatives that achieve a range of CSO control levels
- Considering cost/performance factors
- Developing operational plans to maximize use of facilities for CSO control
- Maximizing treatment at the WWTP
- Phasing the implementation of projects
- Performing post-construction compliance monitoring

Implementation of the plan may be phased, such that projects impacting the most sensitive areas supporting critical uses are given priority. The financial capability of a permittee to implement CSO control projects may also be considered when prioritizing projects.

The CSO Control Policy also acknowledges that, in certain cases, modification of existing WQS may be appropriate to better reflect the impacts of temporary, site-specific wet weather CSOs. It encourages coordination of the WQS review as part of LTCP development, with state authorities participating in the planning process to determine whether changes in WQS are warranted.

In addition, under the 2000 National CSO Policy, plans for long-term CSO control and compliance with WQS may be developed by using either a "presumptive" or "demonstrative" approach.

Presumptive Approach. Under the presumptive approach, compliance with WQS is presumed if one of the following performance criteria is met:

1. No more than an average of four overflow events occur per year on an annual average basis, with up to two additional overflow events per year (six total) possibly being allowed by the permitting authority.
2. Elimination of, or capture for treatment of no less than 85 percent (by volume) of the combined sewage collected in the combined sewer system on a system-wide annual average basis.
3. Elimination or reduction of no less than the mass of pollutants that would be eliminated or captured for treatment in No. 2 above.

The minimum level of treatment applicable to the presumptive criteria is defined in the policy as primary clarification and disinfection of the effluent, if necessary, to meet WQS and protect designated uses. This includes the removal of harmful disinfection chemical residuals, if necessary.

Selection of the presumptive approach does not release the permit owner from the overall requirement of meeting applicable WQS. If the permitting authority determines that the long-term CSO control plan would not result in attainment of WQS, more stringent controls may be required. The performance criteria of the presumptive approach may be evaluated using a receiving water quality model.

Demonstrative Approach. Under the demonstrative approach, compliance with WQS is confirmed through the CSO control planning process. Controls that may not necessarily satisfy the performance criteria of the presumptive approach may be shown to meet WQS by assessing the impacts of those CSO discharges on the receiving water(s).

Under the definition of a successful demonstrative approach, an LTCP must meet the following criteria:

1. The planned control program is adequate to meet WQS and protect designated uses, unless standards or uses cannot be met as a result of natural background conditions or pollution sources other than CSOs.
2. The CSO discharges remaining after implementation of the planned control program would not preclude the attainment of WQS or designated uses, or contribute to their impairment. Where standards and uses are not met in part because of natural background conditions or pollution sources other than CSOs, a total maximum daily load (TMDL) allocation should be used to apportion pollution loads.
3. The planned control program would provide the maximum pollution reduction benefits reasonably attainable.
4. The planned control program is designed to allow cost-effective expansion (or cost-effective retrofitting if additional controls are subsequently determined to be necessary) to meet WQS or designated uses.

It should be noted that both the "Presumptive" and "Demonstrative" approaches require that WQS be met in the receiving streams. The Presumptive approach presumes that WQS will be met by the control alternatives, while the Demonstrative approach requires that the LTCP demonstrate that WQS will be met. In either case, the requirement to meet WQS still applies. The next section provides some background on WQS as well as an approach to CSO control alternative development that will ensure that remaining overflows do not contribute to any WQS violations.

6.1.2 Compliance with PaDEP CSO Control Policy and NPDES Permit

PWSA's NPDES Permit requires a "water quality-based" LTCP for CSO abatement. The LTCP is required to achieve compliance with the state water quality standards upon completion of the LTCP implementation. The results of this Feasibility Study will be the basis of the PWSA's LTCP.

The Commonwealth of Pennsylvania published the *Pennsylvania Combined Sewer Overflow (CSO) Policy* in March 2002. According to the NPDES Permit issued by PaDEP "The long term goal of the LTCP requirement... is to achieve compliance with the state water quality standards upon completion of the LTCP implementation." The state's CSO policy essentially reinforces the EPA Policy codified in 2000. Section II.C of the EPA policy is specifically referenced as the basis for review of LTCPs submitted to the state.

The key elements of an LTCP, as defined by PaDEP, are as follows:

- Continued implementation of the nine minimum controls;
- Protection of sensitive areas (recreation areas, public water supply, unique ecological habitat, etc.);
- Public participation in developing the LTCP and implementation;
- Characterization, monitoring, and modeling of overflows and assessment of water quality impacts;
- Evaluation and selection of control alternative – presumptive or demonstrative approach;
- Development of an implementation schedule and financing plan for selected control options;
- Maximization of treatment at the treatment plant;
- Development and implementation of a post-construction monitoring program plan; and
- Development and implementation of a CSO System Operational Plan.

PWSA's NPDES Permit acknowledges the USEPA's guidance manual, titled *Guidance for Long Term Control Plan (EPA 832-B-95-002)*, which describes the approach for the evaluation of various levels of CSO control.

6.2 WATER QUALITY ISSUES

6.2.1 Background

To develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the above requirements are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."

- Remaining CSO discharges must not contribute to the impairment of "designated use," i.e. "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA) which, by definition, is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. Includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. Covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. Covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated "high quality" and "exceptional quality" waters.

Other. Navigation.

Wherever a "designated use" is not being met due to water quality issues, the stream is said to be impaired. For example, if bacteria counts are consistently above 400 CFU/100 ml in streams, it means that partial or total body contact cannot be allowed. In other words, swimming, water skiing, and similar sports cannot be undertaken due to violations of the bacteria standards. "Use impairments" are normally documented in the USEPA's 303(d) list. The USEPA website states: "The term, '303(d) list', is short for the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- "Identify the waters that require TMDLs (total maximum daily loads);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

6.2.2 PWSA CSO Outfalls and Water Quality Criteria

PWSA has numerous outfalls (over 150) that are jointly permitted with ALCOSAN. These outfalls are addressed in ALCOSAN's WWP. There are also a series of PWSA outfalls (37) that discharge into various tributaries, as shown in Table 6-1.

As shown in the table, most of these PWSA-owned outfalls discharge into receiving waters classified as warm water fisheries (WWF). The only exception is Nine Mile Run, which is a trout stocking fishery (TSF). These PWSA-owned outfalls and PaDEP designated water uses are shown in Figure 3-1. None of the streams currently meet their assigned water quality standards, as shown in Figure 3-2.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of fecal coliform bacteria in units of colony forming units (CFU)/100 ml.

- From May 1 through September 30, during the recreational season, a 30-day geometric mean fecal coliform must not exceed 200 CFU/100 ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30-day period.
- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400 CFU/100 ml, over a 30-day period.

For the remainder of the year, the 30-day geometric mean fecal coliform must not exceed 2,000 CFU/100 ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30-day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes minimum concentrations of dissolved oxygen, which must be met in surface waters of the state. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/L, with a minimum daily average of 5.0 mg/L. Surface waters designated as TSF, must meet a minimum of 5.0 mg/L, with a minimum daily average of 6.0 mg/L, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0 mg/L, minimum daily average of 5.0 mg/L shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are outlined in Section 93.6, General Water Quality Criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life.
b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

TABLE 6-1. RECEIVING WATER QUALITY STATUS WHERE PWSA-OWNED OUTFALLS DISCHARGE

Outfall Structure ID	ALCOSAN Planning Basin	ALCOSAN POC ID	Receiving Water	Designated Use[1]	WQ Attainment (Y/N)	TMDL (Y/N)
OF121H001	UA	A-41-00	Allegheny River	WWF	N	Y
OF009E001	MR	A-58-00	Allegheny River	WWF	N	Y
OF163G002	MR	A-58-00	Girty's Run	WWF	N	N
OF163G001	MR	A-58-00	Girty's Run	WWF	N	N
OF068H002	CC	C-25-00	Bells Run	WWF	N	Y
OF039E001	CC	C-25-00	Bells Run	WWF	N	Y
CSO039J001	CC	C-25-00	Bells Run	WWF	N	Y
OF039K001	CC	C-25-00	Bells Run	WWF	N	Y
OF068H001	CC	C-25-00	Bells Run	WWF	N	Y
OF032N001	UM	M-34-00	Becks Run	WWF	N	N
OF032P001	UM	M-34-00	Becks Run	WWF	N	N
OF030N001	UM	M-34-00	Becks Run	WWF	N	N
OF134A001	UM	M-42-00	Streets Run	WWF	N	Y
OF185H001	UM	M-42-00	Streets Run	WWF	N	Y
OF184E001	UM	M-42-00	Streets Run	WWF	N	Y
OF089D001	UM	M-47-00	Monongahela River	WWF	N	Y
OF128R002	UM	M-47-00	Nine Mile Run	TSF	N	N
CSO036R001	SMR	MH-18	Little Saw Mill	WWF	N	Y
OF035E001	SMR	MH-18	Little Saw Mill	WWF	N	Y
OF035A001	SMR	MH-18	Little Saw Mill	WWF	N	Y
CSO016A001	SMR	MH-18	Little Saw Mill	WWF	N	Y
OF035J001	SMR	MH-18	Little Saw Mill	WWF	N	Y
CSO016A002	SMR	MH-18	Little Saw Mill	WWF	N	Y
OF034R001	SMR	MH-55	Saw Mill Run	WWF	N	Y
CSO095E001	SMR	MH-77	Saw Mill Run	WWF	N	Y
OF095J001	SMR	MH-80	Saw Mill Run	WWF	N	Y
OF138P001	SMR	MH-89	Weyman Run	WWF	N	Y
OF138E001	SMR	MH-89	Saw Mill Run	WWF	N	Y
CSO138K001	SMR	MH-89	Weyman Run	WWF	N	Y
OF097L001	SMR	S-15	McDonoughs Run	WWF	N	Y
CSO139A001	SMR	S-15	McDonoughs Run	WWF	N	Y
S1500POCL01AOF	SMR	S-15	Saw Mill Run	WWF	N	Y

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[1] Designated Use: WWF = Warm Water Fishery, TSF = Trout Stocking Fishery

TABLE 6-1. RECEIVING WATER QUALITY STATUS WHERE PWSA-OWNED OUTFALLS DISCHARGE

Outfall Structure ID	ALCOSAN Planning Basin	ALCOSAN POC ID	Receiving Water	Designated Use[1]	WQ Attainment (Y/N)	TMDL (Y/N)
OF139B001	SMR	S-15	McDonoughs Run	WWF	N	Y
OF139B002	SMR	S-15	McDonoughs Run	WWF	N	Y
OF139B003	SMR	S-15	McDonoughs Run	WWF	N	Y
OF139F001	SMR	S-15	Saw Mill Run	WWF	N	Y
OF060A001	SMR	S-23-00	Saw Mill Run	WWF	N	Y
CSO019M001	SMR	S-42A	Saw Mill Run	WWF	N	Y
OF015P001	SMR	SMRE-40	Saw Mill Run	WWF	N	Y

6.2.3 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program [2]. The PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries were obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh district). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this

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[2] Details of these sampling programs can be found in the *PWSA Receiving Water Quality Assessment Program Technical Memorandum* (December 2006), and the *PWSA CSO Quality Assessment Technical Memorandum* (June 2007).

review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA service area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006, and ended October 1, 2006. Seven monitoring locations, which were selected in, or just outside of, the City of Pittsburgh along the five streams that receive PWSA CSOs, are within the PWSA service area. The seven monitoring sites were located along the five streams that flow through the City of Pittsburgh limits: Becks Run, Chartiers Creek, Nine Mile Run, Saw Mill Run, and Streets Run. Monitoring sites were either downstream from most of the outfalls within a stream and at the upstream boundaries of two of the streams: Chartiers Creek, and Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, phosphorus, ammonia, oil and grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

Detailed findings of the receiving water quality data review can be found in Section 5 of the PWSA Draft Feasibility Study Report (October 2008). In general, the DO concentrations for Chartiers Creek, Nine Mile Run, and Saw Mill Run do not meet regulatory limits during wet weather which indicating that DO impacts are likely related to CSO discharges during the storm events and/or wet weather discharges from upstream municipalities. Chartiers Creek and Saw Mill Run showed DO concentration not meeting standards during dry weather indicating that CSO discharges are not likely causing the condition. Becks Run and Streets Run showed DO meeting concentration limits.

ALCOSAN Program [3]. The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. The level of required monitoring in ALCOSAN's CD included parameters for which PWSA had not monitored and encompasses a much larger area (i.e., ALCOSAN's service area) than PWSA's program. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters, just like the PWSA monitoring program, but also included monitoring for industrial discharges and polychlorinated biphenyls (PCB) sampling.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three wet weather and three dry weather events between 2006 and 2011. Monitoring was conducted in the three rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects, and tributaries were sampled during the recreational season from April 1 through October 31 in any given year.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 CFU/100 ml and 400 CFU/100 ml concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 CFU/100 ml. The percentages of samples that exceeded the given threshold according to ALCOSAN are shown in Table 6-2.

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[3] ALCOSAN *Draft Wet Weather Plan*, January 2013, Section 5.

TABLE 6-2. PERCENT OF SAMPLES WITH GREATER FECAL COLIFORM CONCENTRATION THAN LIMIT DURING RECREATIONAL SEASON

Receiving Water	Concentration During Recreational Season	
	200 CFU/100 ml*	400 CFU/100 ml*
Chartiers Creek	~85%	~73%
Nine Mile Run	~85%	~43%
Saw Mill Run	~100%	~80%
Streets Run	~85%	~55%

* Data are from Figures 5-14 and 5-15 of the ALCOSAN *Draft Wet Weather Plan*, January 2013.

Although there is not a numeric water quality standard for total phosphorus (TP), a common in-stream threshold in the northeast used by USEPA is 0.100 mg/L. This limit was exceeded in more than 75% of the samples in Chartiers Creek. Saw Mill Run has an in-stream target concentration of 0.035 mg/L which was exceeded by 75% of the samples. Total phosphorus appears to be a basin-wide concern, with CSO discharges being a potentially significant source in wet weather. Other results are presented in the *ALCOSAN Draft Wet Weather Plan*, January 2013.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS. Bacteria drove the analyses results since it requires the highest level of reduction from CSOs in order to prevent non-attainment of WQS.

6.2.4 TMDL Reports

There are three total maximum daily load (TMDL) reports that have been completed for some of the receiving streams that receive CSOs from PWSA owned outfalls. These include Saw Mill Run and its tributaries, Streets Run, and Chartiers Creek, which includes its tributary Bells Run. It should be noted that a TMDL is anticipated for Nine Mile Run by 2015, although it is not available now. TMDL streams are shown in Figure 3-3. For Saw Mill Run, the phosphorus TMDL results are presented in Table 6-3.

TABLE 6-3. SAW MILL RUN PHOSPHORUS TMDL RESULTS

Total Phosphorus Load	CSO Load	SSO Load
Existing Load (lb/Growing Season)	7,161.9	1,950.4
Allocated Load (lb/ Growing Season)	177.5	0.0
Percent Reduction (%)	98%	100%

The implication of this is that substantial reductions of CSO and complete elimination of SSO is necessary for compliance. For CSO, it is judged that a control level of 0 overflows per year will be required.

The TMDLs for Streets Run and Chartiers Creek (Bells Run) are related to acid mine drainage parameters. Thus, maintaining 4 overflows per year for these tributaries is judged reasonable. This is especially true in Chartiers Creek, where ALCOSAN's receiving water modeling has demonstrated compliance with WQS at 4 to 6 overflows per year.

6.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, pollution contributed by CSOs is only a fraction of the total pollutant loads from all such sources. In these areas, even complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses. However, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO control levels were assessed. For the typical year, 0, 4, and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of this Wet Weather Feasibility Study).

6.4 IMPACT OF ALCOSAN'S CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of PWSA's Feasibility Study. The Background Section of this Wet Weather Feasibility Study provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities," one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two-year level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Allegheny, and Monongahela) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

It should be noted that ALCOSAN's CD identifies the extent of several "sensitive areas." PWSA-generated sewage flows into a number of ALCOSAN overflows which discharge into these sensitive areas. These outfalls, and the sensitive areas they discharge into, are listed in Table 6-4. Accordingly, and per USEPA CSO Policy, a higher level of control is accounted for in ALCOSAN's WWP. Specifically, ALCOSAN designates 0 overflows per year during the typical year are planned for the outfalls discharging into sensitive areas. PWSA-owned outfalls do not discharge directly into these sensitive areas.

TABLE 6-4. POCS THAT DISCHARGE INTO SENSITIVE AREAS WITHIN PWSA

Outfall	Area Name	Mile Point	Description
O-40	Ohio River Area No. 1	0.0 to 1.0	Parks
O-41			
O-43			
A-47			
M-19	Monongahela River No. 1	2.3	Boat Ramp
M-20			
M-21			
M-22			

6.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this Feasibility Study, the demonstration approach for CSO control levels was preferred as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flow would meet water quality standards by implementing CSO controls that will not allow more than an average of 4 to 6 overflow events per year on an annual average basis.

Based on the PWSA system model, CSO statistics (volume and peak flow) were generated for every outfall as well as for a selection of outfall groupings for control levels of 0, 4, and 10 overflow events per year, based on a "typical year" storm. The analyses presented later in this report identify CSO control facilities required to achieve a range of CSO control levels (ranging from 0 to 4 to 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year, and 10-year return frequency events). Given the costs anticipated, and the expectation of meeting WQS, PWSA is selecting a CSO control level of 4 overflows per year.

Since Saw Mill Run has a TMDL which requires a high level of phosphorous removal (98%), a higher level of control will be required. While 10, 4 and 0 OF/year are analyzed, 0 OF/year will be necessary for compliance. Subsequent discussions are presented in Appendix A, Section 3 of this Feasibility Study.

A range of design storms (2-year, 5-year, and 10-year) were evaluated for transport of flows. PWSA plans to use the 2-year storm. During project improvement design, the option of going to a higher level of service will be considered based on localized issues such as the existence of basement flooding complaints.

Section 7 Alternative Evaluation

The wet weather control alternative development and evaluation process presented in this section is applicable to:

- Control alternatives developed in support of the 2008 report
- Control alternatives for POC sewersheds that include facilities that will be the responsibility of the PWSA

Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail in the POC reports located in Appendix A of this Wet Weather Feasibility Study.

Since the PWSA service area makes up approximately one-fourth of the ALCOSAN service area, the wet weather planning processes for each have been, and must continue to be, undertaken in a collaborative manner. The processes followed by both the PWSA and by ALCOSAN have built upon each other, and both processes are referred to in the following paragraphs.

7.1 INTRODUCTION

CSOs may be controlled in numerous ways. Any factor, such as a piece of equipment, a municipal regulation, or a high-tech treatment technology that reduces the amount of untreated overflows from a sewage system, may be considered a method of CSO control. However, collection systems characterized by high CSO flow rates, large CSO volumes and/or high frequency of overflow occurrence often require the application of control technologies and the construction of additional sewage facilities. These additional facilities normally treat the overflow volume, store the overflow volume for later conveyance to an existing treatment facility through existing conveyance systems, or increase system capacity to convey the overflow volume to an existing treatment facility during the wet weather event.

The size and cost of each control facility is dependent upon the magnitude of the overflow generated by the upstream collection system at the desired level of control. For example, a control alternative designed to allow the discharge of one untreated overflow per year may require a five million gallon facility, whereas a facility designed to allow two untreated overflows may only require a one million gallon facility. Carrying the example further, if the selected level of control is the discharge of four untreated overflows per year, the tank could be made even smaller.

It should be noted that ALCOSAN's Consent Decree (CD) contains a requirement that, in essence, says that ALCOSAN must accept and treat all flows that tributary municipalities convey to the ALCOSAN interceptor. Thus, for a selected level of control, if it could be shown that PWSA's existing collection system could adequately convey all flows to the nearest ALCOSAN interceptor, no additional PWSA control facilities would be required. On the other hand, if it is shown that PWSA's existing collection system could not adequately convey those flows, PWSA would need to develop, evaluate, and construct a CSO control alternative to achieve the selected level of control.

This section presents the approach used by the PWSA to accomplish the following:

- Determine the adequacy of existing PWSA collection systems
- Develop and implement a control technology screening process
- Develop control alternatives
- Evaluate control alternatives

This section also presents the results of the alternative development and evaluation process and describes the recommended alternative for each POC.

7.1.1 Key Terms

As the area's planning efforts evolved from the *PWSA Feasibility Study Report* (October 2008) through the ALCOSAN WWP and the PWSA's *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012), many terms and definitions were used. Though similar, the terms and definitions used by both parties were not the same. For clarity, the definitions of key terms used throughout this report are listed below.

- **Control Technology.** A technology used for controlling wet weather flows.
- **Control Site.** The physical location, denoted by block/lot number(s), of a proposed control alternative.
- **Hydrologic and Hydraulic (H&H) Conditions.** Those conditions that have an effect upon the rate, volume, and frequency of overflows to be controlled. Specific conditions include: precipitation events, performance levels, applicable boundary conditions and sources of contributing flows.
- **Control Alternative.** A unique combination of a control technology or technologies, a control site and a specific set of H&H conditions.

- **Remote and/or Low Flow Alternative.** A control alternative that serves to control overflows from a remote outfall or an outfall having low overflow volume / flow rate. These control alternatives include those that could be implemented by PWSA at a relatively low cost, and are a subset of control alternatives. These alternatives have the potential to become "early action" projects.
- **Outfall Specific Alternative.** A control alternative that serves to control overflows from a specific outfall, or a small group of outfalls. These could serve as one component of a larger control alternative such as a regional or subsystem alternative. ALCOSAN used the term "site alternative" for similar alternatives within their WWP.
- **Regional Alternative.** A control alternative made up of one or more outfall specific alternatives intended to provide a level of flow control applicable to a larger area or grouping of outfalls (i.e. a region). ALCOSAN used the term "basin alternative" for similar alternatives within their WWP.
- **Subsystem Alternative.** A control alternative made up of one or more regional and outfall specific alternatives, and intended to accommodate large flows and/or volumes collected from a large area. ALCOSAN used the term "system-wide alternative" for similar alternatives within their WWP.

7.2 ADEQUACY OF EXISTING PWSA COLLECTION SYSTEM

There are over two hundred locations within the City of Pittsburgh where CSOs discharge to receiving streams. A smaller subset of CSOs discharge from approximately 37 locations controlled by diversion structures that are operated by the PWSA and one that is operated by PennDOT. The remainder of discharges is controlled by diversion structures that are operated by ALCOSAN. The locations of these CSO discharges are illustrated in Figure 7-1.

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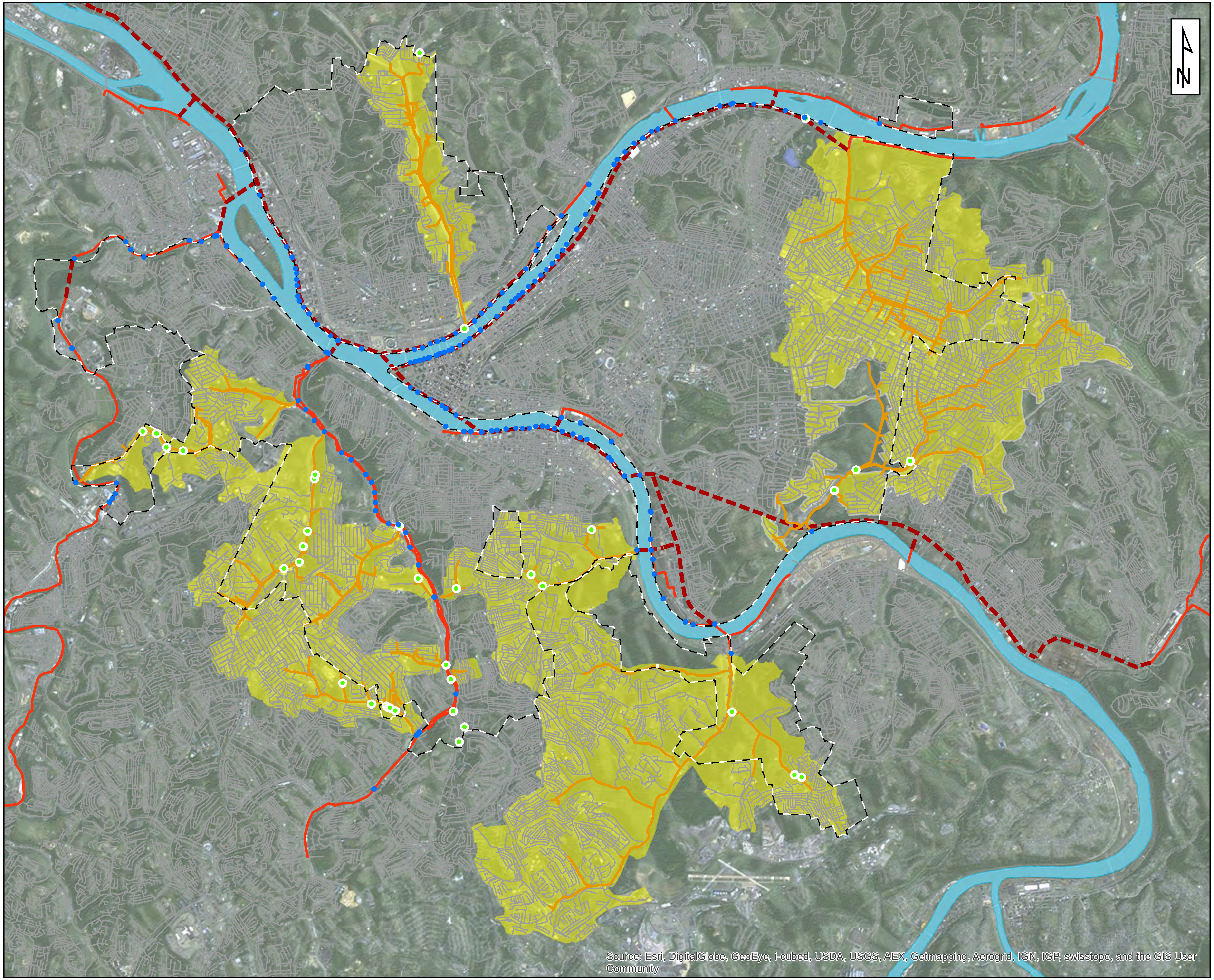
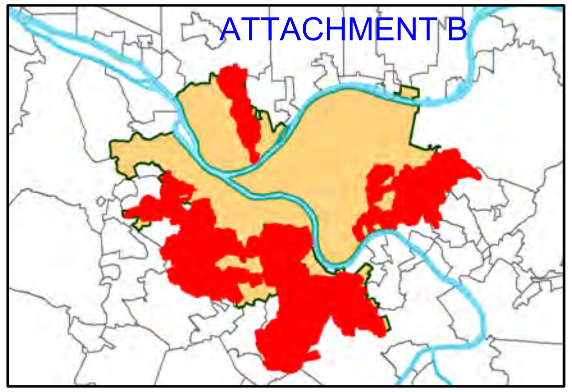
ATTACHMENT B



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



PWSA Service Area Overview

Legend

- ● PWSA Sewer Outfall
- ● ALCOSAN Sewer Outfall
- ― Trunk Sewer
- ― Collector Sewer
- 🟨 14 POC Sewershed Boundaries
- ⬚ PWSA Service Area Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ▬ ▬ Deep Tunnel
- ― Shallow Cut

6,000 3,000 0 6,000 Feet

Figure 7 - 1: CSO Locations

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 7-1 CSO LOCATIONS.mxd

Controls required for the CSO discharges operated by the PWSA must be the responsibility of the PWSA. However, if PWSA's existing collection system can adequately convey all flows to the nearest ALCOSAN interceptor, no additional PWSA control facilities would be required. Thus, any controls required for the CSO discharges from the diversion structures operated by ALCOSAN would be the responsibility of ALCOSAN.

To determine the adequacy of the PWSA collection systems upstream of the ALCOSAN operated diversion structures, the ALCOSAN H&H model was run under future baseline conditions. If the model results indicated that the PWSA collection systems could convey flows generated during typical year rainfall conditions, without excessive system surcharging (manhole flooding, basement backups etc.) the system was considered adequate.

If the PWSA collection system was shown to be adequate, the PWSA control alternative for that sewershed defaulted to "Convey All Flows to ALCOSAN." If it was not, the PWSA control alternative was selected as described in the following paragraphs.

7.3 CONTROL TECHNOLOGY SCREENING PROCESS

The technology screening process provided a way of eliminating technologies from consideration that did not meet the basic criteria for consideration and would therefore not likely achieve program goals. First implemented by the PWSA during the development of the *PWSA Feasibility Study Report* (October 2008), the process was mirrored by ALCOSAN during the development of their January 2013 WWP. Their efforts produced very similar results.

An assumption was made that the technology screening results contained in the *PWSA Feasibility Study Report* (October 2008) were still applicable. The technology screening process was therefore not repeated during the development of this report.

7.3.1 Control Technologies and Screening Criteria

As part of the PWSA Feasibility Study, a technology review, initial analysis, and screening was performed to identify and categorize feasible wet-weather management technologies for use in developing CSO control alternatives.

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities, technical literature, and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet weather management technologies used: source control, collection system control, storage, and treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives. The categories of wet weather management technologies are defined as follows:

- **Source Control** technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from green infrastructure (GI) controls; refer to Section 9 of this Wet Weather Feasibility Study for details on GI controls.
- **Collection System Control** technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.
- **Storage** technologies store excess wet weather flows until sufficient conveyance and treatment capacity becomes available in the system as wet weather flow subside. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.
- **Treatment** technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report* (October 2008).

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories of criteria, and their specific criteria, included:

- **Economic Impact.** Present worth cost (capital, operations and maintenance).
- **Environmental Impact.** Pollution reduction, impact on habitat, and stream flooding.
- **Implementation Impact.** Constructability, permanent land requirements, public acceptance, institutional constraints, and siting restrictions.
- **Operational Impact.** Operating complexity, flexibility, reliability, and compatibility with other PWSA facilities and operations.

During the technology screening phase, queries were directed towards the non-cost criteria because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies are presented in Section 8 of the *PWSA Feasibility Study Report* (October 2008).

7.3.2 Technology Screening Results

Technologies that were considered “feasible” by the PWSA are shown in Table 7-1. As noted above, the PWSA’s technology screening process was mirrored by ALCOSAN during the development of their January 2013 WWP, and their efforts produced similar results. ALCOSAN’s results are also included in the table; the results of both processes are similar enough to further validate the PWSA’s assumption that the technology screening results contained in the *PWSA Feasibility Study Report* (October 2008) are applicable to this Wet Weather Feasibility Study.

TABLE 7-1. TECHNOLOGY SCREENING RESULTS

Control Category		Feasible Technologies: PWSA	Feasible Technologies: ALCOSAN
Source Controls	Source Reduction	Sewer and manhole rehabilitation Green infrastructure / stormwater management	Infiltration / inflow reduction Green infrastructure / stormwater management
Collection System Controls	Maintenance & Repair	Removal of bottlenecks Sewer cleaning and maintenance Polymer injection (lining and coating)	N/A
	Conveyance	Static regulator device improvements Swirl/helical/plunge/vortex energy dissipaters Bending weirs Drop structure optimization Relief sewer(s) Convey all flows to ALCOSAN	Conveyance
	Sewer Separation	Complete separation Partial separation	Sewer separation
Storage	In-line Storage	Inflatable dams Manual and automatic gates Existing unused conduits Static flow control strategies Variable flow control strategies Real-time control strategies Storage and conveyance conduits	In-line storage
	Tunnel Storage	Tunnel storage	Tunnel storage
	Tank Storage	Closed concrete tanks Open concrete tanks / earthen basins	Above ground storage tank Below ground storage tank
Treatment	Screening	Microscreens Static / mechanical screens In-line netting Regulator underflow baffles	Screening (with disinfection)
	Suspended Solids Control	Gravity / high rate sedimentation	Retention / treatment basin Vortex separation

TABLE 7-1. TECHNOLOGY SCREENING RESULTS

Control Category		Feasible Technologies: PWSA	Feasible Technologies: ALCOSAN
		Dissolved air floatation High rate filtration Sand and organic filters Microfiltration Ballasted flocculation Clarification (Densadeg 4d) / Comag Storage and sedimentation Detention and treatment	High rate clarification
	Disinfection	Chlorination / bromination Ozonation Ultraviolet radiation	Disinfection (with screening)
	Re-aeration	Sidestream elevated pool aeration	N/A
	Secondary Treatment	N/A	Satellite sewage treatment

7.4 CONTROL ALTERNATIVE DEVELOPMENT

This section describes the process by which CSO control alternatives were developed for potential use within the PWSA system. Later sections describe the methods used to calculate planning level cost estimates and the approach used to evaluate and rank control alternatives.

During the completion of the *PWSA Feasibility Study Report* (October 2008), PWSA developed control alternatives in a step-wise fashion, starting with remote and low flow outfalls, and proceeding through the outfall specific, regional and subsystem analyses. In addition, PWSA evaluated a “Z Agreement Alternative” that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called “Convey All Flows” in this Wet Weather Feasibility Study.

The control alternative development process applied during the *PWSA Feasibility Study Report* (October 2008) remains applicable. Therefore, the alternative development process was not repeated during the development of this Wet Weather Feasibility Study.

During this Control Alternative Development process, it became evident that most, if not all, of the control technologies considered to be "feasible" during the control technology screening process could not function as a control alternative without being combined with one or more other "feasible" control technologies. For example, a gravity sedimentation basin must be combined with screening and disinfection in order to serve as a viable CSO control alternative. Ancillary technologies, such as pump stations, odor control facilities, or tank flushing systems, while not necessarily required to achieve pollutant reduction goals, may also be required to produce viable CSO control alternatives. Consequently, viable combinations of control technologies were evaluated as CSO control alternatives.

In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which the sizes, costs, and physical impacts of each alternative could be estimated. This section addresses the methods used by the PWSA to accomplish those estimates.

7.4.1 Remote and Low-Flow Alternatives

CSO control alternatives considered for remote location and low-flow outfalls include those that could be easily implemented by PWSA at low relative cost and that would result in the elimination or reduction of the targeted number of overflows. Typically, these projects could include regulator modifications, sewer separation, pipe (in-line) storage, relief sewers, or a combination of these. For the purposes of this study, two 'place holder' alternatives were considered: pipe storage, and sewer separation. These alternatives are briefly described below:

- **Pipe Storage.** Pipe storage could include the construction of a new pipe in the vicinity of the diversion chamber or outfall to receive diverted flow from the main system. Diverted and stored flows would then be slowly fed by gravity back into the main system. Another alternative for pipe storage would include replacement of a length of pipe in the existing system with larger diameter pipe with enough reserve capacity to store anticipated overflow volumes until the wet weather event subsides.

- **Sewer Separation.** The separation of combined sewers into sanitary and storm sewers such that the drainage area is served by independent sanitary and stormwater sewer systems would reduce the hydraulic loading to the outfall. By definition, the complete separation of sewers would result in the elimination of CSOs at the outfall.

These two control alternatives were chosen to provide representative and practical control estimates for budgeting purposes.

7.4.2 Outfall Specific Alternatives

The alternatives evaluated for each outfall included combinations of control technologies that may reasonably be constructed for a single outfall or small group of outfalls. These small groups of outfalls are referred to in this study as "consolidated outfalls." Control alternatives considered feasible for outfall specific alternatives were made up of combinations of the following control technologies:

- Screening and disinfection
- CSO treatment facility, referred to as a retention treatment basin (RTB) by ALCOSAN
- High rate end-of-pipe technologies, referred to as high rate clarification (HRC) by ALCOSAN
- Suspended solids control
- Surface storage tank
- Sub-surface storage tank
- Sewer separation

7.4.3 Regional Alternatives

The alternatives evaluated for each region included combinations of control technologies that may reasonably be constructed for a larger group of outfalls, referred to in this study as Regions. Control alternatives considered feasible for regional alternatives were identical to those considered for outfall specific alternatives with the addition of the following control technology:

- Tunnel storage

7.4.4 Subsystem Alternatives

The alternatives evaluated for each subsystem included combinations of control technologies that may be constructed to accommodate large flows and/or volumes collected from a large, combined group of regions and individual outfalls. Control alternatives considered feasible for subsystem alternatives were made up of the following control technologies:

- Sewer separation
- Tunnel storage

7.4.5 Convey All Flows Alternative

ALCOSAN's Consent Decree contains a requirement that, in essence, says that they must accept and treat all flows that tributary municipalities convey to the ALCOSAN interceptor. A related requirement exists within PWSA's COA, specifically paragraphs 15.c.i, 15.c.ii, and 15.d, which state that PWSA shall work with ALCOSAN with the goal of:

15.c

i. Establishing with ALCOSAN the quantity and rate of sewage flow from the municipality that ALCOSAN will be able to retain, store, convey and treat upon implementation of a Wet Weather Plan and/or LTCP; and

ii. Developing a feasibility study with an alternatives analysis evaluating the Municipality's options to construct sewage facilities necessary to retain, store, convey and treat sewage flows from the Municipality including, but not limited to, any sewage flows that: (A) ALCOSAN cannot accommodate, or (B) ALCOSAN could accommodate, but which the Municipality decides to address in a separate manner ("Feasibility Study").

15.d

> The Municipality shall submit to ACHD the Feasibility Study within six (6) months after ALCOSAN submits a Wet Weather Plan and/or LTCP to EPA and/or DEP as required by the Enforcement Order. The Feasibility Study shall evaluate a range of alternatives, including but not limited to, alternatives to eliminate SSOs, and shall estimate the cost and time necessary to implement or construct each alternative.

A convey all flows alternative was thus developed to incorporate the transport of all PWSA overflow volumes to the nearest ALCOSAN interceptor system.

Many of the PWSA overflows originate from ALCOSAN-owned diversion structures. Thus, the overflow volumes have already been conveyed to the ALCOSAN regulator, and the Convey All Flows alternative does not need to include conveyance structures for those overflows. However, PWSA has numerous overflow locations that originate from PWSA-owned regulators that are not directly connected to the ALCOSAN system. The Convey All Flows alternative includes appropriately sized consolidation sewers to collect and convey those overflow volumes to the nearest ALCOSAN interceptor.

7.4.6 Design Criteria

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis*, April 2007. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), and set tank side water depths (feet). The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process. Design criteria developed for ancillary technologies such as pump stations, odor control facilities, tank flushing systems etc. were also included in the technical memorandum mentioned above.

CSO flow rates and volumes used to size the alternatives were determined from the results of the calibrated H&H Model, under future baseline conditions.

As noted earlier, the control alternative development processes followed by ALCOSAN were similar to those followed by the PWSA. One exception to this was the fact that a number of ALCOSAN's permitted overflows discharge to sensitive areas (as defined in the ALCOSAN Consent Decree), and are therefore subject to higher levels of control. To guard against the future possibility that the PWSA may be required to treat overflows to sensitive areas to a higher level of control, the PWSA analyzed their system to determine if PWSA-owned diversion structures discharged into those sensitive areas. It was found that, during the typical year, no overflows from PWSA-owned structures discharge to sensitive areas.

7.5 CONTROL ALTERNATIVE EVALUATION

As detailed in the *PWSA Feasibility Study Report* (October 2008), an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. The outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are thus still valid, but many have since been superseded by the Convey All Flows alternative.

The PWSA alternative evaluation process utilized 13 economic, environmental, implementation, and operational evaluation criteria to objectively assign scores to each alternative. PWSA also developed and applied "scaling" and "weighting" factors to each criterion to tailor the evaluation to PWSA needs. Scaling factors were used to represent the PWSA-specific measure of the benefit of each criterion, while weighting factors were used to represent the relative importance of each criterion amongst the overall group of criteria. For each outfall/region/subsystem/level of control, the evaluation process consisted of:

- Estimating costs of each alternative.
- Developing evaluation criteria.
- Determining the alternative's "Objective Scores" relative to each evaluation criteria.
- Developing and applying "scaling" and "weighting" factors.
- Ranking each alternative.

This process was repeated for each level of control under which the alternative was to be considered for use. Each of these process steps is summarized in the subsections below.

7.5.1 Cost Estimating Procedures

PWSA Feasibility Study Report (October 2008). Methods to estimate costs for individual CSO control technologies as well as complete control alternatives were developed specifically for use in this report. These methods were detailed in a technical memorandum entitled *Basis of Cost for CSO Control Technologies*, August, 2007. This section presents a summary of the methods used by the PWSA to estimate three primary cost elements: 1) capital costs, 2) annual O & M costs, and 3) present worth costs. These estimates were intended to provide planning level costs for control alternatives, and had an expected accuracy of +50% to -30%.

Capital Costs. For the purposes of the *PWSA Feasibility Study Report* (October 2008), capital costs were defined as the combination of construction costs, site restoration costs, land costs, and non-construction costs associated with construction permitting, engineering design, legal requirements, bonds, insurance, and contingencies.

Planning level opinions of probable capital costs for CSO control alternative components were based on information contained in historical project data from various municipal entities across the country. The data was used in the following order of precedence: 1) costs of completed CSO control projects; 2) costs from contractor bids or engineer's estimates obtained from projects that included similar control technologies and, if historical project data were not available; and 3) published cost curves applicable to the technology.

Capital costs were adjusted to the January 2007 ENR Cost Index to standardize the analysis. Cost data were assembled in order to estimate capital costs for the following items:

- Regulator optimization, including drop shafts and land acquisition.
- Sewer separation, including new/modified regulators and land acquisition.
- Tunnel storage, including pump stations, force mains, consolidation sewers, odor control and screening facilities, new/modified regulators, land acquisition, and costs of additional treatment capacity needed to treat the stored volume.
- Surface and sub-surface storage tanks, including pump stations, force mains, consolidation sewers, odor control and screening facilities, new/modified regulators and/or drop shafts, land acquisition, and costs of additional treatment capacity needed to treat the stored volume.
- Vortex separation, including pump stations, force mains, consolidation sewers, odor control and screening facilities, disinfection, new/modified

regulators and/or drop shafts, land acquisition, and costs of additional treatment capacity needed to treat the stored volume.

- CSO treatment facilities (sedimentation basins), including pump stations, force mains, consolidation sewers, odor control and screening facilities, disinfection, new/modified regulators and/or drop shafts, land acquisition, and costs of additional treatment capacity needed to treat the stored volume.
- High rate end of pipe treatment (ballasted floc), including pump stations, force mains, consolidation sewers, odor control and screening facilities, disinfection, new/modified regulators and/or drop shafts, and land acquisition.
- Screening and disinfection, including pump stations, force mains, consolidation sewers, odor control and screening facilities, disinfection, new/modified regulators and/or drop shafts, and land acquisition.

For additional detail on the components of each of these items, including assumptions made while estimating the costs, refer to the technical memorandum noted above.

Operations & Maintenance Costs. Annual O&M costs were defined as the expenses related to labor, maintenance supplies, replacement equipment and consumable materials in a given year. The calculated O&M costs for CSO control alternatives were adapted to account for periodic operations such as facility inspections and clean-ups after storm events, but also included minimal full-time staffing between events. O&M costs were typically functions of the design flow rate (in MGD) and the duration (in hours per year) that the facility was in operation.

Planning level opinions of probable O&M costs of CSO control alternatives were based on actual facility operating expenses, when available, for similar control alternatives. All costs included expenses for labor, maintenance, repairs, consumable materials, and ancillary expenses, and were adjusted to the January 2007 ENR Cost Index to standardize the analysis.

Net Present Worth Costs. Net present worth (NPW) is defined as the sum of the present worth (PW) values of current and future incomes and salvage values, less the present worth values of current and future expenses at a given time. Calculating the present worth takes into account the time-value of money by applying the following economic factors:

- Planning Interest Rate, an interest rate of 6.625 was used, which was the PaDEP interest rate calculated for fiscal year 2007.
- Economic Life of Capital Expenditures, the assigned service life for each component was based on EPA cost-effectiveness guidelines. They ranged in length from 20 years for mechanical/electrical/I&C equipment, to 70 years for conveyance piping.

For the purposes of this analysis, income from CSO control assets was assumed to be zero, as were the salvage values of those assets at the end of their useful lives. Hence, the NPW calculation was reduced to summing the present worth values of current-day capital costs and future O&M expenditures for each alternative.

Comparison of NPW between alternatives allowed for consistent economic comparisons to be made, with the alternative having the lowest NPW being the most "economic" alternative over its life span. Further discussion of the NPW analysis may be found in the *Basis of Cost for CSO Control Technologies*, August 2007.

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by PWSA in the *PWSA Feasibility Study Report* (October 2008). It should be noted that PWSA had contributed cost data to ALCOSAN for use in the development of the ACT tool.

A detailed discussion of the ACT may be found in the ALCOSAN WWP, a summary of which is provided below.

To support their WWP efforts and to encourage the use of a standardized approach by their tributary municipalities (including PWSA) across the service area, ALCOSAN developed an Alternatives Costing Tool (ACT). The ACT was used to estimate planning level costs for CSO/SSO control alternatives with an expected accuracy of +50% to -30%.

Construction cost estimating data and approaches included in Version 2.0 of the ACT were provided by ALCOSAN, PWSA, Philadelphia Water Department, and ALCOSAN's wet weather planning team members. In addition, cost curves developed from national CSO control programs, as well as the United States Environmental Protection Agency (USEPA), industry organization reports such as

WEFTEC, and cost data provided by other municipal agencies were used. These curves were developed based on actual construction cost data, local adjustment factors, and other engineering judgment decisions.

In addition to estimating capital costs for potential alternatives, the ACT accounts for annual operation and maintenance (O&M) costs, periodic renewal/replacement costs, present worth life-cycle calculations, and other "non-construction" costs such as land acquisition, engineering, legal, and administration. Key outputs from the ACT include current year capital cost, current year O&M costs, current year renewal/replacement costs, present worth based on capital costs and projected O&M and renewal/ replacement costs, future years' O&M costs based on assumed inflation, and total capital costs.

Control alternative information such as facility size, type, and configuration could be entered into the costing tool through standardized templates. Key costing assumptions were as follows:

- Costs were based on 2009 dollars using the December, 2009 ENR CCI index value of 8641, and the 2009 RS Means Location Factor of 99.6 for Pittsburgh.
- O&M and renewal/replacement costs were based on 2027 as the first year of operation and 2046 as the final year of the planning period.
- A default discount rate of 6 percent was used.

Soon after Version 2.0 was issued, the 3RWW Feasibility Study Working Group (FSWG) created a municipal cost subcommittee to review and provide comment on the ACT. Several municipal engineers worked cooperatively with ALCOSAN to develop a set of review comments and recommendations, which were incorporated into Version 2.1 of the ACT.

The most noteworthy revisions made to Version 2.1 were: 1) a new costing module was added for open cut conveyance pipe applications based upon local cost data from the municipalities and the PWSA; and 2) two additional cured-in-place pipe (CIPP) unit cost options were added under the Municipal I/I reduction costing module to reflect data submitted for PWSA and municipal installations.

Version 2.1 was subsequently issued to the FSWG and to ALCOSAN's customer municipalities for their use. PWSA chose to utilize Version 2.1 of the ACT to estimate costs reported in the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Wet Weather Feasibility Study (2013). PWSA again chose to utilize Version 2.1 of the ACT to estimate the costs included in this Wet Weather Feasibility Study report.

7.5.2 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation, and operational criteria were specifically developed for use in assigning "Objective Scores" to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report* (October 2008), and are summarized below under the four main criteria categories:

Economic Impact. The economic impact of each control alternative was measured by calculating the following parameters:

- Annual O&M Cost
- Present Worth Cost

Environmental Impact. The environmental impact of CSO technologies was measured by evaluating the following parameters:

- Pollution Reduction. For each CSO control alternative under consideration, pollutant removal efficiencies and maximum possible removals by pollutant type were considered.
- Impact on Habitat, Stream, River, etc. CSO control alternatives were also screened based on permanent operating impacts to the environment.

Implementation Impact. The implementation impact of CSO control alternatives was measured by evaluating the following parameters:

- Constructability parameters consisted of the level of design and construction sophistication of the CSO control technology.
- Permanent Land Requirement parameters were based on the availability of land and the site requirements, i.e. the relative land area required.
- Public Acceptance parameters consisted of the relative levels of probable public acceptance based on known or expected responses from community, neighborhood and business groups.

- Institutional Constraint parameters related to which agency or agencies would own and/or operate the CSO control and what interagency agreements would be required to implement the technology.
- Siting Restriction parameters involved the feasibility of the CSO technology being accepted for use as a control measure within the PWSA area, to include regulatory agency permitting and the extent of construction permitting.

Operational Impact. The operational impact of CSO control alternatives was evaluated by reviewing the following parameters:

- Operating Complexity parameters considered the relative O&M complexity of the control alternative, including safety and accessibility for operators and maintenance crews.
- Flexibility parameters considered the control alternative in terms of its future expansion and/or retrofit capability.
- Reliability parameters involved the CSO control alternative's relative reliability, including its historical track record, known maintenance problems, and reported design shortcomings.
- Compatibility with other PWSA Facilities and Operations parameters included PWSA's familiarity with similar facilities and if PWSA currently owned and/or operated similar facilities.

7.5.3 Objective Scoring

Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table 7-2.

TABLE 7-2. OBJECTIVE SCORING FOR POLLUTION REDUCTION PARAMETER

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria, etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

7.5.4 Scaling and Weighting Factors

Scaling factors, defined as the PWSA-specific measure of the benefit of each criterion, were determined for each criterion by utilizing utility curves that represented the PWSA-specific measure of the benefit of each criterion. These curves depicted the numeric relationships between the "Objective Score" and the "Subjective Score," and were defined by a series of clear-cut metrics. Additional details regarding the development of scaling factors and utility curves may be found in the *Evaluation of CSO Control Alternatives DRAFT Technical Memorandum*, March 20, 2007.

The scaling factors described above established relative measures for each criterion with which to rate competing CSO control alternatives. However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted."

Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop. During the workshop, the objective scores, metrics, subjective scores, and utility curves for each criterion were presented and confirmed, and weighting factors for each of the 13 criteria were determined. The results of the workshop are presented in Table 7-3. A more detailed explanation of the method used to determine the weighting factors may be found in the *Evaluation of CSO Control Alternatives DRAFT Technical Memorandum*, March 20, 2007.

TABLE 7-3. PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River, etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors.

7.5.5 Alternative Ranking

Following the determination of weighted subjective scores for each CSO control alternative at each level of control, all 13 weighted subjective scores (one for each criteria) were summed. The resulting score, ranging from 0.0 to 1.0, was termed the "Alternative Score." The CSO control alternative with the highest alternative score was deemed the "highest ranked alternative" for a given outfall/region/subsystem and control level.

The results of these rankings were summarized using bar graphs on Alternative Scoring Sheets. As an example, the Alternative Scoring Sheet for the outfall specific alternatives for outfall 048RA22 (serving the 32nd Street sewershed), at a control level of two untreated overflows per year, is presented in Figure 7-2.

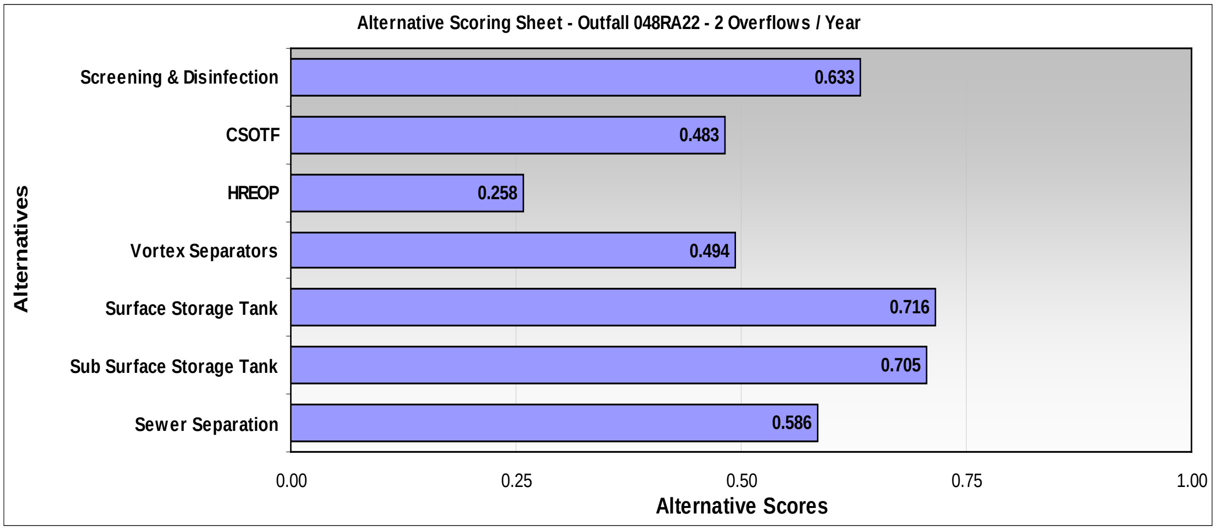


FIGURE 7-2. EXAMPLE OF ALTERNATIVE RANKING BAR GRAPHS

Similar alternative scoring sheets were generated for regional and subsystem alternatives. Complete sets of alternative scoring sheets for outfall-specific, regional, and subsystem analyses may be found in the *PWSA Feasibility Study Report* (October 2008), Appendices D, E and F, respectively.

7.5.6 Coordination with the ALCOSAN WWP

The objective of the *PWSA Feasibility Study Report* (October 2008) was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the applicable environmental requirements. Those processes and analyses presented in that report still apply, and form the foundation upon which this Wet Weather Feasibility Study is based.

It was also noted that the conclusions of the October 2008 report were limited to a level of control of 4 OF/year. In addition, the intent of the *PWSA Feasibility Study Report* (October 2008) was for PWSA to work with ALCOSAN in an effort to mutually develop the best regional plan as ALCOSAN's work proceeded.

To fulfill that intent, minimize potential duplications of effort and to expedite completion of this Feasibility Study, PWSA have identified the use of the existing collection system for all POCs within the PWSA service area for which it could be shown that PWSA's existing collection system could adequately convey all typical year flows to the nearest ALCOSAN interceptor. Any overflow controls required at, or downstream of, the POC would become the responsibility of ALCOSAN. The POCs for which the existing collection system is adequate and no additional controls are recommended are identified with "Convey All Flow" as the recommended alternative (see Table 7-5).

There are 14 POC sewersheds for which it could not be shown that PWSA's existing collection system could adequately convey all typical year flows to the nearest ALCOSAN interceptor, and PWSA must provide control alternatives for them. A list of those 14 POCs is included in Table 7-4. Each of these POCs and their associated improvements are described in their respective POC reports, which are included as Appendix A to this Wet Weather Feasibility Study.

TABLE 7-4. POC SEWERSHEDS REQUIRING PWSA CONTROL ALTERNATIVES

POC Sewershed	Common Name	Receiving Water	ALCOSAN Planning Basin
M-34	Becks Run	Monongahela River	Upper Monongahela
M-47	Nine Mile Run	Monongahela River	
M-42	Streets Run	Monongahela River	
C-25	Bells Run	Chartiers Creek	Chartiers Creek
MH-18	Little Saw Mill Run	Saw Mill Run	Saw Mill Run
MH-11	McCartney Run	Saw Mill Run	
S-15	McDonoughs Run	Saw Mill Run	
S-23	Brook Street	Saw Mill Run	
MH-77	Brookline Blvd.	Saw Mill Run	
MH-80	Englert Street	Saw Mill Run	
MH-55	Timberland Street	Saw Mill Run	
MH-89	Weymans Run	Saw Mill Run	
SMRE-40	Plummers Run	Saw Mill Run	
A-42	Negley Run	Allegheny River	Upper Allegheny
A-51	East Street Valley	Allegheny River	Main Rivers

The development and evaluation of the PWSA's control alternatives has been closely coordinated with that of ALCOSAN. Though the two processes were completed independently, similar control technologies and alternatives were developed, similar evaluation processes were implemented, and coordinated H&H models were utilized. As illustrated in Figure 7-3, ALCOSAN's basin planners developed and evaluated control alternatives in a stepwise process that was very similar to the process followed by the PWSA. These similarities ultimately led each party to independently recommend control alternatives that were highly compatible with each other.

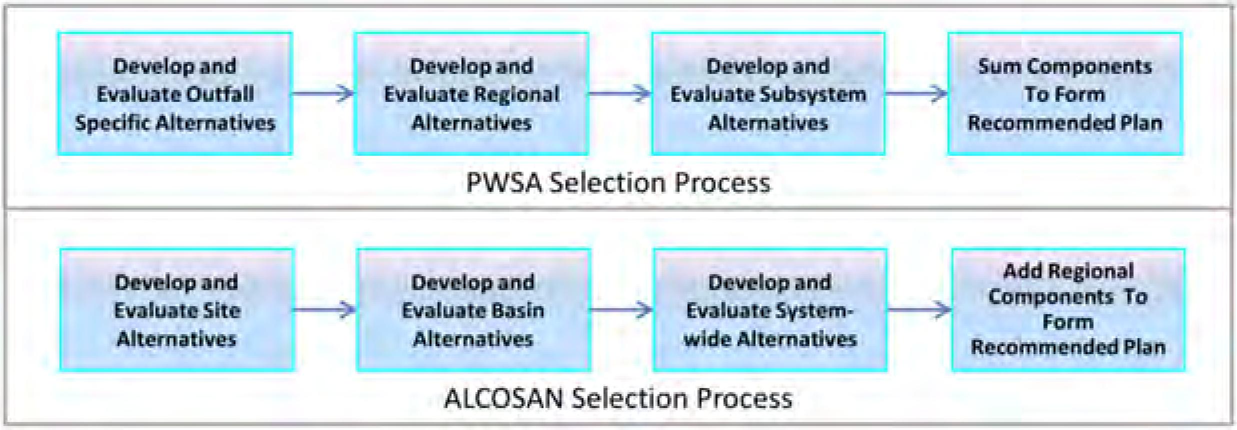


FIGURE 7-3. PWSA AND ALCOSAN CONTROL ALTERNATIVE SELECTION PROCESS

Details of the ALCOSAN alternatives analysis process, including the criteria used to screen technologies and to evaluate control alternatives, may be found in Section 9 of the *ALCOSAN Wet Weather Plan*.

7.6 ALTERNATIVE EVALUATION RESULTS

The control alternatives recommended for each POC sewershed within the PWSA service area are listed in Table 7-5. Also included in the table are the corresponding control alternatives recommended by ALCOSAN for a level of control equal to 4-6 overflows per year. As can be seen, the control alternatives recommended by both ALCOSAN and PWSA for each of the POC sewersheds are compatible. The "Selected Plan" and "Recommended Plan" from the ALCOSAN WWP are briefly described in Sections 12 and 13 of this Wet Weather Feasibility Study.

TABLE 7-5. ALTERNATIVE EVALUATION RESULTS

POC Sewershed	PWSA Recommended Alternative	ALCOSAN Alternative (Selected Plan)[1]	ALCOSAN Alternative (Recommended Plan)[2]
A-01	Convey all flows	Existing Interceptor	Existing Interceptor
A-02	Convey all flows	Existing Interceptor	Existing Interceptor
A-03	Convey all flows	Existing Interceptor	Existing Interceptor
A-04	Convey all flows	Existing Interceptor	Existing Interceptor
A-04A	Convey all flows	Existing Interceptor	Existing Interceptor
A-05	Convey all flows	Existing Interceptor	Existing Interceptor
A-06	Convey all flows	Existing Interceptor	Existing Interceptor
A-07	Convey all flows	Existing Interceptor	Existing Interceptor
A-08	Convey all flows	Existing Interceptor	Existing Interceptor
A-09	Convey all flows	Existing Interceptor	Existing Interceptor
A-10	Convey all flows	Existing Interceptor	Existing Interceptor
A-11	Convey all flows	Existing Interceptor	Existing Interceptor
A-12	Convey all flows	Existing Interceptor	Existing Interceptor
A-13	Convey all flows	Existing Interceptor	Existing Interceptor
A-13A	Convey all flows	Existing Interceptor	Existing Interceptor
A-14	Convey all flows	Existing Interceptor	Existing Interceptor
A-14A	Convey all flows	Existing Interceptor	Existing Interceptor
A-15	Convey all flows	Existing Interceptor	Existing Interceptor
A-16	Convey all flows	Existing Interceptor	Existing Interceptor
A-17	Convey all flows	Existing Interceptor	Existing Interceptor
A-17A	Convey all flows	Existing Interceptor	Existing Interceptor
A-17B	Convey all flows	Existing Interceptor	Existing Interceptor
A-18	Convey all flows	Existing Interceptor	Existing Interceptor
A-18A	Convey all flows	Existing Interceptor	Existing Interceptor
A-18B	Convey all flows	Existing Interceptor	Existing Interceptor
A-19	Convey all flows	Existing Interceptor	Existing Interceptor
A-19A	Convey all flows	Existing Interceptor	Existing Interceptor
A-19B	Convey all flows	Existing Interceptor	Existing Interceptor
A-20	Convey all flows	Existing Interceptor	Existing Interceptor
A-21	Convey all flows	Existing Interceptor	Existing Interceptor
A-22	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-23	Convey all flows	Existing Interceptor	Existing Interceptor
A-25	Convey all flows	Existing Interceptor	Existing Interceptor
A-26	Convey all flows	Existing Interceptor	Existing Interceptor
A-27	Convey all flows	Existing Interceptor	Existing Interceptor
A-27A	Convey all flows	Existing Interceptor	Existing Interceptor
A-28	Convey all flows	Existing Interceptor	Existing Interceptor

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[1] Based on review of the selected plan in the ALCOSAN draft WWP submitted January 2012

[2] Based on review of the selected plan in the ALCOSAN draft WWP submitted January 2012

TABLE 7-5. ALTERNATIVE EVALUATION RESULTS

POC Sewershed	PWSA Recommended Alternative	ALCOSAN Alternative (Selected Plan)[1]	ALCOSAN Alternative (Recommended Plan)[2]
A-29	Convey all flows	New Regional Tunnel	Existing Interceptor
A-29A	Convey all flows	New Regional Tunnel	Existing Interceptor
A-30	Convey all flows	Existing Interceptor	Existing Interceptor
A-31	Convey all flows	Existing Interceptor	Existing Interceptor
A-32	Convey all flows	Existing Interceptor	Existing Interceptor
A-33	Convey all flows	Existing Interceptor	Existing Interceptor
A-34	Convey all flows	Existing Interceptor	Existing Interceptor
A-35	Convey all flows	Existing Interceptor	Existing Interceptor
A-36	Convey all flows	Existing Interceptor	Existing Interceptor
A-37	Convey all flows	Existing Interceptor	Existing Interceptor
A-37A	Convey all flows	Existing Interceptor	Existing Interceptor
A-38	Convey all flows	Existing Interceptor	Existing Interceptor
A-40	Convey all flows	Existing Interceptor	Existing Interceptor
A-41	Convey all flows	New Regional Tunnel	Existing Interceptor
A-42[3]	• Storage facility w/ screening and pump station • Conveyance piping	New Regional Tunnel	Existing Interceptor
A-47	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-48	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-49	Convey all flows	Existing Interceptor	Existing Interceptor
A-50	Convey all flows	Existing Interceptor	Existing Interceptor
A-51[4]	• Relocate diversion structure • Screen diversion structure • Conveyance piping • Sewer separation	Existing Interceptor	Existing Interceptor
A-56	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-58	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-59	Convey all flows	Existing Interceptor	Existing Interceptor
A-59A	Convey all flows	Existing Interceptor	Existing Interceptor
A-60	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-61	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-62	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-64	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-65	Convey all flows	New Regional Tunnel	New Regional Tunnel
A-66	Flows to be conveyed to A-65; A-66 to be eliminated via Rt. 28 widening project.		

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[3] Refer to POC A-42: Negley Run Feasibility Study Report in Appendix A for additional details

[4] Refer to POC A-51: East Street Feasibility Study Report in Appendix A for additional details.

TABLE 7-5. ALTERNATIVE EVALUATION RESULTS

POC Sewershed	PWSA Recommended Alternative	ALCOSAN Alternative (Selected Plan)[1]	ALCOSAN Alternative (Recommended Plan)[2]
C-02	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-03	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-05	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-05A	Convey all flows	New Relief Interceptor	Existing Interceptor
C-07	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-11	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-12	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-13A	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-14	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-15	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-19	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-24	Convey all flows	New Relief Interceptor to Storage Tank	New Relief Interceptor to RTB
C-25[5]	• Replace diversion structures and add screens for 9 diversion structures • Conveyance piping	New Relief Interceptor to Storage Tank	New Relief Interceptor to RTB
C-26A	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-27	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-28	Convey all flows	New Relief Interceptor	New Relief Interceptor
C-29	Convey all flows	New Relief Interceptor	New Relief Interceptor
M-01	Convey all flows	Existing Interceptor	Existing Interceptor
M-02	Convey all flows	Existing Interceptor	Existing Interceptor
M-03	Convey all flows	Existing Interceptor	Existing Interceptor
M-03A	Convey all flows	Existing Interceptor	Existing Interceptor
M-04	Convey all flows	Existing Interceptor	Existing Interceptor
M-05	Convey all flows	Existing Interceptor	Existing Interceptor
M-06	Convey all flows	Existing Interceptor	Existing Interceptor
M-07	Convey all flows	Existing Interceptor	Existing Interceptor
M-08	Convey all flows	Existing Interceptor	Existing Interceptor
M-10	Convey all flows	Existing Interceptor	Existing Interceptor
M-11	Convey all flows	Existing Interceptor	Existing Interceptor
M-11A	Convey all flows	Existing Interceptor	Existing Interceptor
M-12	Convey all flows	Existing Interceptor	Existing Interceptor
M-13	Convey all flows	Existing Interceptor	Existing Interceptor
M-14	Convey all flows	Existing Interceptor	Existing Interceptor
M-14A	Convey all flows	Existing Interceptor	Existing Interceptor

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[5] Refer to POC C-25: Bells Run Feasibility Study Report in Appendix A for additional details.

TABLE 7-5. ALTERNATIVE EVALUATION RESULTS

POC Sewershed	PWSA Recommended Alternative	ALCOSAN Alternative (Selected Plan)[1]	ALCOSAN Alternative (Recommended Plan)[2]
M-15	Convey all flows	New Regional Tunnel	Existing Interceptor
M-16	Convey all flows	New Regional Tunnel	Existing Interceptor
M-17	Convey all flows	New Regional Tunnel	Existing Interceptor
M-18	Convey all flows	New Regional Tunnel	Existing Interceptor
M-19	Convey all flows	New Regional Tunnel	New Regional Tunnel
M-19A	Convey all flows	Existing Interceptor	Existing Interceptor
M-19B	Convey all flows	New Regional Tunnel	New Regional Tunnel
M-20	Convey all flows	New Regional Tunnel	New Regional Tunnel
M-21	Convey all flows	New Regional Tunnel	New Regional Tunnel
M-22	Convey all flows	New Regional Tunnel	New Regional Tunnel
M-23	Convey all flows	Existing Interceptor	Existing Interceptor
M-24	Convey all flows	Existing Interceptor	Existing Interceptor
M-26	Convey all flows	Existing Interceptor	Existing Interceptor
M-27	Convey all flows	Existing Interceptor	Existing Interceptor
M-28	Convey all flows	Existing Interceptor	Existing Interceptor
M-29	Convey all flows	New Regional Tunnel	New Regional Tunnel
M-31	Convey all flows	Existing Interceptor	Existing Interceptor
M-31A	Convey all flows	Existing Interceptor	Existing Interceptor
M-32	Convey all flows	Existing Interceptor	Existing Interceptor
M-33	Convey all flows	Existing Interceptor	Existing Interceptor
M-34[6]	• Close diversion structure • Replace 1 diversion structure and add screening (2 locations)	Existing Interceptor	Existing Interceptor
M-35	Convey all flows	Existing Interceptor	Existing Interceptor
M-36	Convey all flows	Existing Interceptor	Existing Interceptor
M-37	Convey all flows	Existing Interceptor	Existing Interceptor
M-38	Convey all flows	Existing Interceptor	Existing Interceptor
M-39	Convey all flows	Existing Interceptor	Existing Interceptor
M-40	Convey all flows	Existing Interceptor	Existing Interceptor
M-42[7]	• Replace and add screens for 3 diversion structures • Conveyance Piping	New Regional Tunnel	Outfall Relocation
M-44	Convey all flows	New Regional Tunnel	Outfall Relocation

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[6] Refer to POC M-34: Becks Run Feasibility Study Report in Appendix A for additional details.
[7] Refer to POC M-42: Streets Run Feasibility Study Report in Appendix A for additional details.

TABLE 7-5. ALTERNATIVE EVALUATION RESULTS

POC Sewershed	PWSA Recommended Alternative	ALCOSAN Alternative (Selected Plan)[1]	ALCOSAN Alternative (Recommended Plan)[2]
M-47[8]	• Upstream improvements • New diversion structure • Screens at 2 diversion structures • Conveyance piping	New Regional Tunnel	Existing Interceptor
MH-11[9]	• Close diversion structure • Replace 4 diversion structures • Add screens 5 diversion structures • Conveyance piping	Existing Interceptor	Existing Interceptor
MH-18[10]	• Replace and add screens for 10 diversion structures • Conveyance piping	Existing Interceptor	Existing Interceptor
MH-55[11]	• Sewer Separation	Existing Interceptor	Existing Interceptor
MH-77[12]	• Replace and add screens for 5 diversion structures • Conveyance piping	Existing Interceptor	Existing Interceptor
MH-80[13]	• Add outfall screen	Existing Interceptor	Existing Interceptor
MH-89	• Replace 2 diversion structures • Add screens 3 diversion structures	Existing Interceptor	Existing Interceptor
O-08	Convey all flows	New Relief Interceptor	New Relief Interceptor
O-09	Convey all flows	New Relief Interceptor	New Relief Interceptor
O-10	Convey all flows	New Relief Interceptor	New Relief Interceptor
O-11	Convey all flows	New Relief Interceptor	New Relief Interceptor
O-13	Convey all flows	New Relief Interceptor	New Relief Interceptor
O-14	Convey all flows	Existing Interceptor	Existing Interceptor
O-14A	Convey all flows	Existing Interceptor	Existing Interceptor
O-14B	Convey all flows	Existing Interceptor	Existing Interceptor
O-25	Convey all flows	New Regional Tunnel	Existing Interceptor
O-26	Convey all flows	Existing Interceptor	Existing Interceptor

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[8] Refer to POC M-47: Nine Mile Run Feasibility Study Report in Appendix A for additional details.
[9] Refer to POC MH-11: McCartney Run Feasibility Study Report in Appendix A for additional details.
[10] Refer to POC MH-18: Little Saw Mill Run Feasibility Study Report in Appendix A for additional details.
[11] Refer to POC MH-55: Timberland Street Feasibility Study Report in Appendix A for additional details.
[12] Refer to POC MH-77: Brookline Boulevard Feasibility Study Report in Appendix A for additional details.
[13] Refer to POC MH-80: Englert Street Feasibility Study Report in Appendix A for additional details.

TABLE 7-5. ALTERNATIVE EVALUATION RESULTS

POC Sewershed	PWSA Recommended Alternative	ALCOSAN Alternative (Selected Plan)[1]	ALCOSAN Alternative (Recommended Plan)[2]
O-26A	Convey all flows	Existing Interceptor	Existing Interceptor
O-27	Convey all flows	New Regional Tunnel	New Regional Tunnel
O-29	Convey all flows	Existing Interceptor	Existing Interceptor
O-30	Convey all flows	Existing Interceptor	Existing Interceptor
O-31	Convey all flows	Existing Interceptor	Existing Interceptor
O-32	Convey all flows	Existing Interceptor	Existing Interceptor
O-33	Convey all flows	Existing Interceptor	Existing Interceptor
O-34	Convey all flows	Existing Interceptor	Existing Interceptor
O-35	Convey all flows	Existing Interceptor	Existing Interceptor
O-36	Convey all flows	Existing Interceptor	Existing Interceptor
O-37	Convey all flows	Existing Interceptor	Existing Interceptor
O-38	Convey all flows	Existing Interceptor	Existing Interceptor
O-39	Convey all flows	New Regional Tunnel	New Regional Tunnel
O-40	Convey all flows	New Regional Tunnel	New Regional Tunnel
O-41	Convey all flows	New Regional Tunnel	New Regional Tunnel
O-43	Convey all flows	New Regional Tunnel	New Regional Tunnel
S-15[14]	• Replace and add screens for 7 diversion structures • Conveyance piping	Existing Interceptor	Existing Interceptor
S-18	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-23[15]	• Replace and add screen for diversion structure • Conveyance piping	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-24	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-28	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-29	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-2A	Convey all flows	Existing Interceptor	Existing Interceptor
S-30	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-31	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-32	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-33	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-34	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-35	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-36	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-37 / S-38	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-39	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel

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[14] Refer to POC S-15: McNeilly/McDonough's Run Feasibility Study Report in Appendix A for more details.
[15] Refer to POC S-23: Brook Street Feasibility Study Report in Appendix A for additional details.

TABLE 7-5. ALTERNATIVE EVALUATION RESULTS

POC Sewershed	PWSA Recommended Alternative	ALCOSAN Alternative (Selected Plan)[1]	ALCOSAN Alternative (Recommended Plan)[2]
S-40	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-41	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-42	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-42A	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
S-46	Convey all flows	Storage/ Conveyance Tunnel	Storage/ Conveyance Tunnel
SMRE-40[16]	• Close 4 diversion structures • Replace 5 diversion structures and add screens to 6 diversion structures • Conveyance piping • Upstream sewer separation	Existing Interceptor	Existing Interceptor

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[16] Refer to POC SMRE-40: Plummer’s Run Feasibility Study Report in Appendix A for additional details

Section 8 Recommended Alternatives

This section presents details on the recommended capital improvements including the costs and the overflow volume reduction resulting from the improvements.

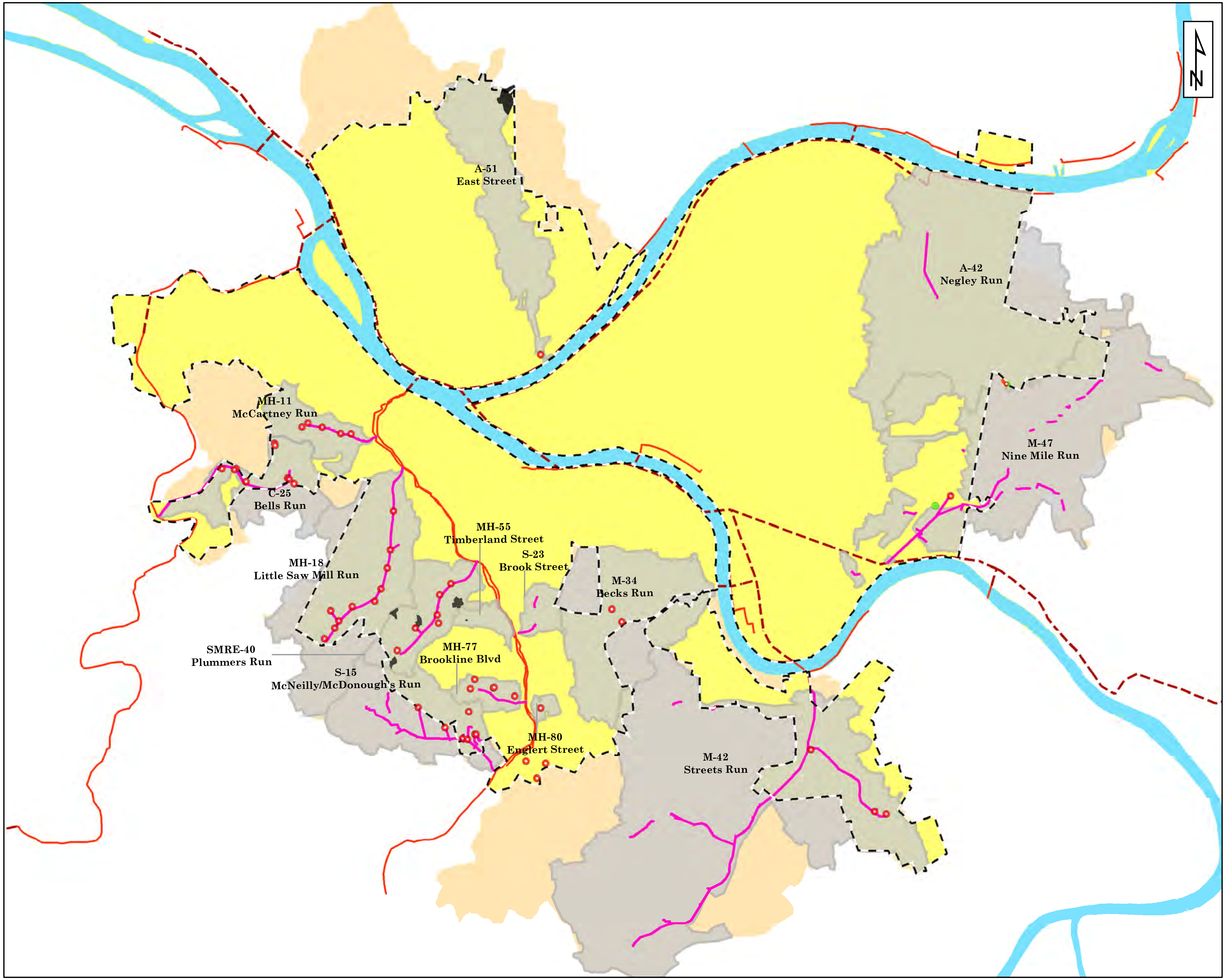
Most of the POC sewersheds within the PWSA service area contain existing systems that can adequately convey all typical year flows to the ALCOSAN interceptor. For these systems, the "convey all flow" alternative is recommended as was shown in Table 7-5. A total of 14 POC sewersheds had existing collection systems for which it could not be shown that they could adequately convey all typical year flows to the ALCOSAN interceptor. For these systems, PWSA must provide additional control. A list of those 14 POCs was included in Table 7-4, and the resulting recommended improvements for these 14 POC sewersheds are summarized in this section and further explained in the POC reports located in Appendix A of this Wet Weather Feasibility Study. Figure 8-1 is a summary map showing the proposed improvements in the 14 POC sewersheds. Maps of the proposed improvements, for each POC, can be found in Appendix C of the Wet Weather Feasibility Study.

The recommended alternatives summarized in this section were selected based on the screening and scoring process described in the Section 7 of this Wet Weather Feasibility Study. This process included the following steps: CSO control technologies screening, control alternative development, and control alternative evaluation based on cost and "non-cost" criteria. Table 7-5 lists the final PWSA recommended alternatives for each point of connection within the PWSA service area.

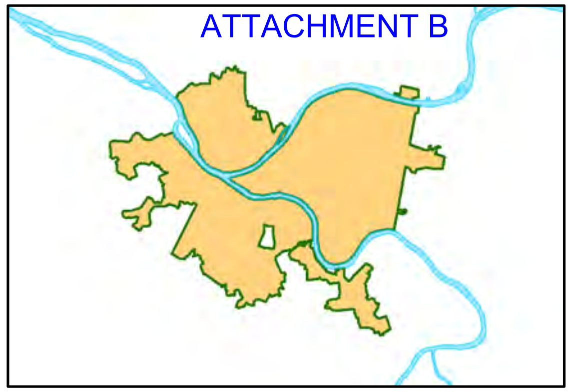
The information presented in the tables in this section was obtained from the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

8.1 RECOMMENDED ALTERNATIVES

The selected 14 POC-specific recommended control alternatives consist mainly of new or upsized conveyance, modified or new regulators, screens, and a storage tank. For each POC, the recommended alternative has been designated in a particular format, consisting of: POC sewershed the alternative addresses (for example, A-42), primary control technology (TNK for tank, C for conveyance), and selected level of control in untreated overflows/year (4 for 4 OF/year). The components of each recommended control alternative are summarized below.



ATTACHMENT B



PWSA Service Area Overview

Legend

- ○ PWSA Diversion Structure Modification
- ● PWSA Sewer Outfall
- — Relief/Consolidation Sewers
- 🟩 Pumping Station
- 🟧 6.15 MG Storage Tank
- ⬛ Sewer Separation
- ▨ Sewershed Boundary
- 🟨 PWSA Service Area Boundary
- 🟧 Extended PWSA Service Area Boundary
- 🟦 River

Existing ALCOSAN Interceptors

- - - - Deep Tunnel
- — Shallow Tunnel

6,000 3,000 0 6,000 Feet

Figure 8 - 1:
Recommended Alternatives

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\Figure 8-1 Recommended Alternatives.mxd

8.1.1 A-42: Negley Run (POC-A42-TNK-4)

The recommended alternative for the A-42 POC sewershed is a storage tank with screens and a pump station and relief sewer along the Negley Run Trunk Sewer. The alternative is designated POC-A42-TNK-4. There is no diversion structure modifications included in this alternative. Alternative POC-A42-TNK-4 location is illustrated in Figure A42-5-1 found in Appendix C of the Wet Weather Feasibility Study. The storage tank is assumed to be an underground tank drained by a pump station sized to drain the full volume of the tank in a 24-hour period. It is to be located in the public bus Park-n-Ride parking lot in Wilkinsburg. Overflows from it are to be drained into the Nine Mile Run watershed. Table 8-1 summarizes the key information about the alternative including the contributing municipalities, level of control, primary and secondary components, and costs. Details of the alternative are provided in the A-42 POC report in the Appendix.

TABLE 8-1. SUMMARY OF POC-A42-TNK-4

POC: A-42 (Negley Run)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh, Municipality of Penn Hills, and Wilkinsburg Borough				
LEVEL OF CONTROL: 4 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Storage tank (2.25 MGal tank and 2.25 MGD pump station)				
COMPONENT	**CAPACITY**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
Below-grade tank	2.25 MGal	$12.32	$12.32	$12.64
Pump station	2.25 MGD	$3.02	$3.02	$3.22
Screening	68 MGD	$0.45	$0.45	$0.46
Subtotal: Primary Component		**$15.79**	**$15.79**	**$16.32**
SUPPLEMENARY COMPONENT: Conveyance (4,000 LF new piping)				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
24-in (Open cut)	750	$0.75	$0.75	$0.77
72-in (Open cut)	3,250	$6.14	$6.14	$6.22
Subtotal: Supplementary Component		**$6.89**	**$6.89**	**$6.98**
TOTAL ALTERNATIVE COST		**$22.68**	**$22.68**	**$23.30**
ESTIMATED TOTAL COST TO PWSA		**$15.47**	**$15.47**	**$15.89**

8.1.2 A-51: East Street (POC-A51-C-4)

The main components of the recommended alternative for the A-51 POC sewershed to achieve 4 overflows per year are sewer separation tributary to DC163L001 and the replacement of the existing diversion structure in the PennDOT culvert. The alternative is designated POC-A51-C-4. The locations of the POC-A51-C-4 improvements are illustrated in Figure A51-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-2 summarizes the key components of the alternative including the contributing municipalities, level of control, primary and secondary components, and costs. Details on POC-A51-C-4 are provided in the A-51 POC report in the Appendix.

TABLE 8-2. SUMMARY OF POC-A51-C-4

POC: A-51 (East Street)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh, Ross Township, and Reserve Township				
LEVEL OF CONTROL: 4 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (3,267 LF new piping) / Sewer Separation				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
8-in (Open cut)	3,127	$2.88	$2.88	$2.96
12'x4' box culvert	140	$0.46	$0.46	$0.46
Subtotal: Primary Component		**$3.34**	**$3.34**	**$3.42**
SUPPLEMENTARY COMPONENT: New diversion chamber/screening (1 new structure)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
PADC024A001	Relocation/ Replacement	$1.35	$1.35	$1.36
	Screening	$0.90	$0.90	$0.90
Subtotal: Supplementary Component		**$2.25**	**$2.25**	**$2.26**
TOTAL ALTERNATIVE COST		**$5.59**	**$5.59**	**$5.68**
ESTIMATED TOTAL COST TO PWSA		**$5.59**	**$5.59**	**$5.68**

8.1.3 C-25: Bells Run (POC-C25-C-4)

The main components of the recommended alternative for the C-25 POC sewershed to achieve 4 overflows per year are the construction of new relief/consolidation sewer along the existing trunk sewers and other specific areas, diversion structure replacement, and outfall screen installation. The alternative is designated POC-C25-C-4. The locations of the POC-C25-C-4 improvements are illustrated in Figure C25-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-3 summarizes the key components of the alternative including the contributing municipalities, level of control, primary and secondary components, and costs. Details on POC-C25-C-4 are provided in the C-25 POC report in the Appendix.

TABLE 8-3. SUMMARY OF POC-C25-C-4

POC: C-25 (Bells Run)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh, Green Tree Borough, and Crafton Borough				
LEVEL OF CONTROL: 4 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (12,870 LF new piping)				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
12-in (Open cut)	83	$0.08	$0.08	$0.08
30-in (Open cut)	6,998	$4.71	$4.71	$4.87
36-in (Open cut)	5,789	$6.05	$6.05	$6.18
Subtotal: Primary Component		**$10.84**	**$10.84**	**$11.14**
SUPPLEMENTARY COMPONENT: New diversion chambers/screening (9 new structures)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC039E001 DC039J001 DC039L001 DC039M001 DC039M002 DC040R001 DC040R002 DC068H001 DC068H002	Replacement Screening	$3.24 $4.05	$3.24 $4.05	$3.28 $4.09
Subtotal: Supplementary Component		**$7.29**	**$7.29**	**$7.37**
TOTAL ALTERNATIVE COST		**$18.13**	**$18.13**	**$18.51**
ESTIMATED TOTAL COST TO PWSA		**$16.05**	**$16.05**	**$16.48**

8.1.4 M-34: Becks Run (POC-M34-C-4)

The main components of the recommended alternative for the M-34 POC sewershed to achieve 4 overflows per year are diversion structure replacement and outfall screen installation to screen overflows before discharge. The alternative is designated POC-M34-C-4. The locations of the POC-M34-C-4 improvements are illustrated in Figure M34-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-4 summarizes the key components of the alternative including the contributing municipalities, level of control, primary and secondary components, and costs. Details on POC-M34-C-4 are provided in the M-34 POC report in the Appendix.

TABLE 8-4. SUMMARY OF POC-M34-C-4

POC: M-34 (Becks Run)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh, Baldwin Borough, and Mount Oliver Borough				
LEVEL OF CONTROL: 4 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: New diversion chamber/screening (1 new structure)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC030N002	Replacement (1)	$0.36	$0.36	$0.36
DC032P001	Screening (2)	$0.90	$0.90	$0.91
Subtotal: Primary Component		**$1.26**	**$1.26**	**$1.27**
TOTAL ALTERNATIVE COST		**$1.26**	**$1.26**	**$1.27**
ESTIMATED TOTAL COST TO PWSA		**$1.26**	**$1.26**	**$1.27**

8.1.5 M-42: Streets Run (POC-M42-C-4)

The main components of the recommended alternative for the M-42 POC sewershed to achieve 4 overflows per year are the construction of new relief/consolidation sewer along the existing trunk sewers and other specific areas, diversion structure replacement, and outfall screen installation. The alternative is designated POC-M42-C-4. The alignments and locations of the POC-M42-C-4 improvements are illustrated in Figure M42-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-5 summarizes the key components of the alternative. Details on POC-M42-C-4, including its anticipated effectiveness at mitigating CSOs, are provided in the M-42 POC report in the Appendix.

TABLE 8-5. SUMMARY OF POC-M42-C-4

POC: M-42 (Streets Run)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh, Baldwin Borough, Brentwood Borough, Pleasant Hills Borough, West Mifflin Borough, and Whitehall Borough				
LEVEL OF CONTROL: 4 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (37,121 LF new piping)				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
12-in (Open cut)	12,936	$5.26	$5.26	$5.36
18-in (Open cut)	12,221	$3.34	$3.34	$3.37
30-in (Open cut)	7,220	$5.16	$5.16	$5.25
36-in (Open cut)	2,085	$2.58	$2.58	$2.63
48-in (Open cut)	2,659	$3.82	$3.82	$3.89
Subtotal: Primary Component		**$20.16**	**$20.16**	**$20.49**
SUPPLEMENTARY COMPONENT: New diversion chambers/screening (3 new structures)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC134A001 DC184E001 DC185H001	Replacement Screening	$1.08 $1.35	$1.08 $1.35	$1.09 $1.36
Subtotal: Supplementary Component		**$2.43**	**$2.43**	**$2.46**
TOTAL ALTERNATIVE COST		**$22.59**	**$22.59**	**$22.95**
ESTIMATED TOTAL COST TO PWSA		**$7.55**	**$7.55**	**$7.75**

8.1.6 M-47: Nine Mile Run (POC-M47-C-4)

The main components of the recommended alternative for the M-47 POC sewershed to achieve 4 overflows per year are the construction of parallel relief sewers, tunnels, and pipes upsized using pipe bursting techniques to convey flow to the ALCOSAN interceptor, diversion structure replacement, and outfall screen installation to screen overflows before discharge. The alternative is designated POC-M47-C-4. The alignments and locations of the POC-M47-C-4 improvements are illustrated in Figure M47-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-6 summarizes the key components of the alternative. Details on POC-M47-C-4, including its anticipated effectiveness at mitigating CSOs, are provided in the M-47 POC report in the Appendix.

8.1.7 MH-11: McCartney Run (POC-MH11-C-0)

The main components of the recommended alternative for the MH-18 POC sewershed to achieve 0 overflows per year are to construct parallel relief sewers to convey flow to the ALCOSAN interceptor, replacing diversion structures, and installing screens in outfalls to screen overflows before discharge. The alternative is designated POC-MH11-C-0. The alignments and locations of the POC-MH11-C-0 improvements are illustrated in Figure MH11-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-7 summarizes the key components of the alternative. Details on POC-MH11-C-0, including its anticipated effectiveness at mitigating CSOs, are provided in the MH-11 POC report in the Appendix.

TABLE 8-6. SUMMARY OF POC-M47-C-4

POC: M-47 (Nine Mile Run)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh, Braddock Hills Borough, Churchill Borough, Edgewood Borough, Municipality of Penn Hills, Swissvale Borough, and Wilkinsburg Borough				
LEVEL OF CONTROL: 4 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (24,924 LF new piping)				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
10-in (Open cut)	467	$0.15	$0.15	$0.16
12-in (Open cut)	410	$0.31	$0.31	$0.32
15-in (Open cut)	1,795	$1.35	$1.35	$1.40
18-in (Open cut)	747	$0.69	$0.69	$0.70
24-in (Open cut)	2,620	$2.19	$2.19	$2.25
30-in (Open cut)	455	$0.41	$0.41	$0.42
42-in (Open cut)	131	$0.23	$0.23	$0.24
42-in (Trenchless)	6,275	$9.14	$9.14	$9.29
48-in (Trenchless)	620	$1.05	$1.05	$1.07
54-in (Trenchless)	1,416	$3.18	$3.18	$3.22
66-in (Trenchless)	4,376	$9.36	$9.36	$9.46
12-in (Pipe burst)	659	$0.54	$0.54	$0.54
15-in (Pipe burst)	1,581	$1.14	$1.14	$1.14
18-in (Pipe burst)	1,893	$1.36	$1.36	$1.36
24-in (Pipe burst)	482	$0.35	$0.35	$0.35
30-in (Pipe burst)	997	$0.72	$0.72	$0.72
Subtotal: Primary Component		**$32.17**	**$32.17**	**$32.64**
SUPPLEMENTARY COMPONENT: New diversion chamber/screening (1 new structure)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
OF128R002	New Diversion Chamber Screening	$1.35 $0.45	$1.35 $0.45	$1.36 $0.46
Subtotal: Supplementary Component		**$1.80**	**$1.80**	**$1.81**
TOTAL ALTERNATIVE COST		**$33.97**	**$33.97**	**$34.45**
ESTIMATED TOTAL COST TO PWSA		**$18.38**	**$18.38**	**$18.88**

TABLE 8-7. SUMMARY OF POC-MH11-C-0

POC: MH-11 (McCartney Run)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh and Ingram Borough				
LEVEL OF CONTROL: 0 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (4,431 LF new piping)				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
12-in (Open cut)	232	$0.09	$0.09	$0.09
24-in (Open cut)	138	$0.07	$0.07	$0.07
30-in (Open cut)	3,043	$1.58	$1.58	$1.65
36-in (Open cut)	733	$0.47	$0.47	$0.48
42-in (Open cut)	285	$0.21	$0.21	$0.22
Subtotal: Primary Component		**$2.41**	**$2.41**	**$2.52**
SUPPLEMENTARY COMPONENT: New diversion chambers/screening (4 new structures)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC019J001 DC019K001 DC019L001 DC040M001 DC040M002	Replacement (4) Screening (5)	$1.44 $2.25	$1.44 $2.25	$1.46 $2.27
Subtotal: Supplementary Component		**$3.69**	**$3.69**	**$3.73**
TOTAL ALTERNATIVE COST		**$6.10**	**$6.10**	**$6.25**
ESTIMATED TOTAL COST TO PWSA		**$6.10**	**$6.10**	**$6.25**

8.1.8 MH-18: Little Saw Mill Run (POC-MH18-C-0)

The main components of the recommended alternative for the MH-18 POC sewershed to achieve 0 overflows per year are to construct parallel relief sewers to convey flow to the ALCOSAN interceptor, replacing diversion structures, and installing screens in outfalls to screen overflows before discharge. The alternative is designated POC-MH18-C-0. The alignments and locations of the POC-MH18-C-0 improvements are illustrated in Figure MH18-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-8 summarizes the key components of the alternative. Details on POC-MH18-C-0, including its anticipated effectiveness at mitigating CSOs, are provided in the MH-18 POC report in the Appendix.

TABLE 8-8. SUMMARY OF POC-MH18-C-0

POC: MH-18 (Little Saw Mill Run)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh, Dormont Borough, Mount Lebanon, Green Tree Borough, and Scott Township				
LEVEL OF CONTROL: 0 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (15,594 LF new piping)				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
12-in (Open cut)	166	$0.16	$0.16	$0.16
24-in (Open cut)	2,573	$2.55	$2.55	$2.61
30-in (Open cut)	62	$0.08	$0.08	$0.08
36-in (Open cut)	4,869	$5.88	$5.88	$5.99
42-in (Open cut)	2,429	$3.19	$3.19	$3.25
48-in (Open cut)	5,495	$7.85	$7.85	$7.98
Subtotal: Primary Component		**$19.71**	**$19.71**	**$20.07**
SUPPLEMENTARY COMPONENT: New diversion chambers/screening (10 new structures)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC016A001				
DC016N001				
DC035A001				
DC035E001				
DC036M001	Replacement	$3.60	$3.60	$3.65
DC036P001	Screening	$4.50	$4.50	$4.55
DC036R001				
DC063B001				
DC063B002				
DC063F001				
Subtotal: Supplementary Component		**$8.10**	**$8.10**	**$8.19**
TOTAL ALTERNATIVE COST		**$27.81**	**$27.81**	**$28.27**
ESTIMATED TOTAL COST TO PWSA		**$24.73**	**$24.73**	**$25.40**

8.1.9 MH-55: Timberland Street (POC-MH55-S-0)

The main component of the recommended alternative for the MH-55 POC sewershed to achieve 0 overflows per year is sewer separation. The alternative is designated POC-MH55-S-0. The alignments and locations of the POC-MH55-S-0 improvements are illustrated in Figure MH55-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-9 summarizes the key components of the alternative. Details on POC-MH55-S-0, including its anticipated effectiveness at mitigating CSOs, are provided in the MH-55 POC report in the Appendix.

TABLE 8-9. SUMMARY OF POC-MH55-S-0

POC: MH-55 (Timberland Street)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh				
LEVEL OF CONTROL: 0 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Sewer separation/Diversion structure closure				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC034R001	Closed via sewer separation	$0.14	$0.14	$0.14
Subtotal: Primary Component		**$0.14**	**$0.14**	**$0.14**
TOTAL ALTERNATIVE COST		**$0.14**	**$0.14**	**$0.14**
ESTIMATED TOTAL COST TO PWSA		**$0.14**	**$0.14**	**$0.14**

8.1.10 MH-77: Brookline Boulevard (POC-MH77-C-0)

The main components of the recommended alternative for the MH-77 POC sewershed to achieve 0 overflows per year are the construction of parallel relief sewers to convey flow to the ALCOSAN interceptor, diversion structure replacement, and outfall screen installation to screen overflows before discharge. The alternative is designated POC-MH77-C-0. The alignments and locations of the POC-MH77-C-0 improvements are illustrated in Figure MH77-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-10 summarizes the key components of the alternative. Details on POC-MH77 -C-0, including its anticipated effectiveness at mitigating CSOs, are provided in the MH-77 POC report in the Appendix.

TABLE 8-10. SUMMARY OF POC-MH77-C-0

POC: MH-77 (Brookline Boulevard)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh				
LEVEL OF CONTROL: 0 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (3,233 LF new piping)				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
24-in (Open cut)	3,233	$3.20	$3.20	$3.28
Subtotal: Primary Component		**$3.20**	**$3.20**	**$3.28**
SUPPLEMENTARY COMPONENT: New diversion chambers/screening (5 new structures)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC096B001 DC096B002 DC096C001 DC096C002 DC096H001	Replacement Screening	$1.80 $2.25	$1.80 $2.25	$1.82 $2.27
Subtotal: Supplementary Component		**$4.05**	**$4.05**	**$4.09**
TOTAL ALTERNATIVE COST		**$7.25**	**$7.25**	**$7.37**
ESTIMATED TOTAL COST TO PWSA		**$7.25**	**$7.25**	**$7.37**

8.1.11 MH-80: Englert Street (POC-MH80-C-0)

The main components of the recommended alternative for the MH-80 POC sewershed is outfall screen installation to screen overflows before discharge. The alternative is designated POC-MH80-C-0. The alignments and locations of the POC-MH80-C-0 improvements are illustrated in Figure MH80-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-11 summarizes the key components of the alternative. Details on POC-MH80-C-0, including its anticipated effectiveness at mitigating CSOs, are provided in the MH-80 POC report in the Appendix.

TABLE 8-11. SUMMARY OF POC-MH80-C-0

POC: MH-80 (Englert Street)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh				
LEVEL OF CONTROL: 0 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Diversion chamber modification (1 modification)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC095K001	Screening	$0.45	$0.45	$0.46
Subtotal: Primary Component		**$0.45**	**$0.45**	**$0.46**
TOTAL ALTERNATIVE COST		**$0.45**	**$0.45**	**$0.46**
ESTIMATED TOTAL COST TO PWSA		**$0.45**	**$0.45**	**$0.46**

8.1.12 S-15: McNeilly/ McDonoughs Run (POC-S15-C-0)

The main components of the recommended alternative for the S-15 POC sewershed to achieve 0 overflows per year are the construction of parallel relief sewers to convey flow to the ALCOSAN interceptor, diversion structure replacement, and outfall screen installation to screen overflows before discharge. The alternative is designated POC-S15-C-0. The alignments and locations of the POC-S15-C-0 improvements are illustrated in Figure S15-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-12 summarizes the key components of the alternative. Details on POC-S15-C-0, including its anticipated effectiveness at mitigating CSOs, are provided in the S-15 POC report in the Appendix.

TABLE 8-12. SUMMARY OF POC-S15-C-0

POC: S-15 (McNeilly/McDonough's Run)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh, Mount Lebanon, Baldwin Township, and Dormont Borough				
LEVEL OF CONTROL: 0 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (14,392 LF new piping)				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
12-in (Open cut)	1,191	$1.02	$1.02	$1.04
18-in (Open cut)	4,131	$3.71	$3.71	$3.80
24-in (Open cut)	3,140	$3.88	$3.88	$3.99
30-in (Open cut)	1,105	$1.21	$1.21	$1.24
42-in (Open cut)	4,825	$6.34	$6.34	$6.46
Subtotal: Primary Component		**$16.15**	**$16.15**	**$16.53**
SUPPLEMENTARY COMPONENT: New diversion chambers/screening (7 new structures)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC096K001 DC096N001 DC097L001 DC139A001 DC139B001 DC139B002 DC139B003	Replacement Screening	$2.52 $3.15	$2.52 $3.15	$2.55 $3.18
Subtotal: Supplementary Component		**$5.67**	**$5.67**	**$5.74**
TOTAL ALTERNATIVE COST		**$21.83**	**$21.83**	**$22.27**
ESTIMATED TOTAL COST TO PWSA		**$14.83**	**$14.83**	**$15.23**

8.1.13 S-23: Brook Street (POC-S23-C-0)

The main components of the recommended alternative for the S-23 POC sewershed to achieve 0 overflows per year are the construction of parallel relief sewers to convey flow to the ALCOSAN interceptor, diversion structure replacement, and outfall screen installation to screen overflows before discharge. The alternative is designated POC-S23-C-0. The alignments and locations of the POC-S23-C-0 improvements are illustrated in Figure S15-5-1 found in Appendix C of the Wet Weather Feasibility Study. Table 8-13 summarizes the key components of the alternative. Details on POC-S23-C-0, including its anticipated effectiveness at mitigating CSOs, are provided in the S-23 POC report in the Appendix.

TABLE 8-13. SUMMARY OF POC-S23-C-0

POC: S-23 (Brook Street)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh				
LEVEL OF CONTROL: 0 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (1,979 LF new piping)				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
24-in (Open cut)	1,863	$1.84	$1.84	$1.89
30-in (Open cut)	116	$0.15	$0.15	$0.15
Subtotal: Primary Component		**$1.99**	**$1.99**	**$2.04**
SUPPLEMENTARY COMPONENT: New diversion chambers/screening (1 new structure)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC060A001	Replacement	$0.36	$0.36	$0.36
	Screening	$0.45	$0.45	$0.46
Subtotal: Supplementary Component		**$0.81**	**$0.81**	**$0.82**
TOTAL ALTERNATIVE COST		**$2.80**	**$2.80**	**$2.86**
ESTIMATED TOTAL COST TO PWSA		**$2.80**	**$2.80**	**$2.86**

8.1.14 SMRE-40: Plummers Run (POC-SMRE40-C-0)

The main components of the recommended alternative for the SMRE-40 POC sewershed to achieve 0 overflows per year are upstream sewer separation to convey flow to the ALCOSAN interceptor, diversion structure replacement, and outfall screen installation. The alternative is designated POC-SMRE40-C-0. The alignments and locations of the POC-SMRE40-C-0 improvements are illustrated in Figure SMRE40-5-1 in Appendix C of the FS. Table 8-14 summarizes the key components of the alternative. Details on POC-SMRE40-C-0, including its anticipated effectiveness at mitigating CSOs, are provided in the SMRE-40 POC report in the Appendix.

TABLE 8-14. SUMMARY OF POC-SMRE40-C-0

POC: SMRE-40 (Plummer's Run)				
CONTRIBUTING MUNICIPALITIES: City of Pittsburgh, Mount Lebanon, Baldwin Township, and Dormont Borough				
LEVEL OF CONTROL: 0 OF/year			**BASIS**: 2-year design storm	
PRIMARY COMPONENT: Conveyance (15,128 LF new piping) / Sewer Separation				
PIPING	**LENGTH (LF)**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
8-in (Open cut)	6,200	$6.04	$6.04	$6.18
24-in (Open cut)	660	$0.65	$0.65	$0.67
24-in (Trenchless)	2,189	$4.34	$4.34	$4.39
30-in (Trenchless)	1,650	$3.46	$3.46	$3.50
36-in (Trenchless)	1,179	$2.63	$2.63	$2.66
42-in (Trenchless)	3,250	$7.92	$7.92	$8.00
Subtotal: Primary Component		**$25.04**	**$25.35**	**$25.40**
SUPPLEMENTARY COMPONENT: New diversion chambers/screening (5 new structures)				
DIVERSION CHAMBER	**COMPONENT**	**CY CAPITAL COST ($MM)**	**PW CAPITAL COST ($MM)**	**TOTAL PW COST ($MM)**
DC034E001 DC035M001 DC035S001 DC062C002 DC062D001 DC062K001	Replacement(5) Screening(6)	$1.80 $2.70	$1.80 $2.70	$1.82 $2.73
Subtotal: Supplementary Component		**$4.50**	**$4.50**	**$4.55**
TOTAL ALTERNATIVE COST		**$29.55**	**$29.55**	**$29.95**
ESTIMATED TOTAL COST TO PWSA		**$28.08**	**$28.08**	**$28.84**

8.1.15 MH-89: Weymans Run

Weymans Run is not one of the 14 POC sewersheds however PWSA does have sewerage facilities located in this shed and is proposing a few improvements.

Under existing conditions PWSA has 3 diversion structures that are tributary to three separate outfalls in the Weymans Run Sewershed. Outfall 138K001 conveys overflows from PWSA diversion structure DC138K001, outfall 138J001 conveys overflows from DC138J001, and outfall 138PJ001 conveys overflows from DC138P001 to Weymans Run. The majority of improvements in this sewershed are being proposed by upstream municipalities, namely Whitehall Borough, because PWSA is a minor flow contributor to this POC. Nonetheless PWSA is proposing to replace two diversion chambers and apply outfall screening to all three outfall locations to help achieve 0 overflows per typical year and to screen overflows before discharge. Please refer to the MH-89 POC report, prepared by Gateway Engineers Inc., found as an Attachment to Appendix A of the Wet Weather Feasibility Study for more details regarding proposed improvements in MH-89. General cost data for MH-89 can be found in Table 8-15.

8.2 WET WEATHER PLAN COSTS

A summary of the total project cost for the recommended alternatives for addressing the entire PWSA sewer system is presented in Table 8-15.

ATTACHMENT B

TABLE 8-15. SUMMARY OF ESTIMATED WET WEATHER PLAN COSTS

POC	CONTROL	TOTAL PW CAPITAL COST ($MM)	TOTAL PW TOTAL COST ($MM)	PWSA ONLY PW CAPITAL COST ($MM)	PWSA ONLY PW TOTAL COST ($MM)
A-42 (Negley Run)	Tank / Conveyance	$22.68	$23.30	$15.47	$15.89
A-51 (East Street)	Conveyance / Sewer Separation / Diversion Structures	$5.59	$5.68	$5.59	$5.68
C-25 (Bells Run)	Conveyance / Diversion Structures	$18.13	$18.51	$16.05	$16.48
M-34 (Becks Run)	Diversion Structures	$1.26	$1.27	$1.26	$1.27
M-42 (Streets Run)	Conveyance / Diversion Structures	$22.59	$22.95	$7.55	$7.75
M-47 (Nine Mile Run)	Conveyance / Diversion Structures	$33.97	$34.45	$18.38	$18.88
MH-11 (McCartney Run)	Conveyance / Diversion Structures	$6.10	$6.25	$6.10	$6.25
MH-18 (Little Saw Mill Run)	Conveyance / Diversion Structures	$27.81	$28.27	$24.73	$25.40
MH-55 (Timberland Street)	Sewer Separation	$0.14	$0.14	$0.14	$0.14
MH-77 (Brookline Boulevard)	Conveyance / Diversion Structures	$7.25	$7.37	$7.25	$7.37
MH-80 (Englert Street)	Diversion Structure	$0.45	$0.46	$0.45	$0.46
S-15 (McNeilly/McDonough's Run)	Conveyance / Diversion Structures	$21.83	$22.27	$14.83	$15.23
S-23 (Brook Street)	Conveyance / Diversion Structures	$2.80	$2.86	$2.80	$2.86
SMRE-40 (Plummers Run)	Conveyance / Sewer Separation / Diversion Structures	$29.55	$29.95	$28.08	$28.84
MH-89 (Weymans Run) *	Diversion Structures	$9.11	$9.15	$2.37	$2.43
Adaptive Management Plan	Green Infrastructure and Integrated Watershed Planning	$9.60	$9.86	$9.60	$9.86
TOTAL WET WEATHER PLAN COSTS		**$218.86**	**$222.74**	**$160.65**	**$164.79**

* Not one of the 14 POC sewersheds

TOTAL = cost for entire project (all municipalities)

PWSA ONLY = PWSA portion of the cost

PW = Present Worth

Total Cost = Capital Cost + O&M Costs

8.3 COMPARISON WITH CSO CONTROL OBJECTIVES

By implementing the recommended CSO Control alternatives described above, the total CSO volume will be significantly reduced. Table 8-16 shows the modeled CSO volumes by POCs before and after the recommended CSO control implementation under the typical year. There is a total modeled reduction in CSO volume of 94% for the 14 POC specific alternatives in the PWSA system.

TABLE 8-16. EXISTING AND FUTURE ANNUAL UNTREATED CSO VOLUMES

POC	LEVEL OF CONTROL	UNTREATED CSO DISCHARGE ANNUAL VOLUME (MG) IN THE TYPICAL YEAR		PERCENT REDUCTION
		EXISTING CONDITIONS	FUTURE CONDITIONS W/ CONTROL	
A-42 (Negley Run)	4 OF/year	23.00	5.3	77%
A-51 (East Street)	4 OF/year	111.40	0.4	~100%
C-25 (Bells Run)	4 OF/year	26.00	2.8	89%
M-34 (Becks Run)	4 OF/year	0.28	0.1	64%
M-42 (Streets Run)	4 OF/year	4.40	1.2	73%
M-47 (Nine Mile Run)	4 OF/year	170.50	13.2	92%
MH-11 (McCartney Run)	0 OF/year	2.10	0.0	~100%
MH-18 (Little Saw Mill Run)	0 OF/year	12.00	0.0	~100%
MH-55 (Timberland Street)	0 OF/year	0.54	0.0	~100%
MH-77 (Brookline Boulevard)	0 OF/year	1.99	0.0	~100%
MH-80 (Englert Street)	0 OF/year	0.01	0.0	~100%
S-15 (McNeilly/McDonough's Run)	0 OF/year	12.00	0.0	~100%
S-23 (Brook Street)	0 OF/year	0.77	0.0	~100%
SMRE-40 (Plummer's Run)	0 OF/year	5.60	0.0	~100%
Total		**370.59**	**23.0**	**94%**

Section 9 Adaptive Management, Green Infrastructure, and Integrated Watershed Planning

PWSA is proposing an evaluation of the ability of green infrastructure and integrated watershed management (IWM) to assist in the control of combined sewer overflows as the first step of a broader adaptive management plan aimed at optimizing the recommended approach to meeting the requirements of the Consent Order and Agreement. PWSA believes that an integrated approach which utilizes a combination of 'green' and 'gray' solutions to address combined sewer overflows and which considers all types of pollutant sources in the watershed to holistically address water quality challenges has the potential to be more cost-effective than a 'gray' only approach and may result in additional triple-bottom-line benefits to the Authority, the city, and its rate payers.

9.1 ADAPTIVE MANAGEMENT

The following sections detail a short-term adaptive management implementation plan designed to objectively assess the ability of green infrastructure to assist in the control of combined sewer overflows and IWM to achieve more efficient compliance with broader water quality standards. This proposed planning process would be conducted at the same time as initial 'gray' improvements called for in the baseline compliance approach, but would be completed in time to allow for development of an optimized compliance approach should findings indicate a hybrid solution or IWM approach would result in lower costs and greater benefits. The short-term adaptive management implementation plan includes planning and analysis, education and outreach, and implementation and monitoring of demonstration projects.

In addition to evaluation of the ability of green infrastructure to assist in the control of CSOs, the plan also includes exploration and evaluation of IWM approaches. IWM approaches have been demonstrated in multiple locations across the country to more efficiently and cost-effectively meet the federal Clean Water Act requirements related to the water quality impacts of CSOs, SSOs, and other source pollution including stormwater. PWSA's IWM evaluation aims to consider CSOs and SSOs in context with others pollutant sources that impact waterway water quality (such as stormwater runoff and dry weather sources) and is in general alignment with USEPA's June 2012 Integrated Planning Framework.

PWSA recognizes that green infrastructure and IWM approaches will require extensive collaboration between regional partners, such as ALCOSAN and other municipalities, as well as PaDEP, ACHD, and USEPA. PWSA is committed to working with these partners to explore and evaluate these different alternatives to meeting water quality standards in our region's waterways in a more cost-effective manner.

9.2 GREEN INFRASTRUCTURE OVERVIEW

Green infrastructure refers to a variety of strategies designed to mitigate the effects of development on the surrounding environment, typically using smaller, distributed management practices which infiltrate, evapotranspirate, and/or detain stormwater runoff on-site. Source control, or practices which prevent, eliminate or control the collection of stormwater or groundwater in combined or sanitary sewer systems, is often also considered a form of green infrastructure. Green infrastructure, both in combined and separated sewer areas, is typically a major component of a broader IWM strategy. The widespread use of green infrastructure practices to manage urban stormwater runoff can create sustainable improvements to urban environments, decrease the quantity of runoff, reduce peak discharges from urban areas, and remove significant levels of stormwater pollutants. Furthermore, the use of green infrastructure typically leads to an increase in the amount of vegetated or green spaces in ways that compliment community functions, improve the urban habitat, and support revitalization of urban neighborhoods. Green infrastructure utilizes the concepts of environmentally sustainable practices such as low impact development, smart growth, or environmental site design.

In addition to supporting improvements in water quality, green infrastructure practices have been shown to offer numerous other social, economic, and environmental benefits. These include urban greening and revitalization, increases in property value, creation of pedestrian corridors, creation of urban habitat, increases in tree cover and reduction of the urban heat island effect, creation of community spaces and amenities, and traffic calming. Green infrastructure practices are often incorporated into beautification projects, vacant parcel revitalization, transportation corridor upgrades, and recreational spaces.

Green infrastructure can typically be applied in two different manners: as part of a typical development project (either new development or redevelopment), or as a retrofit project which aims to add stormwater management where there previously was none. When used for new development or redevelopment, green infrastructure practices are used in place of traditional practices such as detention basins. Ordinances or other development regulations typically dictate the type and extent of stormwater controls required. When used to retrofit existing development, green infrastructure is inserted into a site to mitigate the detrimental effects of historic site design or land planning approaches. In both situations, green infrastructure manages runoff on-site to lessen downstream impacts and to improve the quality of water discharging from the site.

9.2.1 Common Green Infrastructure Practices

Green infrastructure, environmental site design, or low impact development typically has two components: general site design and stormwater control measure (SCM) design. Sustainable site design typically consists of reducing impervious cover to the maximum extent possible, maximizing open space, and ensuring runoff is routed through natural features rather than conveyed across impervious surfaces. SCM design typically consists of utilizing a group of SCMs, sometimes in series, to meet water quality treatment and peak flow control requirements. Examples of typical green infrastructure SCMs include bioretention (rain gardens), infiltration trenches or basins, stormwater wetlands, wet ponds, filtration practices, permeable pavement, green roofs (as shown in Figure 9-1), and rainwater harvesting.

Some of these SCMs, such as bioretention and green roofs, provide significant green space, while others, such as infiltration and permeable pavement, may incorporate vegetation, but vegetation is not central to their function. Because these SCMs are generally small and distributed, these practices can be incorporated into the built environment in innovative ways that take advantage of under-utilized spaces and provide community amenities. Green infrastructure SCMs are often incorporated into public right-of-ways and other existing public and private development where opportunities for larger centralized solutions are impractical or not feasible.

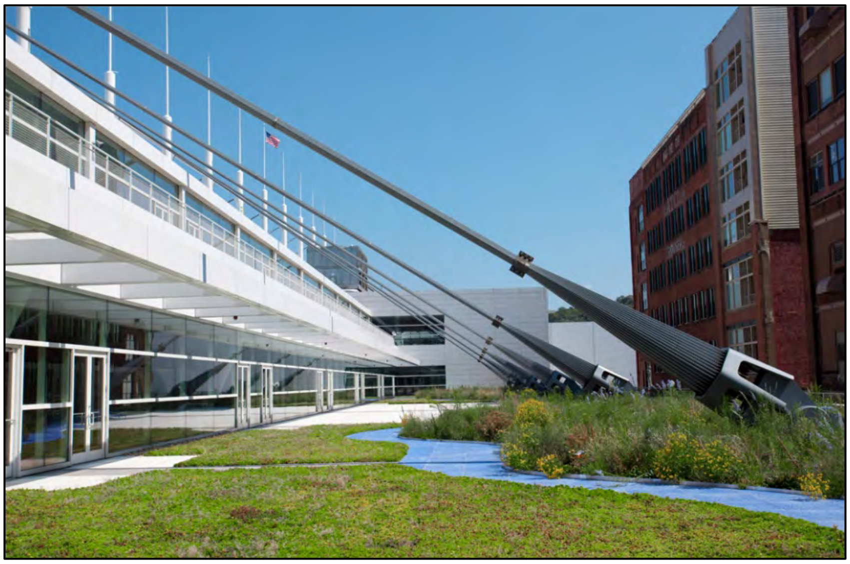


FIGURE 9-1. GREEN ROOF AT THE DAVID L. LAWRENCE CONVENTION CENTER

It is important to note that stormwater controls do not act in a vacuum. Stormwater requirements are often set by local ordinances and development regulations. These local regulations dictate the extent and type of stormwater management required when developing a new site or redeveloping a previously developed site. In addition, the types or locations of stormwater controls allowed may also be limited by existing code requirements or zoning standards which were not developed with green infrastructure in mind. Furthermore, various incentive programs can be established to encourage or support improvements in stormwater management on both existing development and new development.

It is also important to note that stormwater improvements are not limited to the site scale. Broader environmental restoration efforts, such as stream restoration, establishment of riparian buffers, and wetland creation, can significantly aid in the protection of water quality.

9.2.2 Using Green Infrastructure to Control Sewer Overflows

Combined sewer overflows typically occur during heavy rain events where the combined sewer system is surcharged by an influx of stormwater. Controlling the total volume of stormwater, timing of discharge, and peak discharge rate can assist in reducing or eliminating the frequency and total volume of overflows. Green infrastructure controls are typically designed to manage runoff from a one inch rainstorm, which typically correlates to the 85th to 95th percentile storm (meaning 85 or 95 percent of storms are one inch or smaller).

Managing the first one inch or more of runoff has two effects. First, it reduces the total volume of stormwater runoff which reaches the treatment plant during both large and small storm events. Reducing the volume of runoff which reaches the treatment plant has the potential to reduce treatment cost. Source control (inflow & infiltration) offers a similar opportunity to reduce the volume of stormwater runoff entering a combined or separated sewer system. Second, management of the first one inch of runoff reduces the peak discharge from a site which can lead to a reduction in peak flows in combined sewer lines. By reducing peak flows, there is the potential to limit the occurrence and volume of overflows which typically only occur at elevated flow rates.

The potential reduction in peak flow rate in a sewer line, through the use of green infrastructure, is directly correlated with the extent of green infrastructure implemented. Depending on the sewershed, it may or may not be feasible to add stormwater controls to a large enough area to significantly reduce peak flows in a sewer line. Therefore, there are three distinct possibilities:

1. Combined sewer overflows can be addressed through the widespread use of green infrastructure improvements alone (no changes to conveyance system).
2. Combined sewer overflows can be addressed through the use of capacity/storage improvements alone (no changes to on-site stormwater controls).
3. Combined sewer overflows can be addressed by a combination of green infrastructure and capacity/storage improvements.

The third option is known as a hybrid solution, which incorporates both ‘green’ and ‘gray’ solutions. Depending on the sewershed and the sewer system dynamics, green infrastructure solutions, or a hybrid solution, have the potential to reduce the cost of compliance compared to a strictly ‘gray’ only solution and may be able to offer secondary social and economic benefits. PWSA believes that a hybrid solution, utilizing green infrastructure implemented throughout the various sewersheds served by both PWSA and ALCOSAN can have a significant impact on CSO reduction.

In addition, green infrastructure can be used in Municipal Separate Storm Sewer System (MS4) areas to manage stormwater runoff quality and prevent the discharge of pollutants carried in stormwater runoff to the region's waterways. Improvements to stormwater controls in the region's MS4s are anticipated to be a key component of an IWM approach to achieve compliance with broader water quality standards.

9.2.3 Triple Bottom Line Benefits of Green Infrastructure

Numerous studies have been conducted to assess the secondary benefits of green infrastructure solutions. Secondary benefits are typically catalogued in a concept called the triple bottom line (TBL). The TBL considers economic, social, and environmental benefits when selecting the most cost effective solution. Consideration of the TBL supports the sustainable stewardship of both community infrastructure and environmental resources. While 'gray' infrastructure, such as capacity or storage improvements, provides a more straightforward and direct method to control overflows, it offers few secondary benefits. In contrast, green infrastructure provides many benefits beyond controlling overflows. Economic revitalization, neighborhood development, retention and attraction of residents, businesses, and visitors, and many other secondary benefits are often not quantified in a typical bottom line cost estimate which considers only monetary factors.

As shown in Figure 9-2, the TBL can be broken out into its three separate components: economic, social, and environmental. For economics, the direct factors consist of the capital costs and costs associated with operation and maintenance. Indirect economic impacts can include job creation, property value increases, business retention and attraction, increased visitor expenditures, and worker productivity. For environment, the direct factors consist of fewer combined sewer overflows and sanitary sewer overflows and associated pollution reduction. The indirect environmental impacts include habitat creation, cleaner air and water, compliance with tangential regulatory programs, and lower energy and potable water usage. The societal factors may be less apparent; however, they may be significant and include psychological improvement, aesthetic value, reduction in traffic incidents, increased recreational opportunities, resident involvement and pride, community acceptance and appreciation, and public education and outreach.

FIGURE 9-2. TRIPLE BOTTOM LINE

Many of the aspects listed overlap or magnify results in the other bottom line categories. For instance, increased aesthetic value in older neighborhoods may lead to fewer vacancies, improvements in safety, increases in property value, and opening of new businesses to serve residents.

PWSA recognizes the TBL benefits associated with green infrastructure and aims to consider these benefits in optimizing the recommended compliance approach. PWSA will also look to coordinate these efforts with other sustainability initiatives at the city and county levels. As PWSA implements green infrastructure early demonstration projects, the Authority will document TBL benefits to inform and support future decision making related to green infrastructure.

9.2.4 Existing Green Infrastructure Efforts

Numerous green infrastructure initiatives have been ongoing for many years within Allegheny County and the City of Pittsburgh. These previous efforts have helped to raise awareness for the role and potential benefit of green infrastructure in managing combined sewer overflows and building a more sustainable community in which to live and work. There are numerous grass roots organizations and local developers that have implemented or who are currently designing green infrastructure projects across the city and the county. Widespread support and public outreach for green infrastructure already exists across the community, through organizations such as Three Rivers Wet Weather (3RWW) and the Green Infrastructure Network, which will ease the challenges of implementing, operating, and maintaining a large network of green infrastructure SCMs. Table 9-1 outlines a brief summary of select previous or ongoing efforts which PWSA will benefit from as the Authority moves forward with implementing a green infrastructure program.

9.2.5 Evolution of Approach to Controlling Combined Sewer Overflows

Approaches to controlling combined sewer overflows continue to evolve. Previous efforts typically consisted of ‘gray’ infrastructure improvements such as sewer separation, capacity enhancement, or addition of overflow storage. Many ‘gray’ infrastructure programs have been successfully implemented across the country to control combined sewer overflows. However, in the past five years, a shift towards the use of green infrastructure to manage combined sewer overflows has occurred, both locally and nationally. Major combined sewer overflow programs across the region have evolved to incorporate green infrastructure components, with the level of green infrastructure utilized varying between each program. Examples of green infrastructure programs in Pennsylvania include programs at the Philadelphia Water Department and the City of Lancaster. Other examples in the region include programs in Cleveland, Cincinnati, Washington D.C., and New York City.

TABLE 9-1. EXISTING GREEN INFRASTRUCTURE EFFORTS

Entity	Description
PWSA	**Greening the PWSA Wet Weather Feasibility Study Charrettes.** PWSA, with support from local foundations, facilitated a series of three charrettes where the Authority brought together a wide-range of regional stakeholders, including ALCOSAN, to explore the incorporation of green infrastructure into the PWSA Wet Weather Feasibility Study and to identify and address major challenges and barriers to incorporating green infrastructure in the Pittsburgh region. These charrettes were a major success, and kicked off PWSA's efforts to lead the broader implementation of GI in the region. **PWSA Preliminary Assessment of Green Infrastructure Evaluation Tools.** PWSA tested the feasibility and practicality of incorporating the results of 3RWW SUSTAIN GI siting analysis with the Regional SWMM model for use as a tool to evaluate the impacts and potential cost of utilizing green infrastructure to aid in control of combined sewer overflows in both the McDonough's Run and Nine Mile Run sewersheds. This effort included siting of green infrastructure practices using the 3RWW SUSTAIN/Rainways tool and combined sewer system modeling using SWMM to evaluate reductions in peak flow, volume, and overflow events and corresponding impacts to proposed 'gray' solutions. A preliminary cost comparison was performed to test the use of this approach to quantify cost/benefit. These studies are currently being updated to reflect more recent information and more accurately quantify the cost-benefits of implementing green infrastructure. **Panther Hollow Watershed Restoration – Schenley Park.** PWSA has embarked on a collaborative effort with Pittsburgh Parks Conservancy, Pittsburgh Department of Public Works, and ALCOSAN to restore the 177 acres of the Panther Hollow watershed that lies within Schenley Park. This shed is part of the larger Four Mile Run watershed, and in its current state of distress most of the runoff flows into the combined sewer system contributing to the overflow events along the Monongahela River. The first of two phases are set to be constructed in the fall 2013 and will include infiltration trenches, tree groves, and replacement of large lawns with native meadows near Beacon Avenue. Simultaneously, the second phase involves retentive grading, constructed wetlands, and "no mow" fairways on the Schenley Park Golf Course. Later phases will consist of evaluating opportunities for stream daylighting and strategic sewer separation with green infrastructure treatment to disconnect sources of stormwater from the combined sewer system and to restore natural hydrologic stream functions to the existing headwaters. The future phase will also involve a "skinny

TABLE 9-1. EXISTING GREEN INFRASTRUCTURE EFFORTS

Entity	Description
PWSA	street" treatment to Schenley Drive incorporating vegetative swales, permeable paving, and linear rain gardens. This shed area is bisected by dozens of widely used and highly valued trails, and possesses a high level of public awareness and engagement. The implementation of green infrastructure in Panther Hollow has great potential for being a source of inspiration to launch other green stormwater BMPs throughout the City of Pittsburgh. **Green Infrastructure Technical Advisory Committee (GITAC).** PWSA has established a nine-member committee to provide objective, expert advice to the Authority on incorporating green infrastructure and policies into PWSA's feasibility plan, design standards, and other areas of operation as appropriate. Drawn from the community at large, the GITAC members are selected based on their specialized knowledge and expertise in the fields of stormwater management, landscape architecture and design, ecological preservation/restoration, community development, urban issues, and public policy. **Penn Avenue Corridor Improvements**. The redesign/reconstruction of this urban arterial corridor includes GI BMPs like infiltration tree pits, curb bump-outs with bio-swales, and permeable paving.
Three Rivers Wet Weather (3RWW)	**Development of the Rainways Tool.** Created and maintained a tool that is available for residents to analyze private properties for green infrastructure opportunities. The tool can also be used by engineers/developers analyze the possible benefits of green infrastructure in public areas. **Public Outreach.** 3RWW keeps a publically-available comprehensive inventory of public and private GSWI installations throughout the Pittsburgh metropolitan area. 3RWW has also led or participated in multiple source control demonstration projects and efforts to educate residents, engineers/developers, and public officials. **Municipal Green Infrastructure Analysis**. 3RWW completed a green infrastructure analysis for three sewersheds within the ALCOSAN service area, Nine Mile Run, Girty's Run, and McNeilly Run, to aid in the identification and assessment of green infrastructure improvements. 3RWW will continue to evaluate green infrastructure opportunities in other sewersheds to support incorporation of green infrastructure into municipal feasibility studies.

TABLE 9-1. EXISTING GREEN INFRASTRUCTURE EFFORTS

Entity	Description
	Conceptual Green Infrastructure Design. Through a Technical Assistance Grant from the USEPA, 3RWW conducted a detailed planning/design study to evaluate best approaches to incorporating green infrastructure into three city neighborhoods including Swisshelm Park, Brookline and Point Breeze. The conceptual design includes estimates of costs and benefits to the combined sewer system. The draft Point Breeze neighborhood conceptual design report is attached as an example and for reference in the Wet Weather Feasibility Study Appendix D.
ALCOSAN	**Preliminary Green Infrastructure Evaluations.** The ALCOSAN Wet Weather Plan presents an evaluation of the ability of green infrastructure to provide wet weather control in reach of the planning basins. The analysis, as presented in that WWP, identifies a relatively small number of areas in which green infrastructure would be effective in playing a substantive role in controlling CSOs. ALCOSAN has proposed completing a follow-up regional evaluation of green stormwater infrastructure and other source controls. **Downspout Disconnection Analysis.** Field investigations were conducted and used to for an analysis of the feasibility and effects of instituting a rooftop disconnection program. Based on the estimated amount of properties which were qualified for rooftop disconnection in the pilot area, this amount was extrapolated and used this to model and estimate the effects of implementing a more widespread program. The results of this study are available to the municipalities, to encourage implementation of rooftop disconnection within combined sewersheds. **Stream Restoration and Direct Stream Inflow Removal.** Recent stream restoration projects include the restoration of Nine Mile Run in Frick Park, Jack's Run stream and the daylighting of the culverted stream in Sheraden Park. Three major stream inflow re-routing projects are planned including a project to divert acidic discharges into Dooker Hollow in North Braddock Borough. As part of the efforts to eliminate direct stream inflows, five stream inflow removal projects and three stream restoration projects have been completed with three more projects ongoing.

TABLE 9-1. EXISTING GREEN INFRASTRUCTURE EFFORTS

Entity	Description
Green Infrastructure Network (GIN)	Coordinated by the Pennsylvania Environmental Council and 3RWW, the GIN is a voluntary partnership of more than 35 organizations, businesses, authorities, academia and governments working to document and encourage green infrastructure throughout Allegheny County as well as to develop protocols for monitoring green infrastructure and its effectiveness.
Allegheny County	Allegheny County is collaborating with municipalities and other governmental agencies to create stormwater management plans for each designated watershed within the county. These plans will work towards meeting the Pennsylvania Storm Water Management Act (Act 167) with objectives to preserve and restore natural hydrologic and hydraulic functions, decrease stream bank erosion, implement nonstructural solutions, and encourage stormwater management incorporating sound land use and water practices.
Pittsburgh UNITED	Pittsburgh UNITED along with 3RWW has received a federal grant to evaluate the costs and benefits of green infrastructure. The results of this study will be shared with 83 municipalities within the ALCOSAN service area fostering a deeper understanding of cost effective ways to implement green infrastructure.
Congress of Neighboring Communities (CONNECT)	CONNECT's mission is to unite the communities and municipalities creating Pittsburgh urban core. It has used these connections to create an outreach campaign emphasizing the use of green infrastructure and its importance as part of municipal wet weather plans.
Nine Mile Run Watershed Association	The Nine Mile Run Watershed Association provides outreach to residents within the watershed on topics including improved rainwater management through the use of technologies such as rain barrels, rain gardens, or tree plantings. Their mission includes the use of innovative urban ecology projects designed to directly involve the community in helping improve the heath of Nine Mile Run, which is the largest urban stream restoration project in the United States completed by the U.S. Army Corps of Engineers.

TABLE 9-1. EXISTING GREEN INFRASTRUCTURE EFFORTS

Entity	Description
Clean Rivers Campaign	The Clean Rivers Campaign is an outreach and advocacy program working to educate the public on stormwater issues and encourage ‘green’ solutions within Allegheny County. Outreach efforts include holding public meetings between private residents, local organizations, and policymakers.
City of Pittsburgh	The city has amended its zoning ordinance to include ‘green’ strategies to the maximum extent practicable as part of stricter stormwater volume reduction standards. New stormwater standards have also been enacting which require retention of the first 1 inch of runoff and encourages GI practices like maintaining natural drainage patterns, impervious disconnection, and riparian buffers.
Mount Lebanon Municipality	A new stormwater utility was implemented in 2011 which created incentives for large property owners to decrease impervious areas and for smaller property owners to implement on-site stormwater controls. The revenue from this program will be used on stormwater infrastructure improvements and maintenance.
East Liberty Development Corporation	East Liberty Development developed an innovative Green Vision for redevelopment of the urban district of East Liberty. The overlay plan took an inventory of existing environmental systems and recommends sustainable ‘green’ strategies intended to simultaneously improve the urban landscape and economy while improving the natural environment.
Various Private/Public Entities	**‘Green’ building practices**. The City of Pittsburgh is currently ranked 8th in the nation for the number of LEED-certified buildings with more than 60 more buildings pursuing LEED certification. These LEED-certified facilities represent a new push for green technology and utilize an assortment of green infrastructure technologies. **Green Up Pittsburgh**. While not directly targeting stormwater issues, Green Up Pittsburgh’s goal is to add green space within the city by planting on vacant lots or recently demolished sites, which ultimately will reduce surface runoff and improve the urban environment. **TreeVitalize and Tree Pittsburgh.** Both groups work to increase permanent tree cover throughout the Pittsburgh metropolitan area.

In addition to a shift towards the use of green infrastructure, many programs across the country have explored the use of an adaptive management framework that allows for the regular and continual re-evaluation and optimization of compliance plans. This also aligns with recent efforts by USEPA to promote an integrated watershed planning framework which aims to align the compliance activities of various water quality related permits to meet our broader water quality goals in the most efficient and affordable manner.

9.2.6 Green Infrastructure Goals and Objectives

Under the requirements of its Consent Order and Agreement (COA), PWSA's primary goal is to meet consent order combined sewer overflow control obligations on-schedule and in the most cost effective manner for its rate payers. Within the context of the COA, PWSA desires to achieve water quality improvements in the most effective and efficient manner possible. In consideration of these goals, PWSA has several specific objectives for its adaptive management plan to incorporate green infrastructure and IWM concepts.

- First, the authority aims to identify the optimal combination of 'green' and 'gray' solutions, in addition to watershed-based controls, and watershed controls, which result in the greatest cost savings and benefits to the Authority, the city, and the rate payers. This process should maximize the "water quality" benefit of every dollar spent on required overflow control activities and consider triple-bottom-line benefits of proposed solutions.
- Second, PWSA aims to implement green infrastructure solutions inside an adaptive management and/or IWM framework which gives the Authority the needed flexibility to meet its various water quality obligations in the most cost effective manner over the duration of the implementation period. This includes consideration of other water quality concerns, such as compliance with its MS4 permit and existing and future TMDLs, in addition to overflow control obligations.
- Third, PWSA aims to be the regional leader in promoting, facilitating, and implementing improved stormwater controls, particularly green infrastructure, and other IWM approaches on a regional basis. The Authority recognizes that a regional and coordinated effort will be required to address the various water quality issues facing the region. PWSA will continue to play a key leadership role in assisting upstream municipalities, the county, and ALCOSAN to address regional water quality issues.

9.3 PUBLIC PARTICIPATION

The 'Greening the Pittsburgh Wet Weather Plan Charrette Project' was developed with a primary objective to develop a consensus approach to reviewing, recommending and incorporating a plan for the implementation of green infrastructure into the PWSA Wet Weather Feasibility Study. The project was comprised of three charrettes designed to identify green infrastructure opportunities, associated benefits and concerns, and the legal, institutional, and financial obstacles. From February to April 2013, three charrettes were held to explore these various topics. Overall, 125 independent individuals participated, representing a diverse array of public, private, and non-profit organizations. In fact, each charrette had nearly equal representation from all three sectors. These individuals collectively donated over 1,000 hours of their time to assist the PWSA in its effort to better understand the challenges and opportunities associated with green infrastructure. Overall, the charrettes provided a forum for stakeholders to learn more about the wet weather planning process, to build new partnerships, and to share their knowledge about green infrastructure with PWSA.

The charrettes resulted in the identification of many challenges and opportunities, and the development of recommendations to support successful development of a green infrastructure program. Participants identified PWSA as an ideal entity to lead the region's green infrastructure efforts with the support of the city, other agencies, local NGOs, industry stakeholders, universities, and many other partners.

Participants also recommended the creation of a stormwater utility to consolidate stormwater responsibilities and assist in the funding of green infrastructure efforts. In addition, the participants recognized the need for a comprehensive education and engagement campaign. The participants recognized the need for a coordinated plan to overcome impediments to the use of green infrastructure and to encourage, facilitate, and even incentivize the use of green infrastructure throughout the region. A more complete and detailed description of the charrettes and their findings can be found in Appendix B and are summarized below.

- **Charrette 1.** The focus of the first charrette was to assess and evaluate preferred approaches to incorporating green infrastructure in Pittsburgh. First a leading engineering consultant presented an overview of green infrastructure approaches employed in other cities across the country.

The presentation gave details on the types of green infrastructure used, performance indicators, public outreach methods, and cost benefits. Then participants were split into working groups to discuss which GI solutions were most appropriate for public, private, and residential property. Facilitators worked with each working group to complete worksheets outlining specific technologies, where they were currently being used, benefits, and barriers to implementation.

- **Charrette 2.** The focus of the second charrette was to understand and to develop approaches to overcome existing institutional barriers to green infrastructure. First, key institutional leaders held a panel to discuss institutional barriers and opportunities for collaboration and coordination of green infrastructure efforts. Next, the charrette featured two working groups: the first engaged participants in addressing the barriers outlined by the panelists, and the second asked participants to identify potential sites for early demonstration projects. Tables for the first working group were organized into four general categories: Authority and Partnerships, Design and Implementation, Maintenance and Monitoring, and Rules and Regulations. Tables for the second working group were organized by watershed: Saw Mill Run, Nine Mile Run, and A-22, as well as one for the entire city.
- **Charrette 3.** The focus of the third charrette was to review and assess the process identified to incorporate green infrastructure into PWSA's feasibility study. First, PWSA's consultant presented an overview of the draft green infrastructure section of the feasibility study. Next, two working groups allowed participants to react to and expand upon what was presented. For the first working group, participants discussed what they found exciting to them about the green infrastructure section as well as what was missing and what concerns they had. The second working group focused on how PWSA could partner with other organizations to implement what was outlined in the green infrastructure section. The charrette concluded with a presentation on how green infrastructure was implemented in other countries, highlighting the importance of collaboration and challenges associated with operation and maintenance.

PWSA recognizes that public participation and collaboration is an integral part of a successful and effective green infrastructure plan and is committed to continued public outreach and participation efforts.

9.4 CHALLENGES AND OBSTACLES

The public involvement process identified six major categories which encompass the major challenges and obstacles to implementing a hybrid approach using both 'green' and 'gray' solutions to control combined sewer overflows. These include: authority to implement, education and outreach, regulatory/zoning, financial, maintenance, and monitoring. These challenges are described in more detail in Table 9-2.

Questions of authority and ownership surfaced at nearly every level of the discussion during the charrettes. At the highest level, the City of Pittsburgh is just one of 83 municipalities within the ALCOSAN service area, with each having to respond to its own COA, despite the fact that stormwater does not recognize municipal boundaries. Within each of these municipalities, there are many different parties with authority over stormwater management. Inside the City of Pittsburgh, City Planning, the Bureau of Building Inspection, Public Works, and PWSA all review and approve stormwater plans. In addition, regional entities such as County Conservation Districts also have authority over stormwater. These relationships are further complicated as the entities ultimately responsible for water quality, such as PWSA and ALCOSAN, do not regulate land development or own significant amounts of land inside the service area.

Collaboration among all entities with a role in managing stormwater will be required to break down barriers to green infrastructure and support wide spread implementation of green infrastructure throughout the region. Furthermore, extensive education and outreach will be needed to ensure stakeholders and leaders at all levels, from school children to homeowners to business owners to elected officials, understand the importance of a comprehensive stormwater management plan to mitigate pollution to receiving waters, and endorse and fund green infrastructure and IWM strategies.

Additional challenges identified through the public involvement process are detailed in Table 9-2. Included in the table are recommendations developed by PWSA and the charrette participants to overcome the identified challenges.

ATTACHMENT B

TABLE 9-2. SUMMARY OF CHALLENGES AND OBSTACLES

Challenge / Obstacle	Description
Authority to Implement	**<u>Description of Challenge</u>** PWSA has not traditionally been responsible for establishing or enforcing stormwater management standards. **<u>Recommended Approach to Overcome</u>** Create inter-agency task force to initiate the process of working with other city departments and other agencies/organizations to consolidate responsibilities for stormwater management.
Education and Outreach	**<u>Description of Challenge</u>** Implementation of green infrastructure will occur in both the public and private realm and will require the public to be an active participant in planning and implementation. **<u>Recommended Approach to Overcome</u>** Create Green Infrastructure Advisory Committee as a primary interface with the public and develop additional education and outreach programs.
Regulatory	**<u>Description of Challenge</u>** Existing stormwater regulations may not be sufficient to support a broad-based approach to improving stormwater management in the region. **<u>Recommended Approach to Overcome</u>** Work with the city, county, and other stakeholders to adopt new stormwater ordinances and/or requirements which promote and/or require green infrastructure to address both new development and redevelopment activities.
Zoning	**<u>Description of Challenge</u>** Existing zoning regulations may limit or prohibit the use of certain green infrastructure practices or sustainable site design strategies. **<u>Recommended Approach to Overcome</u>** Initiate efforts to resolve zoning issues to make green infrastructure easier to permit and implement.

TABLE 9-2. SUMMARY OF CHALLENGES AND OBSTACLES

Challenge / Obstacle	Description
Cross Department Collaboration	**Description of Challenge** Other city departments have responsibilities related to stormwater and/or implementing projects which require stormwater management. The opportunity exists to consolidate responsibilities related to stormwater and/or to coordinate green infrastructure efforts of all departments. **Recommended Approach to Overcome** Create inter-agency task force to initiate the process of working with other city departments and other agencies/organizations to consolidate responsibilities for stormwater management. Establish standardized policies across all city departments to identify and capitalize on opportunities to incorporate green infrastructure into projects under development or planned for the future.
Cross Agency Collaboration	**Description of Challenge** Other entities, such as the county, the Conservation District, ALCOSAN and PennDOT, have responsibilities or interests related to stormwater management. The opportunity exists to consolidate responsibilities related to stormwater and/or to coordinate green infrastructure efforts of all entities. **Recommended Approach to Overcome** Create inter-agency task force to initiate the process of working with other agencies/organizations to consolidate responsibilities for stormwater management. Establish standardized policies across agencies to identify and capitalize on opportunities to incorporate green infrastructure into projects under development or planned for the future. Coordinate with Regionalization Study which has similar goals.
Interface with ALCOSAN	**Description of Challenge** As part of the ALCOSAN collection system, it is important for PWSA to coordinate activities related to the interface of proposed ‘green’ and ‘gray’ solutions. The activities of each authority should complement each other and represent an integrated plan to address combined sewer overflows.

TABLE 9-2. SUMMARY OF CHALLENGES AND OBSTACLES

Challenge / Obstacle	Description
	Recommended Approach to Overcome Coordinate closely with ALCOSAN to develop recommended hybrid solutions and IWM approaches which minimize cost of compliance for both authorities. Collaborate with ALCOSAN in the assessment and evaluation of green infrastructure alternatives.
Interface with Tributary Municipalities	**Description of Challenge** Twenty-four municipalities are tributary to PWSA's collection system. Success of green infrastructure activities will likely require implementation of green infrastructure in all sewersheds served by PWSA's collection system. In addition, collaboration across municipal boundaries will be required to implement IWM approaches. **Recommended Approach to Overcome** PWSA will serve as a regional leader in green infrastructure and IWM, assisting tributary municipalities in developing and implementing green infrastructure solutions.
Timing	**Description of Challenge** Due to compliance schedules laid out for both ALCOSAN and PWSA, there is not time available to delay planned 'gray' improvements to analyze and assess the optimal role of 'green' improvements. **Recommended Approach to Overcome** Use a phased implementation approach which simultaneously implements time-sensitive 'gray' solutions while planning and assessing 'green' solutions. Configure schedules so recommended compliance approach can be modified before major resources are expended on 'gray' approaches.
Demonstrated Efficacy	**Description of Challenge** At present there is not a sufficient number of monitored green infrastructure projects to demonstrate the effectiveness of green infrastructure solutions in mitigating combined sewer overflows and general water quality improvement. In addition, sufficient monitoring and analysis has not been conducted to assess the potential of integrated watershed planning approaches to more cost-effectively address water quality issues.

TABLE 9-2. SUMMARY OF CHALLENGES AND OBSTACLES

Challenge / Obstacle	Description
	Recommended Approach to Overcome Develop and implement multiple early demonstration projects which will be monitored to determine effectiveness at reducing both site runoff, discharge of stormwater pollutants, and combined sewer overflows. Explore and evaluate opportunities for integrated watershed planning.
Financial	**Description of Challenge** Additional funds will be required to implement planned compliance activities. PWSA must determine the most equitable means of raising the required funds. It is anticipated that a stormwater utility, or stormwater service fee, which charges customers based on their contribution of stormwater runoff, may assist in equitably distributing the costs of controlling combined sewer overflows. **Recommended Approach to Overcome** Develop recommendations for new or modified funding mechanisms and financial incentives which promote incorporation of green infrastructure.
Maintenance	**Description of Challenge** There exist many challenges in maintaining a large number of green infrastructure practices, especially when many are expected to be constructed on private property and managed by private landowners or entities. Regular maintenance and eventual rehabilitation or replacement of green infrastructure practices will be essential to meeting long-term compliance obligations. **Recommended Approach to Overcome** Develop comprehensive maintenance manual to provide standardized guidance on maintenance responsibilities, maintenance expectations, and specific maintenance activities recommended for each type of green infrastructure practice. Build partnerships with other stakeholders to help maintain green infrastructure and ensure its long-term functionality. Dedicate and set aside maintenance funds within PWSA’s budget similar to replacement and rehab funds set aside for “gray” assets to ensure ongoing funding for green infrastructure maintenance.

TABLE 9-2. SUMMARY OF CHALLENGES AND OBSTACLES

Challenge / Obstacle	Description
Monitoring	**Description of Challenge** In order to assess the effectiveness of a green infrastructure practices, significant monitoring will be required to determine baseline conditions and assess incremental progress towards compliance goals. **Recommended Approach to Overcome** Develop a comprehensive monitoring and tracking plan to establish procedures and methods to assess the performance of green infrastructure and to measure downstream water quality improvements.

9.5 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

PWSA is interested in optimizing its approach to meeting compliance objectives through the use of green infrastructure and IWM. PWSA believes that integrated approaches which utilize a combination of 'green' and 'gray' solutions, in addition to watershed-based controls, to address water quality challenges can be more cost-effective than a 'gray' only approach and may result in additional triple-bottom-line benefits to the Authority, the city, and its rate payers. PWSA is proposing an adaptive management plan to assess the optimal balance of 'green' and 'gray' solutions, to demonstrate the performance of green infrastructure solutions, and to explore and evaluate IWM approaches for the PWSA service area and connected municipalities. In addition, the initial phases of this plan aim to overcome challenges which could inhibit the implementation of green infrastructure or other IWM approaches at the scale required to aid in the control of combined sewer overflows.

PWSA recommends an adaptive management approach which follows a thorough and objective process to evaluate the ability of green infrastructure and hybrid 'green'/'gray' solutions to meet compliance objectives in a more cost-effective manner. This process would utilize an upfront four-year-long, short-term implementation plan to assess the ability of green infrastructure, and other IWM approaches, to assist in meeting compliance objectives. The process includes three decision points, spaced evenly over the four-year period, to inform a decision on whether or not to continue with the further evaluation/implementation of green infrastructure and IWM. Depending on the results of this assessment, a Revised Feasibility Study may be submitted to formally request permission to modify or alter the recommended compliance approach. This process may also include or culminate in a formal proposal to PaDEP, ACHD, and USEPA to utilize an integrated planning framework. This process aims to provide objective guidance to both PWSA and the regulators as to the most effective and beneficial means of complying with the COA. Should the process determine that a hybrid approach, or IWM approach, is not more cost-effective or beneficial, PWSA would continue with implementation of the baseline compliance approach detailed in this Feasibility Study.

The short-term implementation plan outlined in the following sections allows for the initial compliance actions outlined in the baseline compliance approach to proceed as planned while this initial assessment of green infrastructure and IWM's ability to support compliance efforts is completed. The adaptive management approach offers the potential for continued optimization of compliance approaches as progress is made, assessed, and targets reevaluated. PWSA recognizes that 'gray' improvements will likely always be required, but believes that the scale of 'gray' improvements may be able to be downsized and a more cost-effective balance of 'green' and 'gray' solutions, and watershed-based controls, may be found which offers the greatest benefits to the community at the most affordable cost. This potential downsizing of 'gray' improvements could be realized for both the PWSA and ALCOSAN regional facilities.

9.5.1 Adaptive Management Framework

An adaptive management framework recognizes that continued evaluation of progress towards compliance and reevaluation of recommended future compliance activities can support a long-term reduction in compliance cost, while optimizing water quality improvement. An adaptive approach bases future actions on the success of previous actions, allowing for continual improvement. It focuses on monitoring and regular re-assessment in order to achieve goals in the most cost-effective and beneficial manner. While an adaptive approach is more difficult for compliance plans which include a smaller set of larger improvements, compliance approaches which utilize hundreds or thousands of smaller improvements are well-suited for re-evaluation and enhancement through an adaptive management process.

The short-term implementation plan detailed in this section is the first step towards an adaptive management approach. The proposed plan aims to optimize the mix of 'gray' and 'green' solutions, and watershed-based controls, to minimize compliance costs and maximize benefits to the Authority, the city, and the rate payers. The proposed plan aims to establish a process through which the success of compliance activities, both 'green' and 'gray', is regularly evaluated and future solutions are recommended based on the effectiveness of previous projects and the potential for new or innovative solutions. This adaptive management process will start with the potential revision of the Feasibility Study at the completion of the four-year adaptive management plan, and will continue at regular intervals through the remainder of the implementation schedule. Such a process allows for the flexibility needed to meet water quality goals through the most cost-effective and beneficial means. This process has been approved by the USEPA for use by several communities across the country, and aligns with the USEPA's Integrated Planning Framework. This process is particularly applicable to green infrastructure programs, where the rate of redevelopment and development of new or improved technologies can greatly impact compliance needs and approaches.

9.5.2 Integrated Watershed Management

PWSA's IWM approach is based on the principles and elements espoused in USEPA's Integrated Planning Framework. The IWM approach recognizes that combined sewer overflows are just one source of pollution affecting waterways, and that compliance with the COA may not achieve attainment of broader water quality standards mandated under the Clean Water Act unless other pollution sources are also controlled. The USEPA's integrated planning framework promotes the ability to manage compliance efforts across the spectrum of pollutant sources and water quality related permits and programs.

The framework allows for flexibility to develop the optimum combination of 'gray', 'green' solutions, and watershed-based controls, required to meet the broader goal of attainment of water quality standards, not just the goals associated with combined sewer overflows. There is the potential that solutions addressing pollutants outside of the combined sewer system, such as stormwater runoff and dry weather sources, may be more cost effective and may provide greater water quality improvements faster than improvements to the combined sewer system. Therefore, an integrated approach looks to minimize the ultimate cost of compliance with water quality standards by looking outside individual permits or compliance programs to identify and optimize solutions which can help restore water quality on a holistic watershed basis in the most cost effective and efficient manner.

PWSA proposes assessing the potential for IWM through a demonstration program in the Saw Mill Run sewershed. This process will assess a wide variety of improvements, aimed not only at controlling combined sewer overflows, but at meeting broader water quality standards through a combination of pollution control strategies.

Saw Mill Run is an optimal sewershed in which to target this assessment of integrated watershed planning on a demonstration scale for the following reasons:

- The completed TMDL study for this watershed establishes stringent requirements for the reduction of discharges of phosphorus.
- There is a high concentration of PWSA CSO structures in this watershed.
- There is a mix of combined and separate sanitary sewer systems operating within the watershed.
- ALCOSAN's Recommended Plan proposes the deferral of the identified required ALCOSAN Saw Mill Run interceptor and tunnel improvements until an unspecified time after 2026.
- Addressing the various pollution sources in this watershed has a greater potential for improving water quality compared to projects that strictly focus on the larger waterways such as the Monongahela and Allegheny Rivers.

Initial efforts to assess the role and potential of IWM in the Saw Mill Run sewershed will include watershed and source characterization, assessment of pollutant source context, identification of demonstration projects, and assessment and development of an integrated controls program. The analysis will also include a comparison between traditional control plans and IWM control plans, both in terms of effectiveness in improving water quality and in affordability.

If the analysis demonstrates that greater water quality and public health improvements can be made at an equal or lower cost than the improvements recommended in the baseline compliance approach, PWSA may submit a formal proposal to PaDEP, ACHD, and USEPA to utilize an integrated planning framework for a portion of or all of the PWSA service area.

9.5.3 Proposed Schedule and Decision Points

PWSA intends to conduct a four-year, in-depth evaluation to determine the ability of green infrastructure to cost-effectively assist in the control of combined sewer overflows and IWM to achieve more efficient and cost-effective compliance with broader water quality standards. This evaluation will be conducted in parallel with the planning and design of 'gray' infrastructure capacity enhancements outlined in the baseline compliance approach for this period. Recognizing the challenges inherent in delivering substantive flow control through green infrastructure, PWSA has outlined a three-stage process to guide the implementation and assessment of initial green infrastructure and IWM activities. The following sections introduce three different adaptive management implementation plans: the 'Year 1 Adaptive Management Implementation Plan', the 'Year 2 & 3 Adaptive Management Implementation Plan', and the 'Year 4 Adaptive Management Implementation Plan'. Each stage is accompanied by a decision point which has been designed to assess progress and determine if PWSA should move forward with efforts to modify the baseline compliance approach to include green infrastructure and IWM or revert to the baseline compliance approach detailed in this Feasibility Study. This process aims to provide objective guidance to both PWSA and the regulators as to the most effective and beneficial means of complying with the COA.

The three decision points are summarized as follows:

- **Decision Point 1.** In order to move through Decision Point 1, preliminary efforts must indicate both regional and regulatory support for accelerated incorporation of green infrastructure practices and/or IWM principles. The items outlined in the 'Year 1 Adaptive Management Implementation Plan' are intended to be a roadmap to gather and coordinate support for incorporation of green infrastructure and IWM into PWSA's compliance approach. If regional and regulatory support have not been achieved at the end of Year One, PWSA will revert to the baseline compliance approach. If regional and regulatory support has been achieved by the end of Year One, PWSA will move forward with the 'Year 2 & 3 Adaptive Management Implementation Plan'.
- **Decision Point 2.** In order to move through Decision Point 2, green infrastructure and IWM planning and early demonstration activities must demonstrate technical justification that green infrastructure and/or IWM can cost-effectively assist PWSA in meeting its combined sewer overflow control obligations or broader water quality standards. The items outlined in the "Year 2 & 3 Adaptive Management Implementation Plan' are intended to be a roadmap to evaluate and demonstrate the effectiveness of green infrastructure and IWM. If activities demonstrate that green infrastructure and/or IWM at the scale required is not feasible or is not cost effective, PWSA will revert to the baseline compliance approach. If activities demonstrate that green infrastructure can assist in cost-effectively meeting compliance objectives, PWSA will move forward with the 'Year 4 Adaptive Management Implementation Plan'.

- **Decision Point 3.** In order to move through Decision Point 3, monitoring and assessment of early demonstration activities must show effectiveness in controlling runoff and the potential for managing combined sewer overflows or improving water quality. The items outlined in the 'Year 4 Adaptive Management Implementation Plan' are intended to be a roadmap for wrapping up planning level activities for full scale implementation of green infrastructure and/or IWM. If the performance of early demonstration activities shows that green infrastructure and/or IWM is not able to cost-effectively contribute to the control of combined sewer overflows or improvement in water quality, PWSA will revert back to the baseline compliance approach. If activities demonstrate efficient performance of green infrastructure and/or IWM controls, PWSA will submit a revised plan incorporating green infrastructure and/or IWM to the regulators for consideration.

Assuming PWSA is able to navigate through the three decision points detailed above, at the conclusion of this process PWSA may submit a Revised Feasibility Study for review and approval by PaDEP and ACHD and/or a formal proposal to PaDEP, ACHD, and USEPA to utilize an integrated planning framework for a portion of or all of the PWSA service area. At the discretion of PWSA and with approval by the regulators, modifications to the COA may be required. The short-term adaptive management implementation schedule is depicted in Figure 9-3.

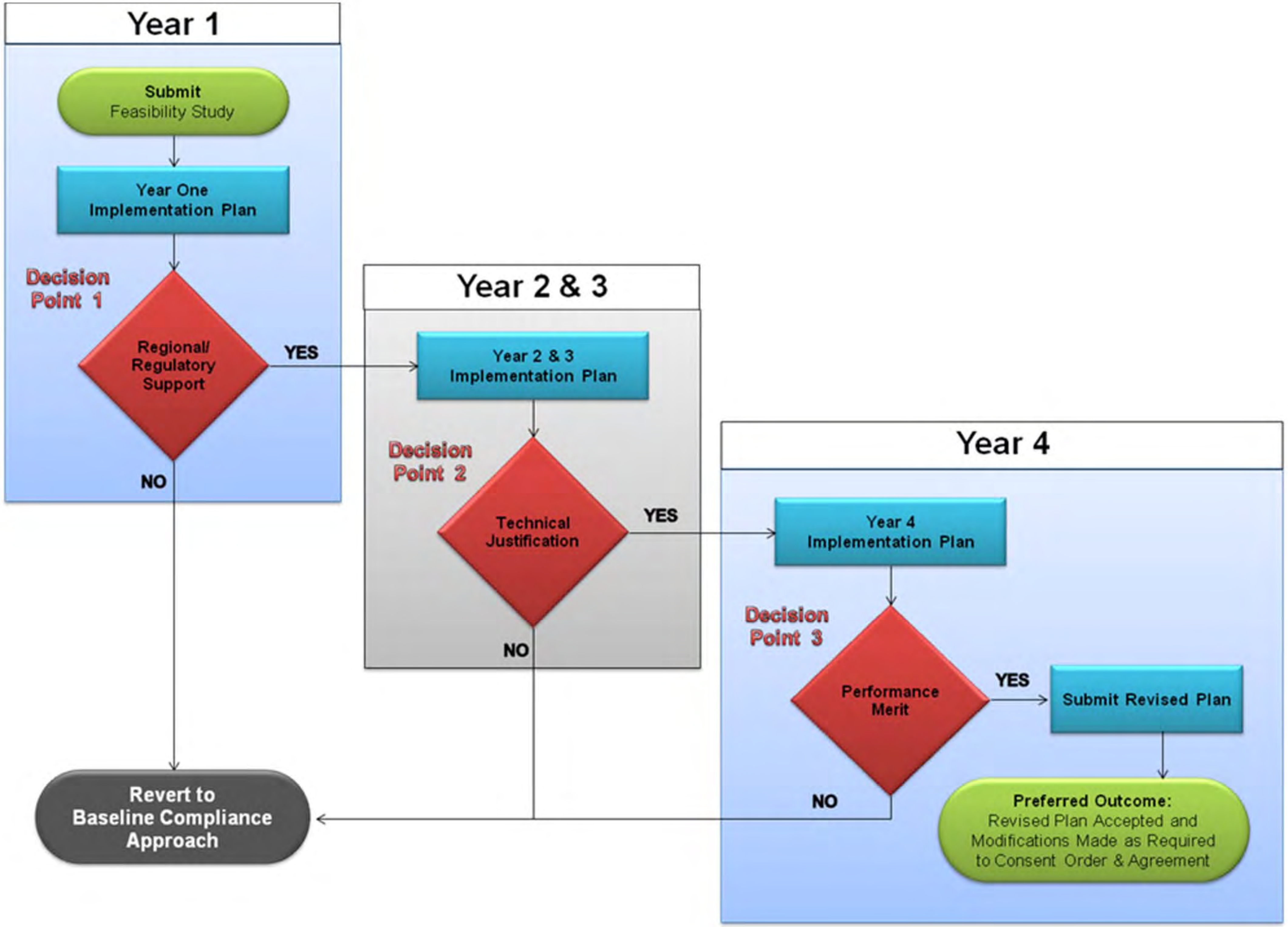


FIGURE 9-3. PROPOSED ADAPTIVE MANAGEMENT SCHEDULE AND DECISION POINTS

9.5.4 Proposed Adaptive Management Implementation Plan

The following sections detail the three adaptive management implementation plans developed to comprehensively assess over a four-year period the ability of green infrastructure to assist in the control of combined sewer overflows and IWM to achieve more efficient and cost-effective compliance with broader water quality standards. Each implementation plan contains both planning activities and implementation activities, and is intended to build on efforts initiated or completed in previous stages.

Year 1 Adaptive Management Implementation Plan. The Year 1 plan focuses on building support behind efforts to expand the use of green infrastructure and IWM in the region and culminates in the initiation of several early demonstration projects which will be used to assess the effectiveness of such practices. The anticipated Year 1 actions are listed here, and discussed in detail in Table 9-3 at the end of this sub-section.

- Submit feasibility study
- Coordinate with regulators
- Develop Inter-Agency Task Force
- Develop Green Infrastructure Advisory Committee
- Coordinate with regional partners
- Initiate implementation of early demonstration projects
- Plan for additional early demonstration projects
- Initiate changes to promote and facilitate the use of green infrastructure

Year 2 & 3 Adaptive Management Implementation Plan. The Year 2 & 3 plan focuses on implementing green infrastructure and IWM projects and assessing the ability of system-wide green infrastructure to assist in the control of combined sewer overflows and the ability of IWM to improve broader water quality. The plan also includes several complimentary actions which will support the implementation, upkeep, and assessment of high quality green infrastructure practices throughout the region. The anticipated Year 2 & 3 actions are listed here, and discussed in detail in Table 9-4 at the end of this sub-section.

- Implement early demonstration projects

- Conduct system-wide green infrastructure alternatives assessment
- Assess costs and benefits of IWM approach
- Develop green infrastructure design manual
- Develop green infrastructure maintenance manual
- Develop recommendations on funding mechanisms and financial incentives
- Develop monitoring and tracking plan
- Initiate further changes to promote and facilitate the use of green infrastructure
- Determine how to involve non-profits or community groups who can assist in implementing green infrastructure

Year 4 Adaptive Management Implementation Plan. The Year 4 plan focuses on developing a detailed plan to implement green infrastructure and IWM concepts into PWSA's compliance approach. This includes extensive assessment of completed projects, and determination of both the effectiveness and cost of utilizing green infrastructure to assist in the control of combined sewer overflows and IWM to improve water quality. The anticipated Year 4 actions are listed here, and discussed in detail in Table 9-5 at the end of this sub-section.

- Monitoring and assessment of early demonstration projects and other regional projects
- Implement recommendations on funding mechanisms and financial incentives
- Initiate further changes to promote and facilitate the use of green infrastructure
- Develop recommendations on green infrastructure implementation targets
- Develop recommendation on IWM targets
- Develop and submit revised feasibility study
- Coordinate with regulators

The detailed summaries of anticipated actions planned for Year 1, Year 2 & 3, and Year 4 are provided in Tables 9-3, 9-4, and 9-5, respectively.

TABLE 9-3. YEAR 1 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
Submit Feasibility Study	**<u>Description of Action</u>** Section 15, Paragraph D of the Consent Order and Agreement requires that PWSA submit a Feasibility Study within 6 months after ALCOSAN submits a Wet Weather Plan (WWP). ALCOSAN submitted their draft WWP in January 2013. **<u>Deliverables and Schedule</u>** PWSA will submit the Feasibility Study to PaDEP and ACHD by July 31, 2013, in accordance with the requirements of the Consent Order and Agreement.
Coordinate with Regulators	**<u>Description of Action</u>** PWSA will meet with PADEP and ACHD to discuss PWSA's proposed plan to evaluate and demonstrate the ability of green infrastructure to assist in the control of combined sewer overflows and IWM to improve water quality. PWSA anticipates that these initial discussions will result in either a formal or informal partnership agreement, which details how the PWSA, PADEP, ACHD, and potentially others, work together to assess the proper role of green infrastructure and IWM in the Pittsburgh region. **<u>Deliverables and Schedule</u>** Development of a partnership agreement which supports PWSA's plan to evaluate green infrastructure and IWM.
Develop Inter-Agency Task Force	**<u>Description of Action</u>** PWSA will develop and regularly convene an inter-agency/inter-departmental task force to streamline responsibilities and permitting processes for stormwater, specifically green infrastructure, as well as mitigation of pollutant sources other than typical CSO and SSO discharges. This task force will be composed of all city departments and outside agencies or organizations which currently set stormwater standards or regulate/permit stormwater. These responsibilities are currently spread across many departments and agencies/organizations and create roadblocks to the rapid adaptation, adoption, and implementation of green infrastructure. Headed by PWSA, this task force will meet

TABLE 9-3. YEAR 1 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
	regularly to identify areas where responsibilities could be consolidated and opportunities to streamline the permitting and approval process. **Deliverables and Schedule** At the conclusion of Year 1, the task force will issue recommendations to be implemented in Year 2 which streamline responsibilities and permitting processes for stormwater management, specifically green infrastructure, as well as mitigation of other watershed pollutant sources.
Develop Green Infrastructure Technical Advisory Committee	**Description of Action** PWSA will form and regularly convene an advisory committee to provide objective, expert advice to PWSA on incorporating green infrastructure and IWM into its policies, planning and design standards, and other areas of operation as appropriate. The advisory committee will consist of nine members selected by application from the following fields: organized labor, development community, environmental organizations, other relevant NGOs, City of Pittsburgh, academia, consulting engineers, and foundation community. The committee will meet monthly, report to PWSA frequently, and issue regular progress reports to the public. **Deliverables and Schedule** Formation of this committee is currently in progress. The committee will hold regular meetings and issue regular recommendations to PWSA. At the conclusion of Year 1, the committee will issue a report summarizing the achievements made in incorporating green infrastructure IWM, as well as the continued challenges to both efforts.
Coordinate with Regional Partners	**Description of Action** Recognizing that PWSA shares facilities and services with other regional partners, a key initial action will be to coordinate IWM and green infrastructure activities with appropriate regional partners. At a minimum, partners are anticipated to include upstream contributing municipalities, ALCOSAN, and 3RWW. PWSA will also be coordinating with 58 other municipalities as part of the effort to incorporate IWM on a regional basis.

TABLE 9-3. YEAR 1 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
	Deliverables and Schedule Coordination efforts will identify areas where regional partners can work together to support adoption and implementation of green infrastructure. Efforts should also assist in aligning schedules and implementation activities to maximize the potential for cost benefits associated with the use of green infrastructure for combined sewer overflow control.
Initiate Implementation of Early Demonstration Projects	**Description of Action** PWSA will work with other organizations to identify and construct an initial set of early demonstration projects. Projects will either be sponsored directly by PWSA or co-sponsored by PWSA if under the jurisdiction of a different department or agency. PWSA's contribution is estimated at \$500,000 to \$2,000,000 for each project. Projects are anticipated to consist of projects currently under-development which can be modified to feature green infrastructure or source control. Each demonstration project will be monitored to assess the benefit of green infrastructure approaches. **Deliverables and Schedule** PWSA, or the partnering organization/entity, shall issue a request for construction bids for each identified early demonstration project before the close of Year 1. A first early demonstration project in Schenley Park, co-sponsored by ALCOSAN and the Parks Conservancy, is already under development
Plan for Additional Early Demonstration Projects	**Description of Action** PWSA will work with other organizations to identify and develop an additional set of early demonstration projects. Projects will either be sponsored directly by PWSA or co-sponsored by PWSA if under the jurisdiction of a different department/agency. PWSA's contribution is estimated at \$500,000 to \$2,000,000 for each project. One or more of the early demonstration projects are anticipated to be located in the Saw Mill Run watershed to aid in the assessment of IWM approaches. Each demonstration project will be monitored to assess the benefit of GI and/or IWM approaches.

TABLE 9-3. YEAR 1 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
	<u>Deliverables and Schedule</u> PWSA, or the partnering organization/entity, shall issue a Request for Proposals (RFP) for planning/design services for each identified early demonstration project before the close of Year 1.
Initiate Changes to Promote and Facilitate the Use of Green Infrastructure	**<u>Description of Action</u>** With support from the Inter-Agency Task Force and the Green Infrastructure Advisory Committee, PWSA will identify and initiate changes to the ordinances, permit processes, development regulations, codes and zoning requirements which will both remove barriers to the use of green infrastructure and promote or facilitate the use of green infrastructure. **<u>Deliverables and Schedule</u>** At the conclusion of Year 1, PWSA shall issue a report detailing the changes made to promote or facilitate the use of green infrastructure. This report should also detail the changes/actions identified for consideration in Year 2.

TABLE 9-4. YEAR 2 & 3 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
Implement Early Demonstration Projects	**<u>Description of Action</u>** PWSA will work with other organizations to design and construct an additional set of early demonstration projects. Projects will either be sponsored directly by PWSA or co-sponsored by PWSA if under the jurisdiction of a different department or agency PWSA's contribution is estimated at $500,000 to $2,000,000 for each project. One or more of the early demonstration projects are anticipated to be located in the Saw Mill Run watershed to aid in the assessment IWM approaches. Each demonstration project will be monitored to assess the benefit of green infrastructure and/or IWM approaches. **<u>Deliverables and Schedule</u>** PWSA, or the partnering organization/entity, shall issue a request for construction bids for each identified early demonstration project before the close of Year 2. All construction on early demonstration projects, both those initiated in Year 1 and those initiated in Year 2, should be completed by the close of Year 3.
Conduct System-Wide Green Infrastructure Alternatives Assessment	**<u>Description of Action</u>** PWSA will conduct a system-wide alternatives analysis to identify best green infrastructure approaches, assess the benefit/impact of green infrastructure, and to determine the relative cost effectiveness of a hybrid approach compared to the baseline compliance approach. This analysis will be conducted for all sewersheds with improvements planned as part of the baseline compliance approach, and will determine the recommended balance of 'green'/'gray' improvements for each sewershed. This effort will be coordinated with ALCOSAN's green infrastructure planning and assessment activities, in addition to other IWM planning activities. **<u>Deliverables and Schedule</u>** PWSA will issue a report detailing the findings of the system-wide green infrastructure alternatives analysis by the close of Year 2. The report will be modified, based on comments from Regional Partners and Regulators, and re-issued by the close of Year 3.

TABLE 9-4. YEAR 2 & 3 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
Assess Costs and Benefits of IWM Approach	**Description of Action** PWSA will conduct an assessment, focused on the Saw Mill Run watershed, of the costs and benefits of utilizing an IWM approach, as detailed by the EPA's Integrated Planning Framework, to meet water quality objectives. This analysis will consider approaches to improving and protecting water quality which could offset or minimize the need for improvements to the combined sewer system. **Deliverables and Schedule** PWSA will issue a report detailing the findings of the IWM planning assessment by the close of Year 2. The report will be modified, based on comments from regional partners and regulators, and be re-issued by the close of Year 3.
Develop Green Infrastructure Design Manual	**Description of Action** PWSA will lead the development of a green infrastructure design manual. Ideally, this will be a collaboration of PWSA and other regional partners which can serve as a regional design manual. The design manual will serve as the consolidated design guidance for green infrastructure, establishing performance standards and providing easy to follow guidance for the planning, design, construction, and post-construction phases of green infrastructure projects. The manual will provide a standardized design process to be used by both public and private entities. This manual would be designed to be flexible in order to accommodate different size projects and unique site conditions and constraints. **Deliverables and Schedule** PWSA will issue the draft design manual for review by regulators, regional partners, and the general public by the close of Year 2. The design manual will be modified, based on comments, and be re-issued as final by the close of Year 3.

TABLE 9-4. YEAR 2 & 3 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
Develop Green Infrastructure Maintenance Manual	**Description of Action** PWSA will lead the development of a green infrastructure maintenance manual. Ideally, this will be a collaboration of PWSA and other regional partners which can serve as a regional maintenance manual. The manual will include two sections, the first for maintenance of publicly owned and maintained green infrastructure practices, and the second for privately owned and maintained green infrastructure practices. The maintenance manual will detail maintenance responsibilities, maintenance expectations, and specific maintenance activities recommended for each type of green infrastructure practice. In addition, the manual will detail in-situ tests which can be used to assess the performance/functioning of a green infrastructure practice, and will detail enforcement strategies, where applicable, for practices which are not maintained properly. **Deliverables and Schedule** PWSA will issue the draft maintenance manual for review by regulators, regional partners, and the general public by the close of Year 2. The design manual will be modified, based on comments, and be re-issued as final by the close of Year 3.
Develop Recommendations on Funding Mechanisms and Financial Incentives	**Description of Action** PWSA will continue the evaluation of existing and potential funding mechanisms, such as an impervious area based stormwater fee, to most equitably allocate the cost of compliance activities among rate payers. The analysis will include assessment of incentives inside the rate structure to encourage addition of stormwater management to individual properties. The analysis will also include assessment of the proper jurisdiction for a stormwater fee (i.e. PWSA service area only or county-wide). **Deliverables and Schedule** PWSA will issue a report detailing recommended funding mechanisms and incentives to support the cost of compliance activities by the close of Year 2. The report will be modified, based on comments, and be re-issued as final by the close of Year 3.

TABLE 9-4. YEAR 2 & 3 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
Develop Monitoring and Tracking Plan	**Description of Action** PWSA will develop a monitoring and tracking plan to detail the method and means of assessing the system-wide implementation and performance of installed green infrastructure or IWM controls. This plan will include a system, such as the Rainways Regional Green Infrastructure Map, to track the installation of green infrastructure or IWM controls. It will also establish monitoring goals, procedures, benchmarks, locations, and quality assurance protocols required to assess the performance of installed components and to quantify progress towards compliance. This information will inform the adaptive management process. **Deliverables and Schedule** PWSA will issue a draft monitoring and tracking plan for review by PaDEP and the ACHD by the close of Year 2. The plan will be modified, based on comments, and be re-issued as final by the close of Year 3.
Initiate Further Changes to Promote and Facilitate the Use of Green Infrastructure	**Description of Action** With support from the Inter-Agency Task Force and the Green Infrastructure Advisory Committee, PWSA will identify and initiate changes to the ordinances, permit processes, development regulations, codes and zoning requirements which will both remove barriers to the use of green infrastructure and promote or facilitate the use of green infrastructure. **Deliverables and Schedule** At the conclusion of Year 2, PWSA shall issue a report detailing the changes made to promote or facilitate the use of green infrastructure. This report should also detail the changes/actions identified for consideration in Year 3. At the conclusion of Year 3, PWSA shall issue a report detailing the changes made to promote or facilitate the use of green infrastructure. This report should also detail the changes/actions identified for consideration in Year 4.

TABLE 9-4. YEAR 2 & 3 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
Determine How to Involve Non-Profits or Community Groups who can Assist in Implementing Green Infrastructure	**Description of Action** PWSA will review policies and procedures for supporting or funding efforts of non-profit organizations or community groups working on implementation and maintenance of green infrastructure practices in neighborhoods served by PWSA. Recognizing that certain types of green infrastructure solutions are best implemented and maintained at the community scale, PWSA will develop a standardized program or means to support these groups in their efforts to implement and maintain green infrastructure practices. This process will include a determination of cost-effectiveness and long-term assurances. **Deliverables and Schedule** PWSA will issue a formal policy outlining under what circumstances and through what means PWSA can support or fund green infrastructure initiatives of non-profit organizations or community groups by the close of Year 2.

TABLE 9-5. YEAR 4 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	**Description**
Monitoring and Assessment of Early Demonstration Projects and Other Regional Projects	**Description of Action** PWSA will implement the procedures outlined in the monitoring and tracking plan in order to assess the impact of green infrastructure, source control, and other IWM practices implemented to date. This assessment will include projection of future impacts/benefits based on continued expansion of green infrastructure and/or IWM efforts. This will also include assessment of challenges and obstacles overcome by the early demonstration projects and a projection of future activities inside sewersheds of interest. **Deliverables and Schedule** PWSA will issue a draft report detailing the collected performance information by the middle of Year 4. The final report will be rolled into a Revised Feasibility Study to be issued at the close of Year 4.
Implement Recommendations on Funding Mechanisms and Financial Incentives	**Description of Action** PWSA will initiate implementation of recommended funding mechanisms needed to support compliance efforts. This will also include implementation of recommended financial incentives to encourage and facilitate addition of stormwater management to individual properties. **Deliverables and Schedule** PWSA will have new/modified funding mechanisms in place, or on the path towards approval, by the close of Year 4.
Initiate Further Changes to Promote and Facilitate the Use of Green Infrastructure	**Description of Action** With support from the Inter-Agency Task Force and the Green Infrastructure Advisory Committee, PWSA will identify and initiate changes to the ordinances, permit processes, development regulations, codes and zoning requirements which will both remove barriers to the use of green infrastructure and promote or facilitate the use of green infrastructure.

TABLE 9-5. YEAR 4 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
	Deliverables and Schedule At the conclusion of Year 4, PWSA shall issue a report detailing the changes made to promote or facilitate the use of green infrastructure. This report should also detail any remaining the changes/actions identified for consideration in subsequent years.
Develop Recommendations on Green Infrastructure Implementation Targets	**Description of Action** PWSA will develop an adaptive management plan which details the conversion of previously identified 'gray' infrastructure components into green infrastructure or hybrid solutions. This process will establish general green infrastructure implementation targets, such as 'greened acres', for each sewershed, and will outline alternative approaches to meeting compliance goals if initial activities do not achieve the level of performance anticipated or are more costly than anticipated. The plan will outline a regular process for evaluating progress and adjusting or modifying the compliance approach accordingly. **Deliverables and Schedule** PWSA will develop an initial adaptive management plan for internal review by the middle of Year 4. The final plan will be rolled into a Revised Feasibility Study to be issued at the close of Year 4.
Develop Recommendation on Integrated Watershed Planning Targets	**Description of Action** PWSA will develop a recommended IWM planning document for the Saw Mill Run sewershed. This plan will consider and assess alternative approaches to meeting water quality objectives and will establish management targets to be used to assess progress towards compliance. The plan will outline a regular process for evaluating progress and adjusting or modifying the compliance approach accordingly. This plan could also include recommendations for the incorporation of IWM concepts into other PWSA sewersheds.

TABLE 9-5. YEAR 4 ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Action	Description
	Deliverables and Schedule PWSA will develop an initial integrated watershed planning document for the Saw Mill Run sewershed for internal review by the middle of Year 4. The final plan will be rolled into the Revised Feasibility Study to be issued at the close of Year 4.
Develop Revised Feasibility study	**Description of Action** If indicated by previous steps, PWSA will update the feasibility study to detail a revised path to compliance which includes the hybrid approach recommended by previous steps. The hybrid approach is anticipated to include green infrastructure components and potentially IWM concepts while utilizing an adaptive management approach to implement the plan most cost-effectively over the course of the implementation period. **Deliverables and Schedule** PWSA will submit the Revised Feasibility Study to PaDEP and ACHD by the close of Year 4.
Coordinate with Regulators	**Description of Action** PWSA will work with PaDEP, ACHD, and USEPA to address issues and concerns related to the Revised Feasibility Study. Any changes necessary to the Revised Feasibility Study will be addressed expeditiously by PWSA. **Deliverables and Schedule** After negotiation, regulators will accept the Revised Feasibility Study and modify the Consent Order and Agreement as necessary.

9.5.5 Preliminary Cost Estimate

The estimated cost of the activities proposed in the short-term adaptive management implementation plan is summarized in Table 9-6. Anticipated costs include costs carried by PWSA only, which include estimated staff time and consultant and contractor costs. Additional costs may be carried by other coordinating partners who participate with PWSA on certain activities proposed in the adaptive management implementation plan. The anticipated four-year total cost of the adaptive management implementation plan is estimated at $9.6 million.

TABLE 9-6. ESTIMATED COST OF SHORT-TERM ADAPTIVE MANAGEMENT IMPLEMENTATION PLAN

Proposed Phase	Estimated Cost
Year 1 Adaptive Management Plan	$ 1,500,000
Year 2 & 3 Adaptive Management Plan	$ 7,250,000
Year 4 Adaptive Management Plan	$ 850,000
TOTAL	**$ 9,600,000**

9.6 LONG-TERM GOALS AND OBJECTIVES

PWSA is interested in identifying the optimum balance between gray infrastructure, green infrastructure, and watershed-based controls in terms of cost of compliance, impact on water quality, and broader benefits to rate payers. The actions presented in the preceding sections constitute an objective plan to evaluate the potential impact of green infrastructure and IWM approaches and to determine the best combination of solutions or approaches moving forward. The proposed approach represents a prudent and objective assessment of cost and benefit leading to reevaluation of the recommended baseline compliance approach. The goal of this process is to implement a long-term program for improving water quality, utilizing an optimal combination of 'gray' and 'green' solutions, and watershed-based controls, to cost effectively reduce discharge of pollutants into the region's waterways in accordance with the Consent Order and Agreement.

PWSA recognizes the wide-ranging benefits green infrastructure can provide the community, such as urban greening and revitalization, and is committed to supporting a broader effort to improve the management of water resources throughout the city and the region. In addition to the combined sewer overflow Consent Order and Agreement, PWSA is also subject to MS4 permit conditions and existing and future TMDL obligations. PWSA recognizes that large-scale implementation of green infrastructure and IWM approaches may help the Authority, the city, and the region to meet their various short- and long-term water resources challenges. Therefore, an integrated approach to improving water quality, including combined sewer overflow reductions, is anticipated to offer benefits to rate payers.

PWSA is committed to implementing an integrated approach to managing water resources and looks forward to building on the foundation of integrated water resources management established in the four-year adaptive management plan. Ultimately, PWSA envisions a paradigm shift in the way stormwater is managed throughout the development process, supporting the Authority's efforts to restore, protect, and preserve water quality while creating more sustainable urban environments.

Section 10 Financial and Institutional Considerations

10.1 MOU AND INTER-MUNICIPAL AGREEMENTS

One of the early steps taken to facilitate the development of up-to-date and relevant Memorandum of Understanding (MOUs) and/or inter-municipal agreements was to determine whether or not there were any existing, applicable MOUs or service agreements. 3RWW, working with the University of Pittsburgh, collected many of the existing agreements. The FSWG also formed an inter-municipal agreements subcommittee to review those existing agreements, develop an agreement outline for use by the municipalities, and prepare draft agendas for use in meetings for negotiating cost sharing and other aspects of multi-municipal projects.

When more than one municipality is involved in the design, construction, and operation of new wet weather control facilities, it is intended that they will develop inter-municipal agreements to outline their mutual understanding of the project as well as their municipal, customer, and legal responsibilities. These responsibilities include, but are not limited to, permitting, ownership, cost sharing, and who will operate and maintain the facility on a long-term basis.

In addition, it is the PWSA's position that agreements or MOUs should contain provisions for periodic review and amendment as necessary by the respective parties and their solicitors.

An MOU was developed in order to document the intent to complete and submit a coordinated Feasibility Study for each complex sewershed. Each of the contributing municipalities was responsible for providing PWSA with accurate and complete supplemental information regarding municipality-specific projects and required improvements.

For the purpose of submitting this Feasibility Study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the project and its schedule are approved by the regulatory agencies.

In general, each MOU states that, for the purpose of submitting the Feasibility Study, the municipalities agree on the estimated cost of the recommended alternative. Each municipality shall have the right to void the MOU if the total cost exceeds a certain threshold above the estimated cost. The MOU also states that the municipalities agree that the basis of allocation for costs of each segment is based on percentage of peak flow contributed to each segment at the time of the MOU, multiplied by the preliminary estimated total cost of each segment agreed to by the municipalities that will share in such costs.

It is intended that an agreement will be entered into by all parties after an implementation order has been issued by the PaDEP and/or the ACHD. Such an order would indicate that the cost to each party would be based on the cost of each segment, to be adjusted for changes in costs made during construction.

Each MOU summarizes the preliminary estimate of the percentage and amount of the total cost of implementation of the recommended alternative for each municipality.

10.2 PROJECT FUNDING

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary according to PWSA's ability to issue bonds, levy taxes, assess fees, etc. The following provides an overview of several funding and financing options that should be considered for financing wet weather control facilities.

10.2.1 Financing Capital Costs

Sources of funds to cover capital costs include the following three general categories: grants, loans/bonds, and equity investment.

- **Grants.** It is important for authorities to commit the administrative resources needed to apply for grants, as well as to hold discussions with federal and state legislators in an effort to determine whether project specific grant funding assistance could be obtained.
- **Loans / Bonds.** Loans, such as the state revolving loan fund through PENNVEST, can provide a low-cost funding mechanism to assist entities in complying with federal and state water quality requirements.

  Bonds can be sold at all levels of government for infrastructure projects. The borrower of a bond repays the capital value of the bond plus interest. The interest rate for a bond varies based on the credit worthiness of the entity backing the bond.

- **Equity Investment.** This would be partial ownership (equity) in a private company, such as a private stormwater or wet weather utility.

10.2.2 Revenue Generation

Several cost recovery options are described below. These options can be used to pay debt costs as well as support operations and maintenance of the wet weather control facilities.

- **Wastewater User Charges.** PWSA charges a uniform rate based on water use in place for its sewer rate structure. Uniform rates are relatively simple for municipalities to implement and for customers to understand. However, given the large number of customers, both in the PWSA service area as well as in upstream communities, connected to the PWSA system and variability in volumes used and infrastructure required to convey, store, and/or treat flows, a rate structure that reflects wastewater and wet weather flow generation separately could also be considered.
- **Property Taxes.** Recover recurrent costs of wastewater collection systems and facilities through an increase in charges assessed on the value of property.
- **Surcharge on Property Tax.** A surcharge is applied on the property taxes within the service area or as a direct separate tax on the assessed value of properties.
- **Community Assessments Based on Wastewater and Wet Weather Flows.** A community assessment approach would result in fees that would reflect the wastewater and wet weather flow contributed by upstream communities. This approach would require installation of meters to measure flows entering the PWSA collection system or development of a reliable, calibrated prediction model. Such an approach would provide incentive for upstream communities to increase efforts to reduce infiltration and inflow (I/I).
- **Storm Water Fees or Separate Penalties/Surcharges for Wet Weather Flow Contributions.** A separate storm water fee could be implemented based on land use and corresponding impervious area within the PWSA service area, as well as in upstream communities. Alternatively, a fee or surcharge could be implemented when flows exceed an established base flow threshold. This would represent an increasing block rate structure (based on flow) which

would encourage communities to implement local stormwater programs that would reduce stormwater flows into the drainage system.

- **Impact / Connection Fees.** An impact fee for connecting to or expanding the use of wastewater and wet weather control facilities could be implemented. The impact fee could be structured such that it varies by the type of connection. For instance, a two-tier impact fee structure could apportion a higher cost to new growth areas and a lower cost to infill or redevelopment areas. Such a program could help encourage growth and development in desired geographic areas. Also, an impact fee could be developed for a geographic area that relates directly to the cost of the conveyance infrastructure serving that area. Allocating projected costs would require an engineering analysis of actual cost to provide conveyance to various POC sewersheds or individual interceptor systems. Fees would need to be tracked by community areas or by sewer shed.
- **Tax Increment Financing (TIF).** TIF is a tool to use future gains in taxes resulting from development of a project to finance those capital improvements. This tool is often used to help finance public infrastructure projects. This tool could be targeted to specific growth areas within the city.
- **Special District Financing.** Special assessment districts are established allowing funds to be levied from certain areas of the service area that receive a direct benefit from the proposed improvements. This is similar in approach to TIF.
- **Indirect Charges.** A surcharge is applied to items or activities that are not directly related to wastewater services (similar to a gas tax). Revenue generated by the surcharge can be applied to cover a portion of the costs of wastewater and wet weather control services.
- **Strategic Budget Allocation.** Portion of a rate bill is placed into a special fund where the money is invested and the interest earned is re-invested. The revenue generated from this special fund can be used for future capital investments.

10.3 AFFORDABILITY AND FINANCIAL CAPABILITY ANALYSIS

This section presents an assessment of the financial environment in which PWSA developed this Wet Weather Feasibility Study (FS). The assessment methodology used is derived from the EPA's *Combined Sewer Overflows – Guidance for Financial*

Capability Assessment and Schedule Development, (EPA Guidance), published February 1997.[1]

The financial capability assessment (FCA) serves two purposes. First, it supports the development of a workable implementation schedule for the FS. Second, it can help determine the amount of external funding needed to maintain affordable rates for customers.

10.3.1 Current Conditions (2012) Residential Indicator

The residential indicator (RI) is an approximation of households' abilities to pay their total wastewater costs. It is calculated by dividing the total annual wastewater costs for the typical household within the PWSA service area by the median household income (MHI) within the service area. Table 10-1 shows the RI criteria as stated in the EPA Guidance.

TABLE 10-1. EPA RESIDENTIAL INDICATOR

Residential Indicator	Cost per Household
Low Impact	Less than 1.0% of MHI
Mid-Range Impact	1.0 – 2.0% of MHI
High Impact	Greater than 2.0% of MHI

10.3.2 Current Annual Wastewater Cost per Household

Annual wastewater cost per household (CPH) for the PWSA service area has two primary components:

1. Current (2012) PWSA sewer (collection and conveyance system) costs
2. ALCOSAN (conveyance and treatment) costs

Both must be fully accounted for in order to accurately assess PWSA customer burden.

The current (2012) PWSA annual cost per household is calculated using the most up-to-date financial information; it is composed of the following costs:

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[1] EPA 832-B-97-004

- Operations and Maintenance (which includes administration costs)
- Debt Service
- Cooperation Agreements

Two adjustments must be made to aggregate PWSA costs to isolate the residential sewer portion. First, the water portion must be separated from the sewer portion. Based on analysis of the PWSA rates and previous rate studies, approximately 33% of total costs are allocated to sewer and 67% to water. Second, the sewer amount is divided between residential and non-residential customers.[2] Accordingly, 61% of costs are recovered from residential customers and 39% from non-residential customers.

The final step in calculating the cost per household is to divide the residential share of sewer cost by the number of households served by PWSA. The number of households was determined by an analysis of the 2010 Census block groups in the City of Pittsburgh. The total number of households contributing to the PWSA system is 134,275.[3]

Table 10-2 shows the PWSA 2012 cost per household as $139 based on the cost allocation and financial information.

TABLE 10-2. PWSA ANNUAL COST PER HOUSEHOLD CALCULATION [4]

O&M	$40,900,000
Debt Service	$40,000,000
Cooperation Agreements	$13,300,000
Stormwater	TBD
Total Cost	**$94,200,000**
Sewer Share	$30,700,000
Residential Share	$18,700,000
Number of households	134,275
Final Cost per Household	**$139**

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[2] The allocation percentage is based on 2011 billed flow data from the ALCOSAN billing system.

[3] Derived from 2010 Census Block Group Data

[4] Most recent financial information is taken from the 2012 PWSA Remarketing Circular and the 2011 Single Audit

The 2012 ALCOSAN residential cost per household was previously determined in the ALCOSAN Affordability Analysis to be $260.[5] Table 10-3 shows this amount added to the previously calculated PWSA CPH to derive the total 2012 PWSA cost per household of $399.

TABLE 10-3. TOTAL COST PER HOUSEHOLD

Total Cost Per Household	
PWSA	$139
ALCOSAN	$260
Total Cost Per Household	**$399**

10.3.3 Current (2012) Pittsburgh Median Household Income

The median household income (MHI) of the City of Pittsburgh is used to determine the burden of the household for the 50th percentile of income. The use of MHI in the residential burden calculation provides an indication of the burden for the entire service area because half will be above the burden level and half will be below. The 2012 MHI for Pittsburgh is $38,090 (2007-2011 American Community Survey Estimate, inflated to 2012).

10.3.4 Pittsburgh Residential Analysis

To calculate the 2012 Residential Indicator, the current typical cost per household ($399) may be divided by the median household income of the service area ($38,090), resulting in a current conditions Residential Indicator of approximately 1.05%. According to the standards set in the EPA Guidance, current wastewater costs within the PWSA service area impose mid-range burden on the residential users.

A cumulative distribution frequency curve showing the distribution of wastewater costs amongst Pittsburgh's Census income block groups is provided as Figure 10-1. Approximately 85% of the population and households within the PWSA service area have current annual wastewater costs that would be considered low to mid-range

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[5] Section 11.5.4 of the ALCOSAN Wet Weather Plan

under the EPA Guidance criteria. It is notable that as of 2012, 15% of households are already above the high burden threshold.

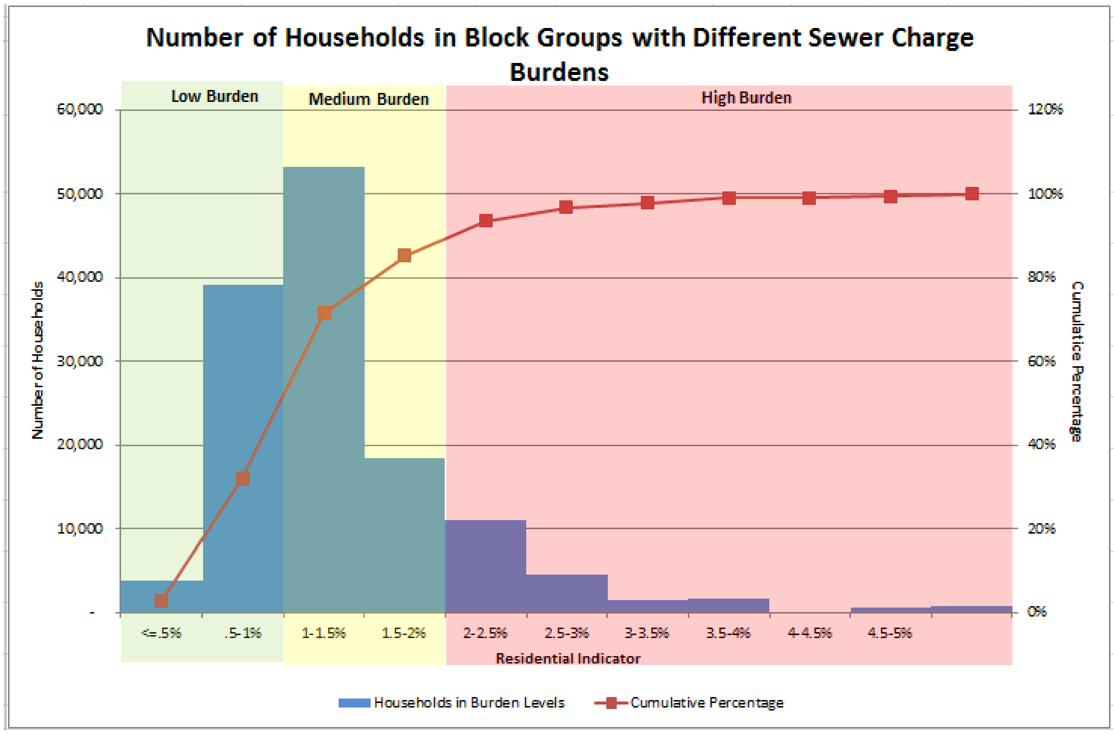

FIGURE 10-1. CURRENT HOUSEHOLD BURDEN DISTRIBUTION

10.3.5 Financial Capability Indicator

The financial capability indicator (FCI) complements the residential indicator analysis of household affordability by providing an assessment of PWSA's ability to finance the Wet Weather Feasibility Study. The FCI compares PWSA, or the city of Pittsburgh, to six EPA-defined benchmarks in the areas of debt burden, socioeconomic conditions, and financial operations, as shown in Table 10-4.

TABLE 10-4. EPA FINANCIAL CAPABILITY CRITERIA

Category	Criteria	Explanation
Debt	Bond Rating	Most recent bond rating
	Debt Burden	Total overall net debt as a percentage of full market property value
Socioeconomic	Unemployment Rate	Comparison of regional unemployment rate to the national average
	Median Household Income (MHI)	Comparison of regional MHI to the national average
Financial Management	Property Tax Burden	Ratio of tax revenue to total property value
	Property Tax Collection Rate	Ratio of property taxes levied to property taxes collected

EPA's debt and financial indicators are based on the use of tax revenues to finance wastewater system improvements through general obligation bonds. As a municipal authority, PWSA finances major capital improvements through revenue bonds. As such, where appropriate, a blend of PWSA and Pittsburgh data was used for this analysis.

The 2011 Pittsburgh Comprehensive Annual Financial Report (CAFR) was used to calculate financial capability indicators. The most recent bond ratings and official statements were collected online from Moody's and Standard and Poor's.

10.3.6 Debt Indicators

The EPA intends debt indicators to "assess the current debt burden conditions and the ability [of the permittee] to issue new debt." The two debt indicators outlined in the guidance are the most recent bond rating and overall net debt as a percent of full market value.

Bond Ratings. Bond ratings incorporate analysis of political and economic risk, the capability and willingness of a government to make debt payments, and the population of the service area. Long-term economic growth, demographic trends, and current political conditions contribute to the credit rating. A description of the EPA Guidance criteria for bond ratings is shown in Table 10-5. For the purposes of this analysis, ratings are given for general obligation bonds of the city and PWSA's revenue bonds.

TABLE 10-5. BOND RATING CRITERIA

FCI Categorization	Moody's	Standard & Poor's
Strong	Aaa, Aa, A	AAA, AA, A
Mid-Range	Baa	BBB
Weak	Ba, B, Caa, Ca, C	BB, B, CCC, CC, C, CI, R

PWSA Revenue Bonds. As of August 16, 2012, PWSA had an underlying rating of 'A' long-term (with a stable outlook) from Standard & Poor's Rating Services, and A2 from Moody's on its senior lien revenue bonds (includes 1998B, 2008A, 2008B-1, 2008B-2, 2008D-1, and 2008D-2 issues). Moody's did not explicitly note that PWSA faced large capital expenditures due to the Wet Weather Feasibility Study, but they did state that "significant new debt borrowings that further leverage the system" could make the rating go down.

Standard and Poor's mentions PWSA's high leverage and future CSO costs as factors offsetting the strengths of PWSA:

> "In our view, offsetting factors are … A 2004 consent decree, with regulatory-driven mandates to reduce combined sewer overflows (CSO) as the focus of a large capital improvement program … and an already highly leveraged system."

Standard and Poor's states that an upgrade within the next two years is unlikely due to the Authority's highly leveraged position and the probability of significant amount of additional debt.

PWSA's 'A' rating for its revenue bonds is the lowest that qualifies for a "strong" rating under the EPA Guidance criteria.

City of Pittsburgh Bond Ratings. On January 19, 2012, Standard and Poor's Rating Services affirmed its BBB rating of Pittsburgh's long-term rating on General Obligation (GO) bonds and revised its outlook to stable.

Standard and Poor's specifically cites efforts to address the city's pension system as the reason for the change in outlook:

> "We base the outlook revision on our view of the city's efforts to begin to address financial pressures associated with its pension system, although significant challenges related to the system's funding remain."

Pittsburgh's "BBB" rating for its GO bonds qualifies as "mid-range" under the EPA Guidance criteria.

Debt Burden. Debt burden is measured by overall net debt as a percent of full market property value, which evaluates the ability of local government to issue additional debt. In this case, since PWSA will be issuing the debt rather than the City of Pittsburgh, it is an indicator of local government burden. Overall net debt is defined as current total liability to be repaid by property taxes divided by the municipalities' full market property value. Table 10-6 shows the percentages of debt that indicate strong, mid-range, and weak burdens.

TABLE 10-6. OVERALL NET DEBT INDICATOR CRITERIA

	Debt / Full Market Property Value		
FCI Categorization	**Low**	**to**	**High**
Strong	0.00%	to	2.00%
Mid-Range	2.00%	to	5.00%
Weak	>5.00%		

Overall net debt has two components: the general obligation debt issued directly by the City of Pittsburgh, and Pittsburgh's share of the debt of its overlapping entities such as the school districts and Allegheny County. To calculate the indicator, the total general obligation debt for the municipality is added to the municipal portion of school district debt and the municipal portion of county debt and divided by full market property value of municipal real estate.

Full Market Property Value was determined using the 2011 CAFR for Pittsburgh. The dataset includes assessed value of real estate and full market value of real estate. Dividing Pittsburgh's overall net debt of $1.4 billion by the full market value of real estate of $13.4 billion yields an indicator value of 10.1%, which is 5.1% above the 5% threshold for a weak rating under the EPA Guidance.

TABLE 10-7. PITTSBURGH DEBT TO PROPERTY VALUE RATIO

Direct Net Debt	Overall Net Debt	Market Value of Real Estate	% Debt / Property Value	Benchmark
$716,114,000	$1,360,784,000	$13,486,434,000	10.1%	Weak

A shortcoming of the EPA Financial Capability Analysis is that it does not give any additional weight to an indicator that exceeds its upper threshold by a substantial margin. Effectively, the Debt Burden Indicator for Pittsburgh is "very weak."

10.3.7 Socioeconomic Indicators

Per EPA Guidance, "socioeconomic indicators are used to assess the general economic well-being of residential users in the permittee's service area."[6] To assess the economic well-being of the permittees, the EPA Guidance uses permittee unemployment rate and median household income compared to national averages.

Unemployment Rate. The unemployment rate compared to the national average is used as an assessment of the economic well-being of residential users in the service area. The EPA Guidance criteria for unemployment are listed in Table 10-8.

TABLE 10-8. UNEMPLOYMENT INDICATOR CRITERIA

FCI Categorization	Local Unemployment Rate
Strong	More than 1 percentage point below National Average
Mid-Range	(+/-) 1 percentage point of the National Average
Weak	More than 1 percentage point above National Average

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[6] EPA 832-B-97-004, pg. 28

Data for the unemployment rate are taken from the American Community Survey (ACS) estimates for 2007-2011. The ACS was chosen instead of the Bureau of Labor Statistics (BLS) as the data source for municipal unemployment figures because the BLS numbers provide a snapshot in time, whereas the ACS gathers data over a 5-year period. Therefore, the ACS 5-year estimate is subject to a smaller margin of error than the BLS estimate.

The 2007–2011 unemployment rate for Pittsburgh is provided in Table 10-9. The average for this indicator is 0.3% above the national average of 8.7%, which is mid-range. The unemployment indicator includes another shortcoming of the EPA Guidance criteria. In the case of Pittsburgh, a 9.0% unemployment rate should be considered high, regardless of the national average. The unemployment indicator receives a "mid-range" rating based on the EPA Guidance criteria, whereas it should actually indicate "weak" economic performance.

TABLE 10-9. PITTSBURGH UNEMPLOYMENT INDICATOR

(Comparable National Unemployment Rate = 8.7%)		
2007-2011 5-Year % Unemployment Estimates	**Local Unemployment Rate minus National Rate**	**Categorization**
9.0%	0.3%	Mid-Range (2)

Median Household Income (2011). The EPA Guidance criteria for the MHI indicator are described in Table 10-10.

TABLE 10-10. MHI INDICATOR CRITERIA

Categorization	Local MHI
Strong	More than 25% above Adjusted National MHI
Mid-Range	(+/-) 25% of the Adjusted National MHI
Weak	More than 25% below Adjusted National MHI

Based on 2011 American Community Survey data, the 2011 adjusted national median household income was $52,762. The 2011 Pittsburgh MHI was $37,161, or 70% of the national average. The Pittsburgh MHI is 30% less than the national average, 5% below the weak rating threshold under the EPA Guidance, and therefore is rated as "weak."

10.3.8 Financial Management Indicators

Financial management indicators calculate property tax revenues as a percent of the assessed property value as well as the property tax revenue collection rate. These metrics are primarily applicable in the analysis of municipal general obligation bonds.

Tax Burden Indicator. This indicator is a measure of the taxable resources available to support debt. Table 10-11 shows the tax burden indicator as derived by dividing Pittsburgh's property and income tax revenue by the full market value of the taxable property within the city.

TABLE 10-11. TAX BURDEN INDICATOR

Categorization	Low	to	High
Strong	0.00%	to	2.00%
Mid-Range	2.00%	to	4.00%
Weak	> 4.00%		

In 2011, the anticipated municipal property tax revenue, including millage for overlapping entities of school district and county, was $208 million, and the income tax revenue was $75 million. The full market value for Pittsburgh was $13.4 billion; resulting in a Pittsburgh tax to full market value ratio of 2.1%, a mid-range score, as shown in Table 10-12.

TABLE 10-12. PITTSBURGH PROPERTY TAX BURDEN

Municipality	2011 Full Market Value	2011 Expected Property Tax Revenue (Including Overlapping Entities)	2011 Earned Income Tax Revenue	Revenue as % of Property Value	Benchmark
Pittsburgh	$13,486,434,000	$208,904,375	$74,537,388	2.1%	Mid-Range (2)

Property Tax Revenue Collection Rate. The property tax collection rate is considered an indicator of the efficiency of the tax collection system and the ability of property owners to pay current property tax levies. The EPA Guidance indicators are described in Table 10-13.

TABLE 10-13. PROPERTY TAX REVENUE COLLECTION RATE INDICATOR

Property Tax Revenue/Property Tax Levied			
Categorization	**High**	**to**	**Low**
Strong	100%	to	98%
Mid-Range	98%	to	94%
Weak	< 94%		

In 2011, Pittsburgh's levied property taxes of $145 million exceeded its actual collected property tax revenue of $134 million, resulting in a collection rate of 93.2%[7], as shown in Table 10-14. Pittsburgh's indicator score is 1% lower than the "weak" indicator threshold.

TABLE 10-14. PITTSBURGH PROPERTY COLLECTION RATE

2011 Property Tax Revenues	2011 Expected Tax Revenues	Collection Rate	Categorization
$135,744,044	$145,653,487	93.2%	Weak (1)

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[7] Information on Pittsburgh property tax collected and property tax levied comes from the Pittsburgh Comprehensive Annual Financial Report for 2011

10.3.9 Analyzing Current Financial Capability Indicators

To generate a financial capability numerical score, financial capability indicators are compared to national benchmarks established in the EPA Guidance. Table 10-15 shows the EPA criteria established in the guidance document.

TABLE 10-15. PERMITTEE FINANCIAL CAPABILITY INDICATOR BENCHMARK

Indicator	Strong (3)	Mid-Range (2)	Weak (1)
Bond Rating	AAA-A (S&P) or	BBB (S&P)	BB-D (S&P)
	Aaa-A (Moody's)	Baa (Moody's)	Ba-C (Moody's)
Overall Net Debt as a Percent of Full Market Property Value	Below 2%	2% - 5%	Above 5%
Unemployment Rate	More than 1% below the National Average	± 1% of the National Average	More than 1% above the National Average
Median Household Income	More than 25% above National MHI	± 25% of the National MHI	More than 25% below National MHI
Property Tax as a Percent of Full Market Property Value	Below 2%	2% - 4%	Above 4%
Property Tax Collection Rate	Above 98%	94% - 98%	Below 94%
Service Area Indicator	**Average of all Indicators**		

Indicators from the previous sections are compiled in Table 10-16. The overall rating is an average of the six components; it is presented in the final row and will be used in the Financial Capability matrix.

TABLE 10-16. SERVICE AREA FINANCIAL CAPABILITY INDICATOR AVERAGE

Metric	Value	Score	Score Value
Bond Rating	2.5	Mid-Range	2
Overall Net Debt (as a Percent of Full Market Property Value)	10.09%	Weak	1
Unemployment	0.3%	Mid-Range	2
Median Household Income	30%	Weak	1
Property Tax Revenues (as a Percent of Full Market Property Value)	2.1%	Mid-Range	2
Property Tax Revenue Collection Rate	93%	Weak	1
Permittee Indicators Score	**-**	**Mid-Range**	1.50

The Bond Rating score is based on an average between the score for PWSA debt and city of Pittsburgh debt. PWSA received a "strong" score with a numerical value of 3, while the city of Pittsburgh received a "mid-range" score with a numerical value of 2.

The current financial capability indicator is "mid-range" but very close to "weak." The scores in multiple areas would need to improve substantially in order to reach a "strong" rating, though a slight deterioration of any of the scores could make the indicator "weak."

10.3.10 Future Conditions without Wet Weather Compliance Costs

There are many potential permutations of the implementation schedule and cost for both PWSA and ALCOSAN components of their respective wet weather plan. As such, any one plan chosen as a basis for the financial analysis will certainly not precisely match the actual construction schedules and costs when they are finalized. In this uncertain environment, it was decided that analytical consistency with other groups was important. Therefore, the financial capability analysis was conducted assuming a completion date of 2026, which is in accordance with recommendations provided by the 3RWW FSWG as well as the schedule put forward in the ALCOSAN Wet Weather Plan.

10.3.11 PWSA System Costs without the Wet Weather Plan

The costs of PWSA's ongoing Capital Improvements Program and capital cost inflation of 3.10%[8] will result in increasing annual costs for the existing PWSA collection and conveyance system. As summarized on Table 10-17, the annual costs for the current PWSA facilities are projected to increase from an estimated $26 million in 2012, to $42 million in 2027. The projected costs in 2046 would be approximately $62 million.

TABLE 10-17. PROJECTED ANNUAL PWSA WASTEWATER COSTS WITHOUT WET WEATHER PLAN

PWSA Annual Cost	2012	2027	2046
O&M	$13,500,000	$23,100,000	$44,100,000
Debt Service & Reserves	$12,800,000	$19,300,000	$17,800,000
Cooperation Agreement	$4,400,000	$2,400,000	$2,400,000
Total	**$30,700,000**	**$44,800,000**	**$64,300,000**

The projected annual costs are shown graphically in Figure 10-2. Costs are projected through 2046 according to current and historical spending patterns. The revenue requirements for PWSA necessary to maintain current level of service are provided as a baseline to which wet weather affordability impacts and spending can be compared. For planning purposes, annual debt service requirements include the existing debt amortization schedule as well as debt payments for anticipated annual capital improvements at an average annual cost of $4.5 million (2012 dollars).

The typical cost per household for PWSA's wastewater collection and conveyance services is estimated to be $139 in 2012. Without including the recommended wet weather projects, PWSA costs per typical household would be projected to grow at an annual rate of about 3.34% through 2046. The annual PWSA cost per typical household without the recommended wet weather projects would be projected at $207 in 2027.

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[8] Capital cost inflation based on ALCOSAN Costing Tool utilized in development of Draft July 2012 Wet Weather Plan

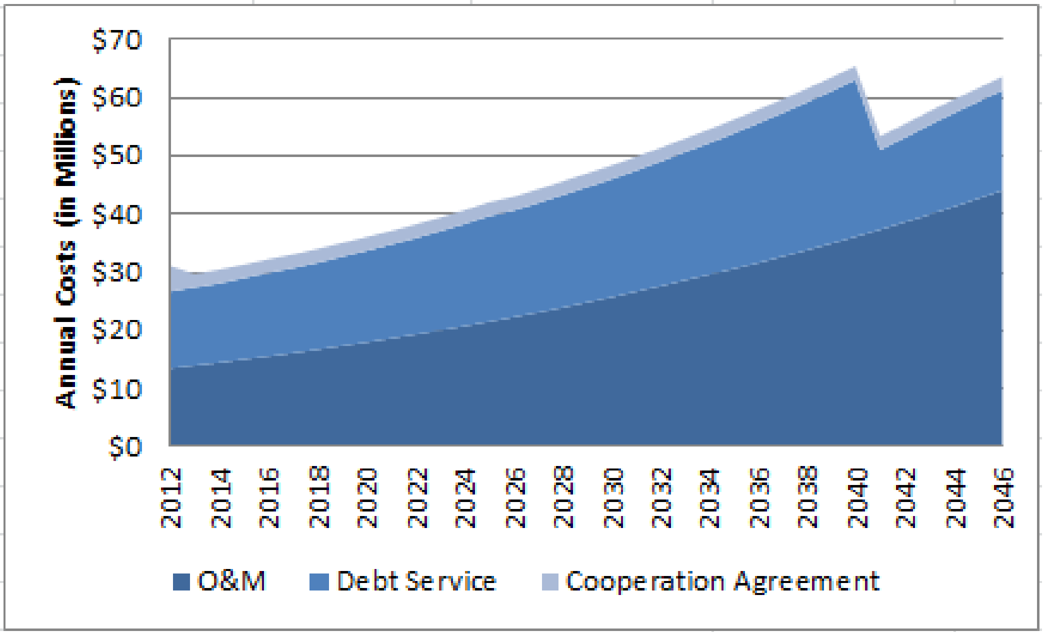

FIGURE 10-2. PROJECTED PWSA ANNUAL WASTEWATER COSTS FOR O&M AND DEBT SERVICE PAYMENTS WITHOUT WET WEATHER PLAN

10.3.12 PWSA Wastewater System Cost Projections Without the Wet Weather Plan

The ALCOSAN Draft Wet Weather Plan includes estimates for the impacts of a $1.5 billion program completed by 2026 on residential customers. As part of the analysis, an estimate of residential sewer costs without including the PWSA recommended wet weather projects was also provided. According to that analysis, the ALCOSAN cost per household is estimated to increase to nearly $400 annually by 2027.

10.3.13 Total Cost per Household without the Wet Weather Plan

The total cost per typical household in 2027 without the PWSA wet weather projects and without the ALCOSAN Wet Weather Plan would be approximately $600 annually. Over the time period, household income is projected to increase by 2.50% annually.[9] The PWSA median household income of $38,090 in 2012 would therefore increase to $55,166 in 2027. Dividing the total wastewater costs by the median

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[9] Income growth based on 1989-2009 Census Data which shows average income growth for the City of Pittsburgh and the nine other largest municipalities in the service area to be 2.5%, annually.

income yields a Residential Indicator of 1.1%. The projected costs per household without the wet weather projects for the planning period are shown in Table 10-18.

TABLE 10-18. RESIDENTIAL INDICATOR WITHOUT WET WEATHER PROJECTS

Year	RI	Cost Per Household			Median Household Income
		PWSA	ALCOSAN[10]	Total	
2012	1.0%	$139	$260	$399	$38,100
2027	**1.1%**	**$207**	**$398**	**$606**	**$55,100**
2046	1.2%	$297	$790	$1,087	$90,500

10.3.14 Revenue Requirement Impacts of the Wet Weather Plan

The total capital cost estimate for the recommended PWSA wet weather projects is approximately $170 million (2012 dollars).[11] The projected PWSA annual revenue requirements resulting from the implementation of these projects are presented in Table 10-19 and shown graphically on Figure 10-3. The total PWSA revenue requirement will increase by 50% by 2027, from $31 million without the projects to $67 million during the first full year of operation of the new wet weather facilities. This amount includes $15.8 million in debt service (not including related reserves) and an additional $5.5 million in incremental O&M costs (2027 dollars).

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[10] Section 11.5.3 of the ALCOSAN Wet Weather Plan

[11] $160.65 million (2010 dollars) detailed in Section 8 inflated by approximately 3.1% annual capital cost inflation to 2012 dollars.

TABLE 10-19. PWSA ESTIMATED ANNUAL WASTEWATER COSTS

Line Item	2012	2027	2046
Cooperation Agreement	$ 4,400,000	$ 3,200,000	$ 3,200,000
Operations and Maintenance	$ -	$ -	$ -
Current System	$ 13,500,000	$ 23,100,000	$ 44,100,000
Wet Weather	$ -	$ 5,500,000	$ 10,800,000
Stormwater	$ -	TBD	TBD
Other[12]	$ (400,000)	$ 500,000	$ 1,000,000
Subtotal	$ 13,100,000	$ 29,300,000	$ 56,200,000
Debt Service	$ -	$ -	$ -
Current Debt	$ 13,200,000	$ 13,600,000	$ -
Incremental Debt Service	$ -	$ -	$ -
Capital Improvement Plan	$ -	$ 5,200,000	$ 17,400,000
Wet Weather Plan	$ -	$ 15,900,000	$ 15,800,000
Subtotal	$ 13,200,000	$ 34,700,000	$ 33,200,000
TOTAL	**$ 30,700,000**	**$ 67,000,000**	**$ 92,300,000**

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[12] Negative value signifies a reduction in coverage amounts allowed by a reduction in the cooperation agreement amount from 2012 to 2013

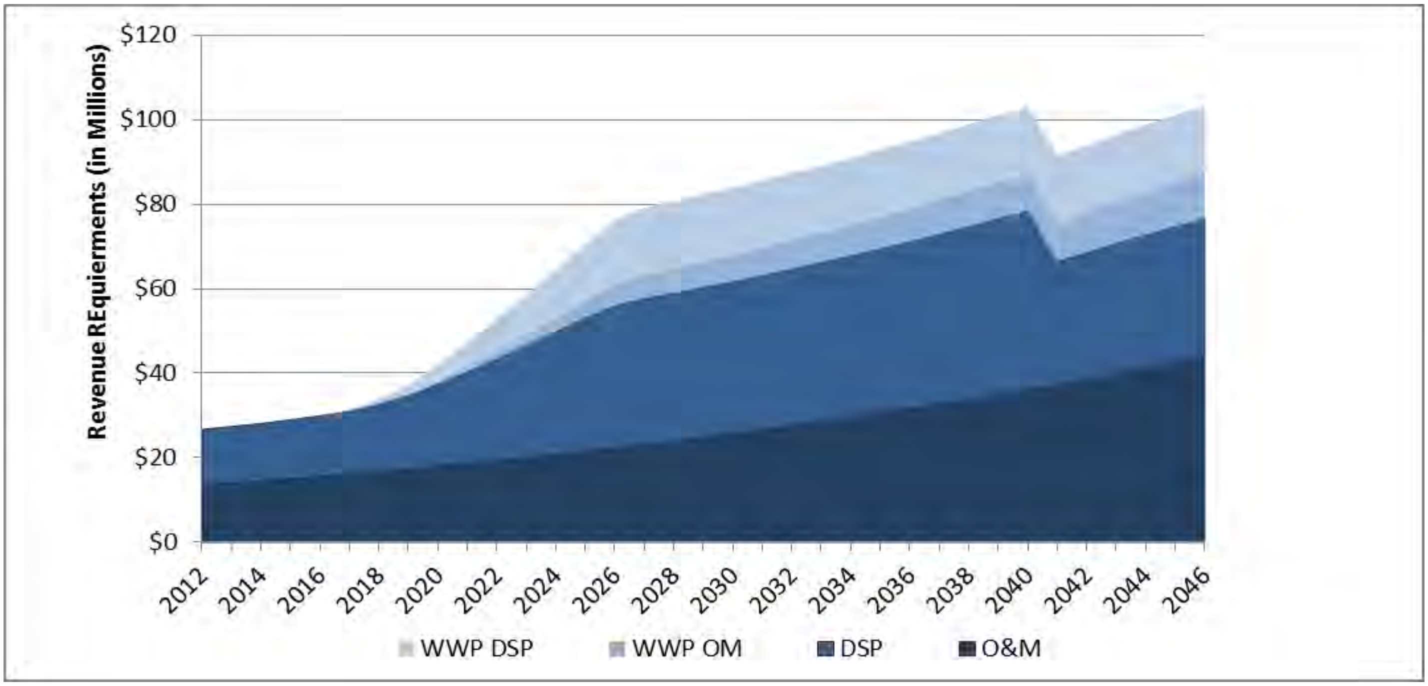

FIGURE 10-3. PROJECTED PWSA REVENUE REQUIREMENTS

10.3.15 Affordability Impacts of the Recommended Program

Projected Cost per Household. The projected costs per household resultant from the implementation of the PWSA Wet Weather Plan and ALCOSAN's Recommended Plan, which does not include all of the costs associated with ALCOSAN's Selected Plan, are shown through the 2046 planning period on Table 10-20. The total cost for PWSA customers will be tripled from a projected $399 for the current system to a total of $1,113 during the first full year of operation (2027 dollars). Projected PWSA cost per household will total $306, including about $98 for Wet Weather Plan improvements. The addition of the projected $808 in ALCOSAN to the projected $305 in PWSA system costs results in an estimated cost per household in 2027 of $1,113.

TABLE 10-20. PWSA CURRENT AND PROJECTED WET WEATHER PLAN ANNUAL COST PER HOUSEHOLD

Cost Per Household	2012	2027	2046
PWSA Cost per Household			
Current System Charges	$139	$207	$297
Wet Weather Plan Charges	$0	$98	$122
Stormwater	$0	TBD	TBD
Subtotal	$139	$305	$419
ALCOSAN Cost per Household [13]			
Subtotal	$248	$808	$1,219
Total Cost Per Household	**$387**	**$1,113**	**$1,638**
Median Household Income	$38,100	$55,200	$90,500
Residential Indicator	**1.0%**	**2.0%**	**1.8%**

Although PWSA is currently considering implementing a stormwater fee, it is anticipated that the bulk of this fee will be devoted to costs captured in the Wet Weather Plan. As such, inclusion of the anticipated stormwater fee would double count a portion of the burden on customers. Still, due to evolving stormwater regulations, it is anticipated that there will be an increased level of stormwater service in excess of that which is captured by Wet Weather Plan infrastructure. The cost of this increased level of service is unknown but will certainly increase the residential burden when the enhanced services are implemented.

The future cost of enhanced stormwater controls further support the need for integrated planning as well as adaptive management. Such efforts will allow PWSA to adapt to and mitigate the financial impacts of enhanced wastewater services on PWSA customers.

Projected Regional Residential Indicator. The current (2012) Pittsburgh median household income of $38,090 is projected to increase to $55,166 in 2027. Dividing the projected annual cost per household of $1,113 by the projected MHI results in a Residential Indicator of 2.02%, or a "high burden" based on the EPA Guidance criteria.

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[13] Section 11.5.5 of the ALCOSAN Wet Weather Plan

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2035, before declining again. The estimated Residential Indicator over time is shown on Figure 10-4.

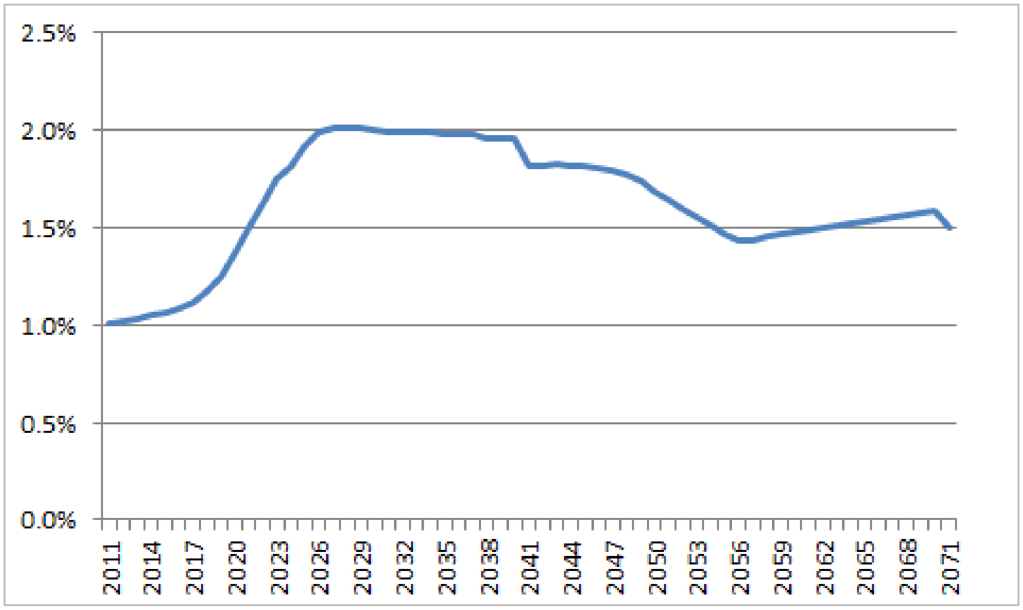

FIGURE 10-4. ESTIMATED RESIDENTIAL INDICATOR THROUGH 2046

10.3.16 Analysis of Impacts

Household Impacts. As shown in Figure 10-5, the implementation of the Wet Weather Plan and the related ALCOSAN improvements will result in a dramatic increase in the number of households within the PWSA service area for whom annual wastewater costs will constitute a high burden. The number of households in the service area with a high burden will increase from about 20,000 households in 2012 (15%) to more than 90,000 households in 2027 (68%). Over the same time period, the number of households with a low burden will decrease from around 43,000 (32%) to 4,000 households (2.8%).

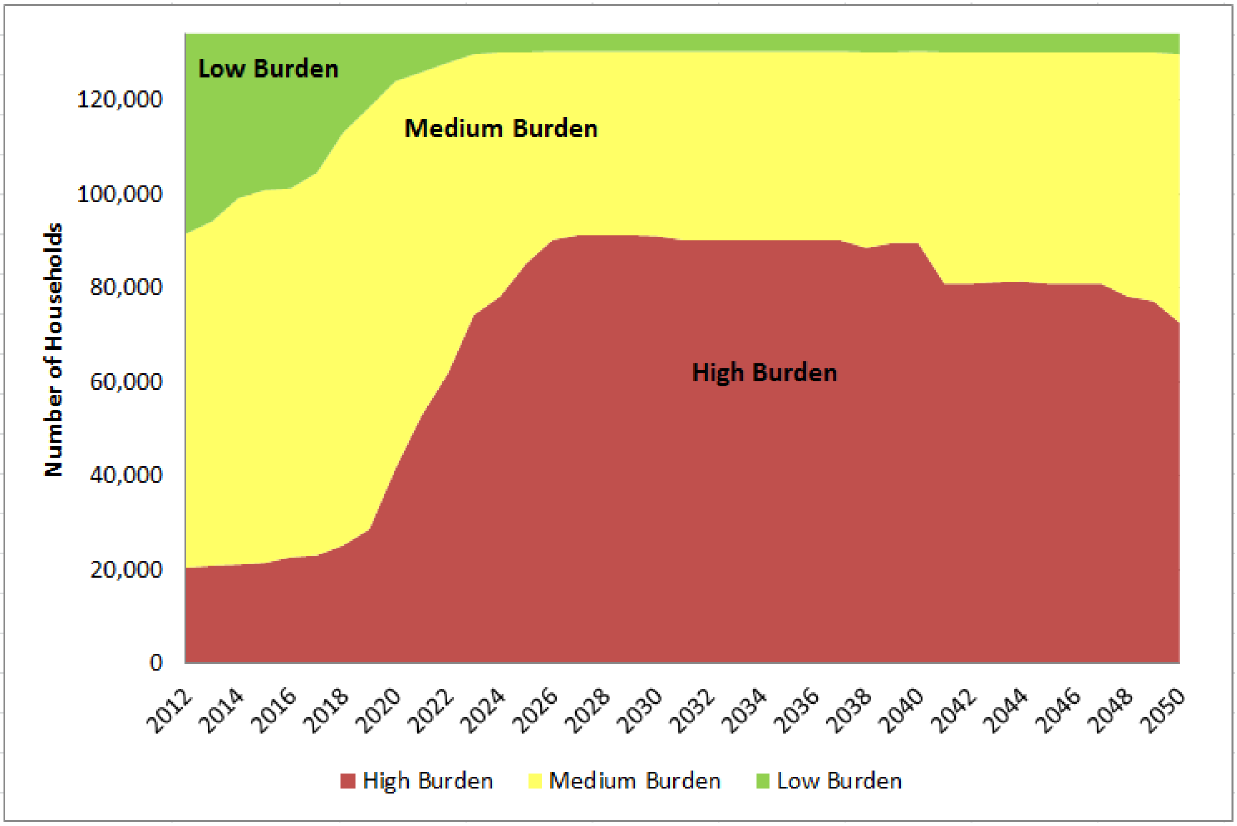

FIGURE 10-5. BURDEN LEVEL OF PWSA HOUSEHOLDS

The household impact can also be evaluated in terms of a cumulative frequency distribution of residential indicators across the service area, as shown on Figure 10-6. The relative number of households by residential indicator brackets (0%-0.5%, etc.) is also shown as well.

The data underlying Figure 10-6 reveal the following statistics relating to the impact of the Wet Weather Plan:

- The population weighted average RI, weighted by Census Block Group, for households with a high burden (RI > 2%) is projected to be 3.31%. This number, as distinct from the median, shows the disproportionately large impact higher sewer costs will have on lower income customers.
- The RI will exceed 2.5% of household income for approximately 139,400 residents within the city of Pittsburgh.
- The RI will exceed 3.0% of the household income for approximately 93,100 residents.

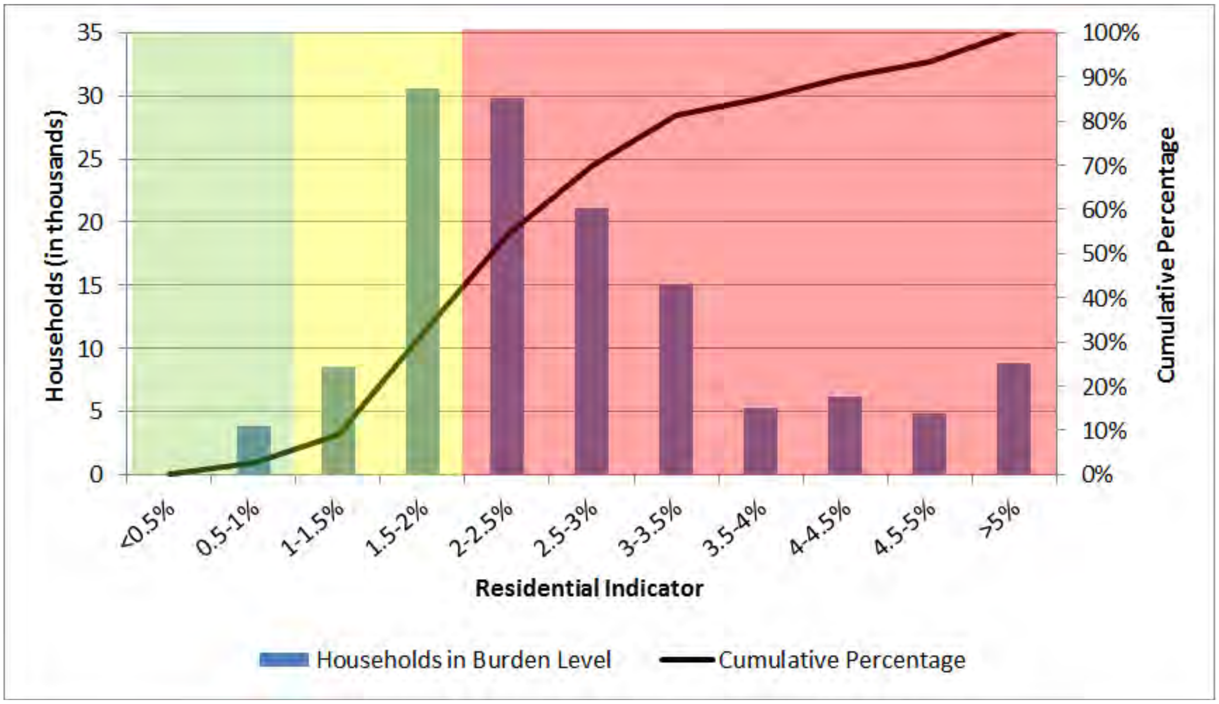

FIGURE 10-6. RESIDENTIAL INDICATOR CUMULATIVE FREQUENCY ANALYSIS (PROJECTED 2027)

10.3.17 Uncertainties

Key variables beyond PWSA's control reduce the accuracy of long-term financial projections. Through sensitivity analysis, PWSA has identified four factors that could materially affect the future residential indicator. These factors include: the residential share of wastewater costs, total capital cost, income growth, and bond interest rates.

Three scenarios were analyzed for each variable: default, best, and worst cases. The scenarios were used to determine the likely range of residential indicators that would result from a $160 million capital program, which escalated to 2012 dollars is $170 million. Table 10-21 displays the inputs used to generate the best, default, and worst case scenarios for the residential indicator. The isolated effect of each input variable on the residential indicator (in 2027) is shown in the last two columns. Changes in the income growth rate have the highest impact on the residential indicator, followed by residential burden and program capital costs.

TABLE 10-21. SENSITIVITY ANALYSIS VARIABLES

Variable Input	Default Case	Range Tested	Change in RI	
			2027 Best Case	2027 Worst Case
Residential Burden	61%	51% - 71%	-0.09%	0.09%
Income Growth	2.5%	2.10% - 2.70%	-0.07%	0.14%
PWSA Bond Interest Rate	6.0%	4.00% - 8.00%	-0.03%	0.03%
Capital Costs ($ millions)	170	112 - 240	-0.05%	0.09%

The capital cost range in the sensitivity analysis reflects a margin of error of +50% to -30% in the planning estimates from the Alternatives Costing Tool (ACT) which was developed by ALCOSAN and the Philadelphia Water Department (PWD).[14]

The default scenario results in a projected residential indicator of 2.02% for 2027 and 1.81% for 2046. A sensitivity analysis conducted on the best-case and worst-case scenarios for critical assumptions suggests a residential indicator range of 1.76% to 2.52% over the same time period. The range of potential residential indicators for a $170 million program estimate is shown in Figure 10-7.

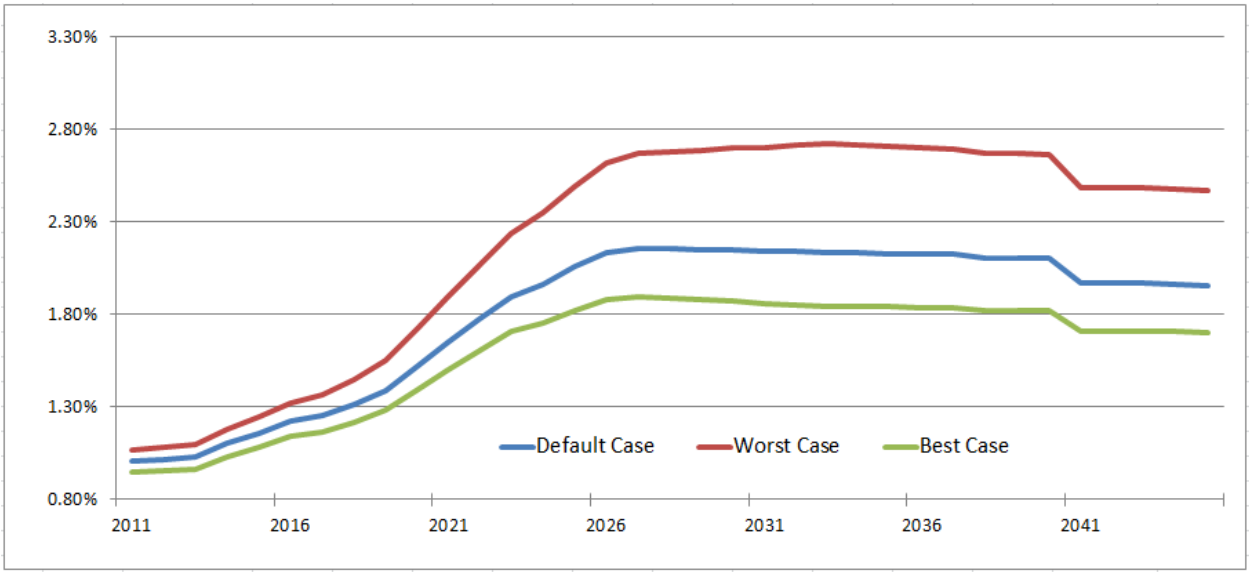

FIGURE 10-7. SENSITIVITY ANALYSIS RESULTS

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[14] Section 9.1.3 of the ALCOSAN *Wet Weather Plan*

As noted earlier, the ALCOSAN plan cost and timeframe is a significant uncertainty. For the sensitivity analysis, the ALCOSAN WWP is assumed to cost $1.5 billion and be completed by 2026 for all scenarios. For every $100 million increase in the cost of the ALCOSAN program (with no change in schedule), the 2027 PWSA residential indicator increases by 0.05%. Therefore, if the ALCOSAN program requirement reaches $3.1 billion, as some alternative Wet Weather Plans showed, the residential indicator for PWSA customers would increase by an additional 0.8% to nearly 3%.

10.3.18 Forecasted Financial Capability Assessment

In the Financial Capability Assessment, the Bond Rating Indicator and the Property Tax Collection Rate Indicator were determined to be near the threshold between a "mid-range" rating and a "weak" rating. Each indicator is likely to be adversely affected during the period of the Wet Weather Feasibility Study.

The Property Tax Collection Rate is likely to be adversely affected due to the Wet Weather Plan because of the burden it places on customers. It may be more difficult for the City of Pittsburgh to collect revenue and property taxes as customers begin to pay more in sewer costs.

The bond ratings of PWSA and the City of Pittsburgh may be adversely affected due to current debt levels combined with the additional borrowing necessary for the Wet Weather Program. The additional debt generated by the Wet Weather Feasibility Study may also increase the debt burden of the City of Pittsburgh.

Therefore, the impact of the PWSA Wet Weather Feasibility Study is likely to diminish the future financial capability of the City of Pittsburgh and PWSA. Even under ideal conditions, the average Financial Capability Indicator is not anticipated to improve beyond its current "mid-range" score.

Implementing the Wet Weather Feasibility Study and the related ALCOSAN improvements is anticipated to result in a Residential Indicator above 2%. The 2012 Financial Capability Score (see Table 10-16) of 1.5 under current conditions falls into the bottom of the EPA "mid-range" and is at the threshold for a "weak" rating. The Wet Weather Program could easily push the Financial Capability Score below the "weak" threshold due to the increased risk to bond ratings as well as to tax collection rates. Therefore, the overall matrix score is "high burden," as shown in Table 10-22.

TABLE 10-22. POST IMPLEMENTATION FINANCIAL CAPABILITY MATRIX

	Residential Indicator (Cost Per Household as a % MHI)		
Financial Capability Indicators	**Low (<1.0%)**	**Mid-Range (1.0 - 2.0%)**	**High (>2.0%)**
Weak (<1.5)	Medium Burden	High Burden	High Burden
Mid-Range (1.5 - 2.5)	Low Burden	Medium Burden	High Burden
Strong (>2.5)	Low Burden	Low Burden	Medium Burden

In this table, dark red indicates burden level with the current Financial Capability Scores, and lighter red represents the likely future score based on the effects of implementing the PWSA wet weather plan projects.

10.3.19 Alignment with the ALCOSAN Selected Plan

The affordability analysis uses figures from the ALCOSAN "Recommended" Plan, which specifies a $1.5 billion program to be completed in 2026. However, the completion of the entire PWSA Wet Weather Feasibility Study is dependent on the completion of ALCOSAN's Wet Weather Program improvements, which are not covered entirely by the 2026 Recommended Plan. The ALCOSAN "Selected" Plan covers all wet weather improvements, and specifies a $3.1 billion program ending in 2046, therefore necessitating a timeline past 2026.

The PWSA affordability analysis presented above assumes that PWSA's Wet Weather Plan will be completed during the same time frame as the ALCOSAN Recommended Plan. However, if the analysis takes into account greater detail regarding ALCOSAN WWP construction, the duration of the PWSA capital plan is likely to go beyond 2026 (see Section 13 of this Wet Weather Feasibility Study). Figure 10-8 shows the dramatic increase in the RI that results from assuming construction the ALCOSAN Selected plan (completed by 2046) and an extension of the PWSA construction timeline beyond 2026, to accommodate construction of the Saw Mill Run improvements.

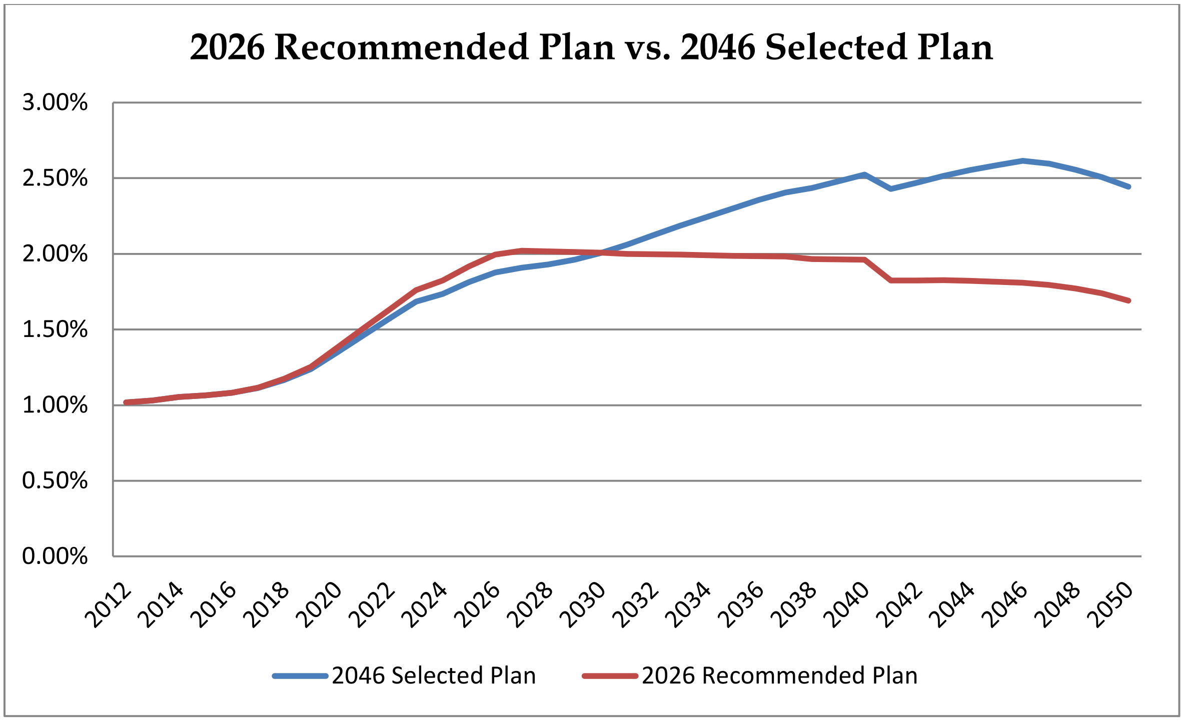

FIGURE 10-8. COMPARISON OF RI FOR PLANNING PERIODS

The maximum RI produced by the affordability analysis performed based on the ALCOSAN 2026 Recommended Plan and PWSA construction ending in 2026 is 2.02%. The maximum RI increases to 2.62% when the analysis is changed to reflect the ALCOSAN Selected Plan and an extended construction schedule for PWSA to construct its improvements in alignment with ALCOSAN's implementation of its Selected Plan.

Section 11 Stakeholder Involvement

Sewer system infrastructure is for the most part invisible; most sewer system customers do not think about the sewer infrastructure that lies beneath the ground as long as the water and waste drains away. Thus it is important to raise public awareness of the PWSA sewer infrastructure needs so that public support of capital improvement projects can be achieved. Stakeholder involvement and public awareness also provide a mechanism to ensure that the affected public, rate payers, and system users understand the regulatory and environmental "drivers" for undertaking the chosen plan, as well as the economic impact that its implementation will have on the region. Municipal coordination is required within multi-municipal sewersheds to inform and solicit input from the tributary communities in the feasibility study development process.

PWSA's continuing goals are to promote stakeholder involvement and undertake a municipal coordination initiative to ensure: 1) that all federal, state, and local regulatory requirements for municipal cooperation are met, 2) develop an understanding within the customer and stakeholder base of the need to implement a capital plan, 3) work with tributary municipalities throughout the development of the feasibility study, and 4) foster support for the implementation of the chosen plan.

In addition to coordination in activities facilitated by 3RWW, PWSA participated in stakeholder groups formulated as part of ALCOSAN's public outreach and municipal coordination. Participation in these efforts supported municipal coordination activities that were required by ALCOSAN's Consent Decree. Coordination through 3RWW and ALCOSAN forums capitalized on these opportunities to share resources and provide a cost-effective stakeholder involvement program.

11.1 PARTICIPATION IN 3RWW STAKEHOLDER GROUPS

Federal and state Consent Orders require cooperation among PWSA, its tributary municipalities, and ALCOSAN during development of a comprehensive regional solution to wet weather overflow pollution problems. To facilitate this effort and promote stakeholder involvement, 3RWW established various groups and forums to bring together elected officials and municipal/authority managers and engineers. 3RWW stakeholder groups, such as the Feasibility Study Working Group (FSWG) and meetings regarding POC sewershed coordination, heavily aided in the municipal cooperation and coordination process.

PWSA utilized these 3RWW forums to disseminate and solicit information among PWSA, the stakeholders, and tributary communities. Beginning in 2012, POC sewershed coordination meetings were held to review system improvements proposed by the PWSA. General topics discussed at these meetings included:

- Source reduction and green infrastructure
- Site and technology selection
- Alternatives analysis
- Affordability and implementation schedule

The focus of subsequent meetings, through 2013, centered on the consolidation of multi-municipal POC-based Feasibility Studies into a single report. 3RWW took the lead in developing the POC reports, and continued to coordinate efforts to get PWSA and their tributary municipalities together for discussion. Fostering consensus among participants was the intent, and the following meetings topics were discussed:

- Proposed level of control
- Verification/agreement of the proposed alternative
- Cost allocation
- Development of a memorandum of understanding (MOU)

Section 7 of the individual POC reports includes a detailed list identifying date, time, and location of POC sewershed coordination meetings where PWSA was a major participant and discussion centered on the subject POC. Another forum facilitated by 3RWW, which was utilized by PWSA to communicate with its stakeholders and local municipal representatives, included PWSA's attendance and presentations given at annual 3RWW sewer conferences.

11.2 STAKEHOLDER AND PUBLIC INVOLVEMENT OVERVIEW

While municipal cooperation is mandated by both state and federal Consent Orders, and stakeholder involvement is encouraged, PWSA also considered it important to engage with the public and convey information on wet weather planning and receive feedback. PWSA's public involvement process included presentations to city council and various stakeholder groups. These presentations were made available to the public by means of cable television and presentation slides accessible on the City of Pittsburgh's City Council website. PWSA also presented at and attended the annual 3RWW sewer conferences, which are open to the public. These initiatives were designed to inform as well as solicit input from and engage stakeholders. From 2003 through the present, various workshops and speaking forums, identified as public involvement presentations, were undertaken by PWSA. These demonstrations included CSO planning workshops, and presentations to the ACHD, PaDEP, ALCOSAN, and technical panels. Topics presented included flow and water quality monitoring, collection system modeling, the PWSA Long-Term Control Plan, and the Municipal Feasibility Study.

11.3 TRIBUTARY MUNICIPALITY COORDINATION

PWSA led a series of Wet Weather Feasibility Study coordination meetings with most of the contributing municipalities that are within each multi-municipal sewershed. These meetings with the contributing municipalities were utilized to discuss the information and findings in each of the respective POC feasibility studies. The planning information discussed was provided to each of the municipalities prior to the submission of the information to ALCOSAN per ALCOSAN's request by the end of July 2012. Table 11-1 lists the subject POC, sewershed discussed and the tributary municipalities invited to the Wet Weather Feasibility Study coordination meetings. All meetings were held at the PWSA office.

11.3.1 Green Infrastructure Charrettes

The City of Pittsburgh, like its neighboring municipalities and cities across the nation, is faced with the challenge of how to address the overflow of sewage into its rivers during wet weather events. Traditional gray infrastructure has been the go-to solution to date. Increasingly though, cities are turning to the natural ability of environmental systems to help reduce the flow of stormwater, and thus combined sewer overflows. However, as with any new approach or technology, many challenges exist with understanding how to effectively implement green infrastructure, and this is certainly true in Pittsburgh. That is not to say that solutions to those challenges don't exist; rather, they are not currently embedded within the institutions traditionally tasked with dealing with stormwater and wastewater systems.

TABLE 11-1. WET WEATHER FEASIBILITY STUDY COORDINATION MEETINGS

POC	Sewershed	Municipalities	Date	Time
M-34	Becks Run	Baldwin Borough, Mt. Oliver Borough	3/13/12	1:30 PM
M-42	Streets Run	Baldwin Borough, West Mifflin Borough	3/13/12	1:30 PM
C-25	Bells Run	Crafton Borough, Green Tree Borough	3/20/12	1:30 PM
A-42	Negley Run	Municipality of Penn Hills	3/27/12	1:30 PM
M-47	Nine Mile Run	Edgewood Borough, Municipality of Penn Hills, Swissvale Borough, Wilkinsburg Borough	3/27/12	2:15 PM
S-15	McDonoughs Run	Baldwin Township, Dormont Borough, Municipality of Mt. Lebanon	4/10/12	1:30 PM
MH-18	Little Saw Mill Run	Dormont Borough, Green Tree Borough, Municipality of Mt. Lebanon, Scott Township	4/10/12	2:15 PM
SMRE-40	Plummers Run	Dormont Borough	4/10/12	3:00 PM
A-51	East Street	Ross Township, Reserve Township	4/24/12	1:30 PM

Therefore, at the behest of Mayor Luke Ravenstahl and the Honorable Daniel Deasy, the City of Pittsburgh and the PWSA turned outwards to various stakeholders, including professors and researchers, architects and engineers, and environmental non-profit practitioners who live and work in the City of Pittsburgh, for help. They also reached out to national experts and international colleagues to help inform the discussion.

The "Greening the Pittsburgh Wet Weather Plan" Charrette Project was developed in early 2013 with the primary objective to develop a consensus approach to reviewing, recommending, and incorporating a plan for the implementation of green stormwater infrastructure technologies and policies into the PWSA Wet Weather Feasibility Study.

The project was comprised of three charrettes designed to identify green infrastructure opportunities, associated benefits and concerns, and the legal, institutional, and financial issues. From February to April 2013, three charrettes were held to explore these topics. Overall, 125 independent individuals/stakeholders participated, representing a diverse array of public, private, and non-profit organizations. Each charrette had nearly equal representation from all three sectors. These individuals collectively donated over 1,000 hours of their time to assist PWSA in its effort to better understand the challenges and opportunities associated with green infrastructure. The attendance for all three charrettes is summarized in Table 11-2.

TABLE 11-2. CHARRETTE STAKEHOLDER ATTENDANCE

Charrette Stakeholder Attendance				
Charrette	**Public Sector**	**Private Sector**	**Non-Profit Sector**	**Total**
1	35	23	29	**87**
2	34	21	24	**79**
3	21	23	22	**66**

The first charrette was held February 15, 2013, and featured presentations from PWSA and their partners on the wet weather planning process, how green infrastructure would be included in the plan, and how other cities have successfully implemented green infrastructure. These presentations served to ensure that participants were knowledgeable about the wet weather planning process and about what is possible, based on the experience of other cities. The presentations were followed by energetic small-group conversations about what green infrastructure technologies would be best suited for public, large-scale private, and residential land uses. Many participants reported afterwards that this was the first time that they were part of such diverse and solutions-oriented conversations about green infrastructure.

Due to participants' interest in the institutional challenges to green infrastructure, the second charrette, which was held March 21, 2013, featured a panel of key regional leaders, moderated by Bill Flanagan of the Allegheny Conference on Community Development, and included:

- Bob Hutton, GIS Project Coordinator, PWSA

- Jan Oliver, Director of Regional Conveyance, ALCOSAN
- Dan Sentz, Environmental Planner, City of Pittsburgh
- Rob Kaczorowski, Public Works Director, City of Pittsburgh
- Michelle Buys, Environmental Engineer, ACHD
- Cheryl Moon-Sirianni, P.E., Assistant District Executive for Design, PennDOT District 11
- Brenda Smith, Executive Director, Nine Mile Run Watershed Association
- Todd Reidbord, President, Walnut Capital (Developers of Bakery Square)

Each of the panelists discussed his or her organization's role relative to green infrastructure, and what they saw as their main barriers and opportunities associated with implementing green infrastructure. PWSA's Bob Hutton concluded the panel discussion by summarizing that green infrastructure will be successful in Pittsburgh if there is collaboration and commitment, that we have to believe in it, identify opportunities, and make it happen! Following the panel, participants worked with panelists in small groups to discuss those barriers and possible solutions, in greater detail. A second working group that afternoon focused on identifying possible pilot projects at specific locations in Pittsburgh. Equipped with several maps, participants discussed types of green infrastructure technologies, locations, and socio-political considerations for projects in several watersheds.

Finally, the third charrette was held on April 4, 2013, and featured an in-depth presentation about the green infrastructure section of PWSA's Wet Weather Feasibility Study (see Section 9 of this Wet Weather Feasibility Study), with some high-level suggestions of the types of short-term actions that would be taken to further inform PWSA's decision making process, such as the creation of a task force and implementation of pilot projects. The presentation also highlighted both the adaptive management approach, which focuses on monitoring and regular assessment/evaluation to inform future actions, and the Integrated Watershed Management approach, which would establish a process to provide flexibility to meet broader water quality requirements through the most cost-effective and beneficial means. Again, two working groups allowed participants to react to and expand upon what was presented. For the first working group, participants discussed what was exciting to them about the green infrastructure section and the adaptive management approach, as well as what was missing and what concerns they had. The second working group focused on how PWSA could partner with other organizations to implement what was outlined in the green infrastructure section. The charrette concluded with a presentation about the similarities and differences of implementing green infrastructure in France.

Additional details on the charrettes, including challenges, findings, and recommendations are summarized in a detailed report found in Appendix B. Charrette discussion topics that are more technical in nature are presented in the Wet Weather Feasibility Study, Section 9.

11.4 PARTICIPATION IN ALCOSAN STAKEHOLDER GROUPS

ALCOSAN created various stakeholder groups under their public participation and municipal coordination programs that were responsible for fostering a consensus-based planning process as well as a stakeholder-supported wet weather plan. PWSA committed to its direct and continuing involvement and cooperation with these stakeholder groups. They provided a forum or conduit for PWSA to convey its constituencies' thoughts and concerns to ALCOSAN so that the best interests of the PWSA and its rate payers were reflected in the regional plan. PWSA had an active role in the Customer Municipality Advisory Committee (CMAC) providing municipal feedback during ALCOSAN’s planning process. Information such as Preliminary Flow Estimates (PFEs), municipal planning information and proposed wet weather capital solutions and costs, was disseminated and discussed at Basin Planning Committee meetings facilitated by ALCOSAN, where the PWSA was a vital participant. PWSA and its representatives attended ALCOSAN public meetings and benefited from these opportunities to share public and municipal information and resources. PWSA’s participation in ALCOSAN stakeholder groups, a part of both entities stakeholder involvement programs, was essential to developing a regional plan as well as developing the PWSA Feasibility Study.

Section 12 Integration of Selected Alternatives

The selected PWSA system improvements listed in Section 8 of this Wet Weather Feasibility Study (WWFS), along with green initiatives that may be adopted as described in Section 9 of this WWFS, are intended to meet the requirements of the COA. They also need to be implemented in conjunction with the system-wide Wet Weather Plan (WWP) recommended by ALCOSAN to meet their CD requirements. This section describes how the recommended improvements will tie into the ALCOSAN Wet Weather Plan (Referred to as the Regional Wet Weather Plan or WWP). Also, integration with tributary municipalities for sewersheds and improvements whose flows discharge through the PWSA systems is discussed. This including the MH-89, or Weyman's Run, sewershed for which Whitehall assumed the lead municipality role.

12.1 INTEGRATION WITH THE REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations. In general, the PWSA municipal improvements are upstream of the ALCOSAN POCs and are designed to increase flow capacity in the system tributary to the POC. The ALCOSAN improvements generally start at the ALCOSAN POC and are intended to allow the potentially larger volumes of wastewater to drain into the new ALCOSAN system while reducing the total amount of overflow volumes to meet water quality requirements.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan," consists of a Wastewater treatment plant improvements; a regional tunnel that generally extends parallel to the existing interceptor up the Allegheny, Monongahela, and Ohio Rivers; cross-connections between the regional tunnel and existing interceptor; parallel relief sewers and a storage tank along Chartiers Creek; parallel relief sewers along Saw Mill Run; storage tanks along Turtle Creek; and all the tributary municipal improvements implemented.

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the "Selected Plan" to meet the Consent Decree requirements, ALCOSAN acknowledges challenges that would prevent the implementation of the complete plan by 2026, which is the deadline specified in the ALCOSAN Consent Decree. Consequently, ALCOSAN proposes the implementation of an “initial phase” of the Selected Plan by 2026. ALCOSAN calls this initial 2026 phase the “Recommended Plan”. An implementation schedule of the remaining portions of the “Selected Plan” would happen after 2026 and is specified in the Regional WWP. The Recommended plan contains a portion of the intended Wastewater Treatment plant improvements, shorter tunnels along the Allegheny River Segment, Monongahela River Segment, and the Ohio River Segments of the regional tunnels, and a RTB and shorter relief sewer (Chartiers Creek Segment) upstream of the RTB in Chartiers Creek. The Recommended Plan does not include the new parallel relief sewer along Saw Mill Run, or the full extent of the regional tunnels along the rivers.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the “Recommended Plan” by 2026 and ultimately the “Selected Plan” through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank, or other means. This is intended to allow a large portion of the overflow to drain directly into the new wet weather facilities, which would reduce or eliminate the amount of overflows discharging to receiving water and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems are intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed.

Table 7-5 lists the POCs that will have their POCs that have connections to the ALCOSAN control alternatives downstream according to the WWP. The table identifies what type of ALCOSAN control is downstream of the POC for both the Selected Plan and the Recommended 2026 plan. is connected to according to the WWP, and if the POC contains proposed municipal system improvements per this Feasibility Study.

12.2 INTEGRATION WITH NEIGHBORING MUNICIPALITIES

There are 10 sewersheds within the PWSA service area for which improvements are being recommended that have drainage contributions from neighboring municipalities. The recommended alternatives for each POC identified in Section 8 of this WWFS are sized to accommodate those flows. Inter-municipal cost sharing agreements will have to be reached with all the affected municipalities. Alternatives have been recommended based on the PWSA analysis. Facilities that are shared between the City of Pittsburgh and the tributary municipality(s) will be financed jointly, and facilities completely outside of the City of Pittsburgh will be financed by those affected municipalities. PWSA met with and provided copies of the interim reports to the affected municipalities in order to solicit input from those municipalities regarding the alternatives and recommendations. PWSA also attended a number of meetings that were held by representatives of the tributary municipalities and 3RWW at which planning for these sewersheds was discussed. Comments received from the tributary municipalities were incorporated into the recommendations.

The component summary tables for each alternative are presented in Section 5 of each of the POC reports. The component summary tables include which municipalities have portions of the alternative contained in them. Each portion of a municipal alternative is necessary to eliminate surcharging and flooding in the system within that sewershed up to the 2-year design storm and either 4 or 0 overflows per year depending on the sewershed.

It is important to note that there currently are studies in progress in the City of Pittsburgh that are investigating flooding conditions in the A-42 sewershed. These studies may recommend other sewer improvements designed for larger storms. Ultimately, the preliminary improvements presented in this document may be modified to incorporate those recommendations. It is anticipated that future improvements to the ALCOSAN facilities will increase the capacity of the diversion chambers and downstream piping sufficiently to eliminate backwater effects in the PWSA trunk sewers.

The MH-89, Weyman's Run, sewershed extends into Castle Shannon Borough, Whitehall Borough, and Brentwood Borough, with a small portion of the PWSA service area contributing to the sewershed. Through discussions with those tributary municipalities, it was agreed that one of those upstream municipalities, Whitehall Borough, take the lead in submitting the draft feasibility study. Any cost sharing agreements between the affected municipalities, including the City of Pittsburgh, would be discussed in that feasibility study.

Section 13 Implementation Plan

This section provides an implementation plan and schedule for the recommended alternatives in this Feasibility Study. It includes the development and result of the implementation schedule, how the municipalities are to coordinate with PWSA during implementation, regulatory compliance and coordination tasks, and a discussion on the post construction monitoring and reporting activities.

It is noted that a detailed implementation schedule cannot be developed until a mutually acceptable final plan of action for the regional (ALCOSAN) Wet Weather Plan is formalized. However, given basic assumptions for the type, complexity, and magnitude of construction being recommended in this and the regional WWP, and experience with similar projects being implemented elsewhere, a conceptual project timeline can be developed. More detailed and refined sequencing, scheduling, and construction methods will be developed as details of the regional plan are finalized.

13.1 IMPLEMENTATION SCHEDULE

This section presents the implementation schedule for the PWSA recommended improvements from Section 8 of this Wet Weather Feasibility Study (WWFS). It includes the projects and tasks required for implementation, and the factors considered to sequence the projects in order to implement the proposed facilities by the earliest feasible date. Appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks were derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible. Affordability was taken into consideration by balanced distribution of the costs of the POC specific and system-wide projects via phases. Inclusion of the adaptive plan management and the Act 537 submittal obligations were also considered in the schedule development process and explained in this section. The schedule also assumes the period for review of the PWSA Feasibility Study ends in July 2014, one year after submission of the FS to the regulatory agencies.

13.1.1 Project Parameters

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and Public Coordination
- Preliminary Design (includes siting and property acquisition)
- Final Design
- Permitting
- Public Bid / Contract Award
- Construction
- Commissioning and Project Closeout

Funding and Public Coordination. The estimated project cost associated with recommended system-wide alternatives demand that non-traditional as well as traditional funding sources and alternatives be explored. As a minimum, the phasing of any funding program for this project should be considered. A summary of funding alternatives that could be considered for this project is explained in Section 10 of this Wet Weather Feasibility Study.

Although funding options for the selected alternative may be limited, all available options should be investigated. For this reason, it is typical to allocate time within the project schedule for investigating funding alternatives in order to develop an acceptable financing program or strategy so that the project can be implemented. While the funding phase of the project can overlap other phases, such as preliminary design, for the purposes of this study, it is recommended that six months be inserted into the conceptual project timeline as a placeholder for the funding phase. If the funding phase overlaps other project phases, consideration should given to interim financing in order to fund on a short term basis the early development phases of the project.

Public coordination is an important step in the selection of improvements for the study area. Opportunities should be provided for public comment through a proactive outreach program consisting of meetings and information distribution through such means as newsletters and published documents. This coordination is usually performed in conjunction design and construction and can last up to six months. For the purpose of this study, the public coordination is assumed to be performed in conjunction with the Funding Task.

Preliminary Design, Siting, and Property Acquisition. Preliminary design typically involves the sizing, layout, siting and design of facilities to a 30% level of completion. The preliminary design phase allows the project team to investigate, discuss, and finalize locations for major project components as well as identify potential utility conflicts resulting in the need for possible utility relocations. Other major design factors that may be considered during the preliminary design phase would include ease (or difficulty) of soil removal, potential noise pollution associated with construction activities, construction impacts to neighborhoods, and an evaluation of environmental factors in order to minimize project impact to the environment. The preliminary design should also result in a more refined project cost estimate.

During the preliminary design phase, the availability of property and easements for project components, such as storage tanks and new pipe construction, should be investigated. The time required for acquisition of selected sites is a variable that is difficult to predict; however, during the preliminary design phase, options for the purchase of properties should be secured so that access to the properties can be obtained. Final acquisition of properties can proceed and overlap other project phases such as final design.

It is recommended that a maximum of nine months be allocated for this phase of each specific project.

Final Design. The final design phase typically involves the completion of construction plans and specifications, development of public bid and contract documents, final utility coordination, and the identification and development of all required permits. It is recommended that a maximum of nine months be allocated for final design for each POC.

Permitting. Contact with the Pennsylvania Department of Conservation and Natural Resources (DCNR) is required to determine if plant or animal species of special concern, such as endangered species, are located within the study area. If there is any temporary work within the rivers, coordination with the Army Corps of Engineers may be necessary. Additional permits that may be needed include, but are not necessarily limited to, highway occupancy permits for work associated with any consolidation sewers, soil erosion and sedimentation control plan approvals through county and state regulatory agencies, railroad crossing permits, occupancy permits from the Port Authority of Allegheny County, and construction permits from the PaDEP. The deed for each property under which new pipe construction crosses will require investigation as to whether it includes mineral rights where the property owner owns all of the minerals beneath his or her property.

The development of permit applications can be performed during the final design phase; however, submission of permit applications to regulatory agencies may not occur until or near the final stages of the final design phase. Therefore, permit application review, comment and approval time must be taken into account. ACT 537 compliance obligations, which is described in Section 12.1.5 is also included in this task. It is recommended that a maximum of six months be allocated at the end of each final design phase for the submission, review and approval of permits.

Public Bid / Contract Award Phase. Typically, the public bidding period for public works projects is a minimum of 30 calendar days; however, consideration should be given to as much as a three-month public bidding period. Compliance with the Commonwealth of Pennsylvania separations of trades regulations will result in a number of Construction Contracts that will extend the time required for detailed review of bids received, analysis of bidder qualifications to perform the work for which they are bidding on, and financial analysis of low bidders in order to assure that they have the financial ability to complete the anticipated work. Therefore, an additional three months should be added to each public bid/award phase thereby resulting in a total of six months for public bidding and award of construction contracts. Based on this information and for the purpose of developing this preliminary implementation plan, it is estimated that each bid cycle will take a maximum of six months.

Construction Phase. Each of the 14 sewershed projects can be constructed independent of each other. Many variables must be considered when selecting an appropriate time period for construction of the anticipated facilities. Some examples include the following:

- Some facilities can be constructed concurrently. For example, in A-42, the storage tank can be constructed while the new parallel relief sewer is being constructed.

- The relocation of utilities must be considered during the construction phase. The project sites may contain a number of utilities, ranging from individual lines that service private property to major trunk lines that provide coverage to a broad area. Major utilities may include sewer, water, telephone, electric, natural gas, and steam facilities that are located within tunnel alignments and the consolidation sewer systems. Cable television lines typically share the same locations as electric and telephone facilities.
- Excavated material will need to be tested in accordance with guidance from the U.S. Environmental Protection Agency. This material cannot be placed in sensitive areas such as wetlands, floodplains, parklands or historic sites.
- A general order of construction within each sewershed with improvement recommendations is described as follows:
  - Storage tank construction or sewer separation;
  - Downstream to upstream construction of trunk sewers and associated diversion structure modifications; and
  - Downstream to upstream construction of tributary sewers

In general, the storage tank (for example in A-42) and the sewer separation work can be constructed independently from the proposed relief sewer and sewer expansion within the sewershed. A storage tank stores excess flow from its tributary area and relieves the flow back into the sewer system when sufficient capacity is available. Sewer separation results in removal of wet weather flows from the combined sewer reducing the flow in the main sewer. Neither of these methods adds flow or increases the HGL within the system and may actually reduce the HGL downstream. Thus, it is recommended that these storage and separation projects be constructed first, and then note the response of the system and possibly re-evaluate the need for further system improvements.

The trunk sewers from the POC should be constructed before the tributary sewers to ensure sufficient capacity is available within the trunk sewers to collect the potentially higher flows from the tributary sewers. It is also recommended to construct in the downstream-to-upstream direction for the same reason.

A time of approximately two years should be allowed for the construction period of each POC.

Commissioning and Project Closeout. This phase of a project typically involves final inspection of the completed work, testing of mechanical systems, reviews of project documentation (record drawings), project audit (if required), and official acceptance and transfer of the completed work to the Owner. Portions of the commissioning and project closeout phase can commence during the final construction stages; however, it is recommended that up to six months be allocated after construction is completed for project closeout.

13.1.2 Regional Wet Weather Plan Coordination

The proposed complete regional WWP, referred to in ALCOSAN's plan as the "Selected Plan," consists of wastewater treatment plant improvements, a regional tunnel that generally extends parallel to the existing interceptor up the Allegheny (Allegheny River Segment), Monongahela (Monongahela River Segment), and Ohio (Ohio River Segment) Rivers, cross-connections between the regional tunnel and existing interceptors, parallel relief sewers (Chartiers Creek Segment) and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the tributary municipal improvements implemented.[1]

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the "Selected Plan" to meet the Consent Decree requirements, ALCOSAN acknowledges challenges that would prevent the implementation of the complete plan by 2026, which is the deadline specified in the ALCOSAN Consent Decree. Consequently, ALCOSAN proposes the implementation of an "initial phase" of the Selected Plan by 2026. ALCOSAN calls this initial phase the "Recommended Plan." An implementation schedule of the remaining portions of the "Selected Plan" would occur after 2026 and is described in the Regional WWP. The Recommended Plan contains a portion of the intended wastewater treatment plant improvements, portion of the tunnels along the Allegheny River Segment, Monongahela River Segment, and the Ohio River Segments of the regional tunnels, and a retention treatment basin (RTB) and shorter relief sewer (Chartiers Creek Segment) upstream of the RTB in Chartiers Creek. The Recommended Plan does not include the new parallel relief sewer along Saw Mill Run, or the full extent of the regional tunnels along the rivers.

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[1] ALCOSAN *Draft Wet Weather Plan*; January 2013; Section 9

The current ALCOSAN WWP plan includes a schedule that shows the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/agency.

In developing the schedule, the sequencing of the POC specific projects was synchronized with the regional WWP wherever possible. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it is important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended to have the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to realize the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements coinciding closely the ALCOSAN capacity improvements within the portion ALCOSAN is constructing.

This consideration helped guide the selection of implementation dates of each POC to coincide with ALCOSAN capacity improvement implementation downstream of the respective POCs. According to the ALCOSAN WWP, the Allegheny River Segment of the regional tunnel is being constructed between 2021 and 2024. Therefore the construction portion for A-51 and A-42 would occupy the same time period. The Monongahela River Segment of the regional tunnel is being constructed between 2023 and 2026. Therefore, the construction portion for M-42 and M-47 would be at that same time period. The Chartiers Creek Relief Sewers and RTB are being constructed between 2018 and 2026. The PWSA improvements for C-25 would coincide with when the RTB portion of the ALCOSAN improvements can be constructed. It is not specified in the Regional WWP when the RTB portion of Chartiers Creek will be constructed. According to the ALCOSAN WWP, the implementation for the Saw Mill Run Basin conveyance improvements are not scheduled to start until after 2026 and specific dates are not specified. The PWSA implementation schedule for improvements of the Saw Mill Run POCs (S-15, SMRE-40, MH-11, MH-18, S-23, and MH-77) is contingent on the schedule of the ALCOSAN improvements and would begin after 2026 also. Improvements for the M-34, MH-55, and MH-80 are mainly diversion structures modifications and screen installations and would be constructed separately under the first phase of the schedule.

13.1.3 Project Phases

Affordability is an important issue to consider while developing an implementation schedule. In addition to sequencing the projects based on coordination with the regional WWP, the projects are grouped and distributed in the schedule also based on affordability. These groups are called "phases" and are intended to help balance the distribution of costs throughout the schedule. PWSA has divided the overall implementation schedule into the following five phases:

Phase 1. Phase 1 includes the Adaptive Plan Management and all of the Diversion Structure Modifications and Outfall Screen installations for all the POC specific improvements. The Adaptive Management Plan, which is explained in Section 9 of this WWFS and below in Section 13.1.4, is scheduled to begin immediately after the submission of this PWSA Feasibility Study and take four years. The results of this plan potentially can affect the size and amount of "gray" facilities within all of the other POC specific improvements other than the diversion chamber modifications and outfall screen installations. The diversion chamber modifications and outfall screens installation work can be started immediately and concurrently with the adaptive management plan since the results of the adaptive management work are not anticipated to affect either the need for or the major design elements of these improvements. The capital cost estimate is $54.1 million, and the phase is implemented between 2013 through 2026 and potentially longer throughout the project. This phase includes all the improvements for M-34, MH-55, and MH-80 which are significantly smaller projects (diversion structure modifications and installation of screens).

Phase 2. Phase 2 includes improvements for C-25, A-42, and A-51, which coincide with the improvements for the Allegheny River Segment and Chartiers Creek RTB in the ALCOSAN WWP. It is assumed that although the Allegheny River Segment of the regional tunnel does not extend up to the A-42 POC, that the capacity relief would extend upstream and benefit A-42. The capital cost estimate of Phase 2 is $27.6 million. Phase 2 would begin in 2017 and extend to 2023. There is a potential the C-25 construction period may extend to 2026 depending on the ALCOSAN WWP Chartiers Creek construction, which extends from 2018 to 2026.

Phase 3. Phase 3 includes improvements for M-42 and M-47, which coincide with the improvements for the Monongahela River Segment RTB in the ALCOSAN

WWP. It is assumed that although the Monongahela River Segment of the regional tunnel does not extend up to these POCs, that the capacity relief would extend upstream and benefit M-42 and M-47. The capital cost estimate of Phase 3 is $21.7 million. Phase 3 would begin in 2021 and extend to 2026.

Phases 4 and 5. Phases 4 and 5 are the SMR POC improvements divided into two phases to distribute the costs if possible. As stated before, the ultimate schedule for SMR depends on the Regional Wet Weather Plan schedule to implement improvements in SMR. Phase 4 includes MH-11, MH-77, S-23, and SMRE-40. The capital cost estimate is $31.5 million. Phase 5 includes MH-18, and S-15 and the capital cost estimate is $25.8 million. The implementation dates are to be determined.

13.1.4 Adaptive Management Plan

PWSA is proposing an adaptive management implementation plan, described in detail in Section 9 of this WWFS, is intended to evaluate how much, if any, green infrastructure can be integrated into the “grey” improvements being recommended in this feasibility study. This plan should be completed before the implementation of the large majority of the conveyance and storage improvements since they could affect the sizes and lengths of these improvements. The project should be complete in the short-term as to not delay the construction of those POC specific projects. Since the diversion chamber modifications and outfall screen installations are independent of the green infrastructure evaluation, these initial “gray” components can move forward concurrently with implementation of the adaptive management plan.

This effort can be started immediately after submission of this Wet Weather Feasibility Study, after July 30, 2013. PWSA intends to conduct a four-year in-depth evaluation divided into three stages described and accompanied with decision points at the end of each stage to assess if moving forward with the plan is necessary. Description of each stage is explained in Section 9 of this Wet Weather Feasibility Study.

13.1.5 Act 537

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs.

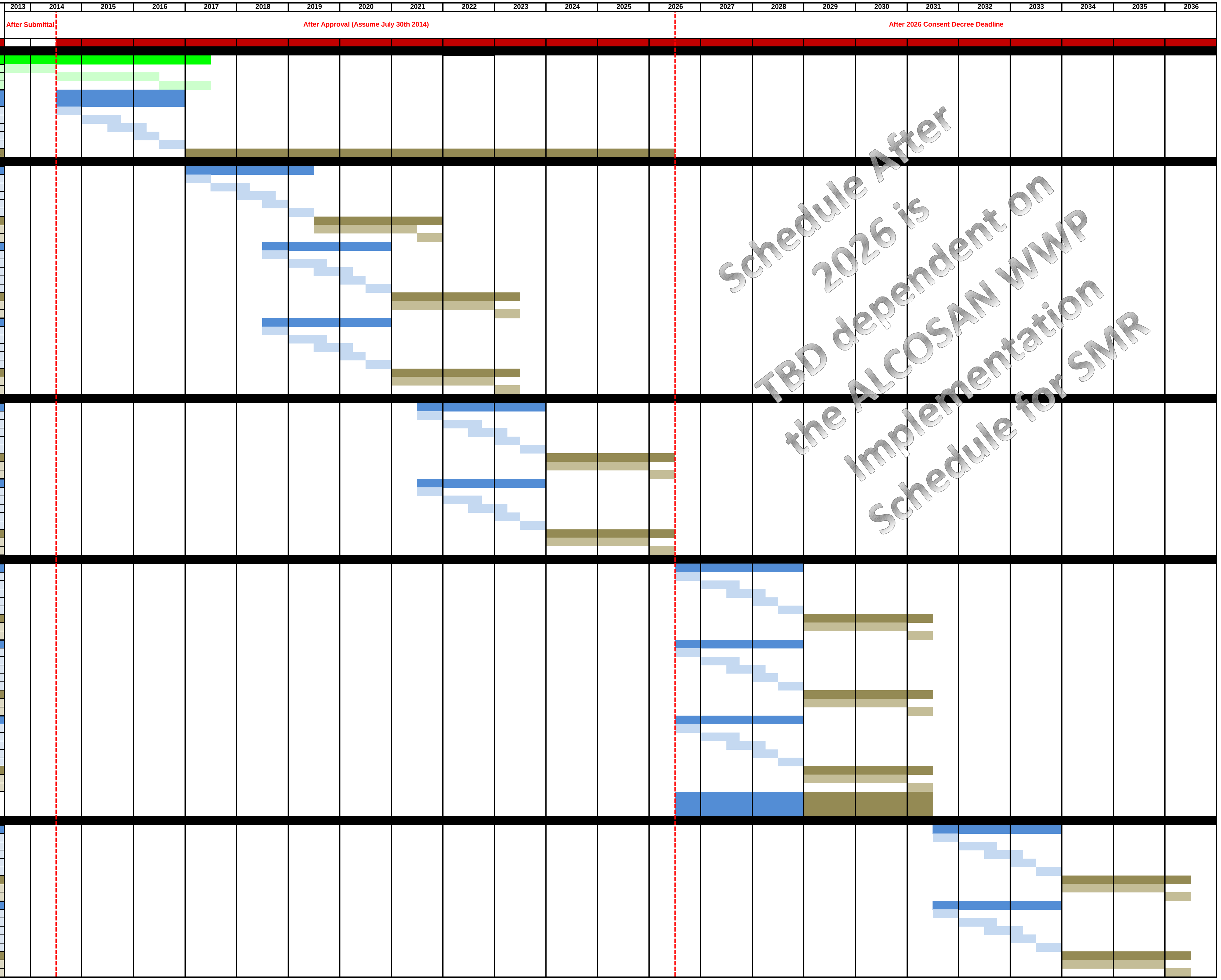
The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to ALCOSAN, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins. Since final plans of a given project are required in the process, this task is included in the schedule as part of permitting which is concurrent and after final design whenever the final plans are finished.

13.1.6 Proposed Schedule

Figure 13-1 provides a project timeline which delineates the recommended alternatives into the five phases over a 12-year program as described in the respective POC reports in the appendices.

FIGURE 13-1. IMPLEMENTATION SCHEDULE

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

13.2 JOINT MUNICIPAL PLANNING AND IMPLEMENTATION

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. Draft Memorandums of Understanding (MOUs), which are described generally in Section 10 of this WWFS and specifically for each POC in Section 6 of each POC report, would serve as an initial understanding of what would form a new future agreement between the municipalities. The draft MOUs developed contains provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the PWSA service area, particularly at each inter-municipal connection point for each multi-municipal sewershed.

All associated parties in the POC sewershed have participated in planning meetings to review and discuss the selected flow management plan and required improvements as described in Section 8 of this Wet Weather Feasibility Study, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. Copies of the proposed MOUs can be found in Section 6 of the POC reports, which can are presented in Appendix A of this WWFS. Signature pages of executed MOUs or other expressions of agreement as provided by the municipalities are attached as Addenda to Section 6 of the POC reports.

ATTACHMENT B

APPENDIX A

WET WEATHER FEASIBILITY STUDY

POINT OF CONNECTION REPORTS

PLEASE REFER TO THE SEPARATELY LABELED BINDERS FOR HARD COPIES OF APPENDIX A OF THE WET WEATHER FEASIBILITY STUDY

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
A-42: NEGLEY RUN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

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1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected / approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh / PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008) The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City Of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer muncicipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh, Penn Hills, and Wilkinsburg. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.
- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.
- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.
- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.

- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.

- Section 7.0 describes how stakeholders were included in the plan development.

1.2 EXISTING SYSTEM DESCRIPTION

This POC FS Report addresses POC A-42, also known as Negley Run. The A-42 sewershed is located in the Upper Allegheny Planning Basin. The Upper Allegheny basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: A-42 Negley Run Existing Facilities Map*. The A-42 sewershed is served by four trunk sewers.

- The Washington Boulevard trunk sewer system consists of two trunk sewers which travel along the Washington Boulevard Corridor and conveys flow to the ALCOSAN CSO diversion structures located near Allegheny River Boulevard. These trunk sewers vary in size from 36 to 108 inches in diameter.

- The Negley Run Boulevard trunk sewer system consists of two trunk sewers which travel under Negley Run Boulevard from Penn Circle in East Liberty to Washington Boulevard. These trunk sewers vary in size from 36 to 90 inches in diameter.
- The Silver Lake Drive trunk sewer system consists of two trunk sewers that convey flow to Washington Boulevard via Silver Lake Drive. These sewers vary in size from 36 to 96 inches in diameter.

- The Upper Nine Mile trunk sewer system travels from Bennett Street at Frankstown Avenue to Rosedale Street via Batavia Street and Multi Way. These sewers vary in size from 48 to 96 inches in diameter.

There are four PWSA CSO diversion chambers in the sewershed that overflow to the Allegheny River at one PWSA permitted CSO. The A-42 sewershed encompasses approximately 3,547 total acres in two areas. The Negley Run area has 2,839 acres and the Upper Nine Mile area has 662 acres. The City of Pittsburgh contains 3,165 total acres (2,839 in Negley Run and 326 in Upper Nine Mile Run), Penn Hills contains 370 acres (46 in Negley Run and 324 in Upper Nine Mile Run), and Wilkinsburg has 12 acres, all in the Upper Nine Mile Run area. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to A-42* for specific information on this POC.

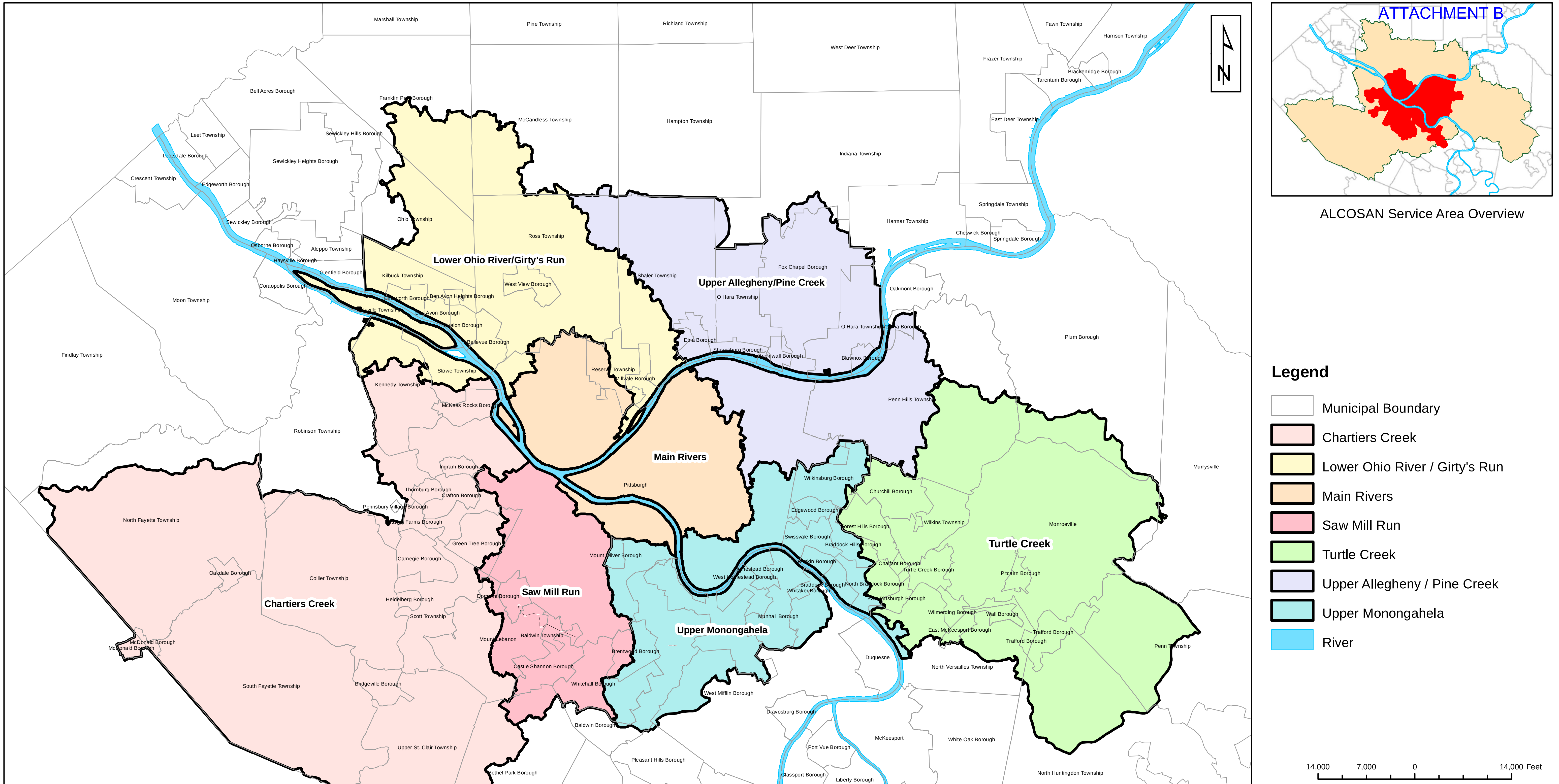

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

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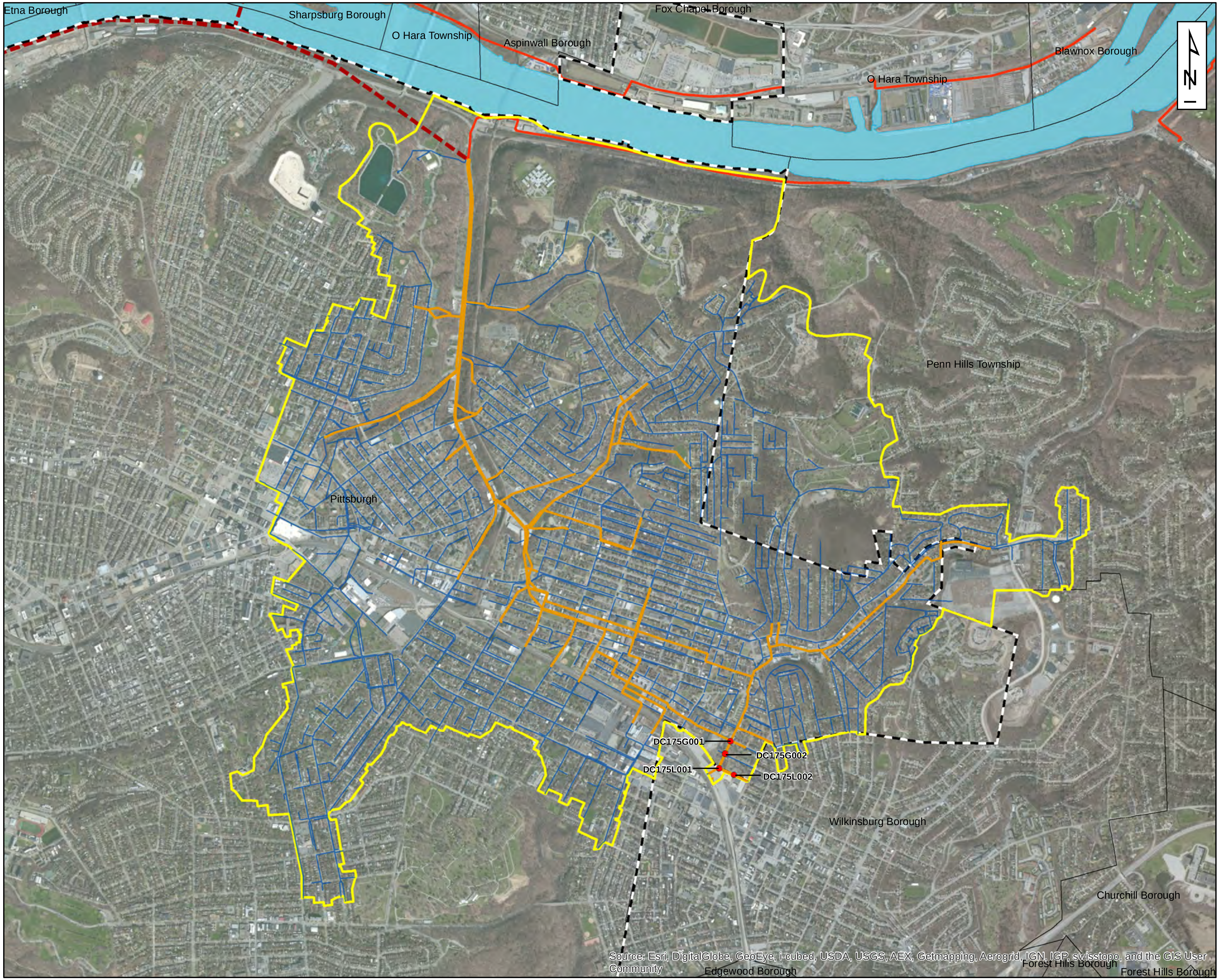
Quality Water Quality Service

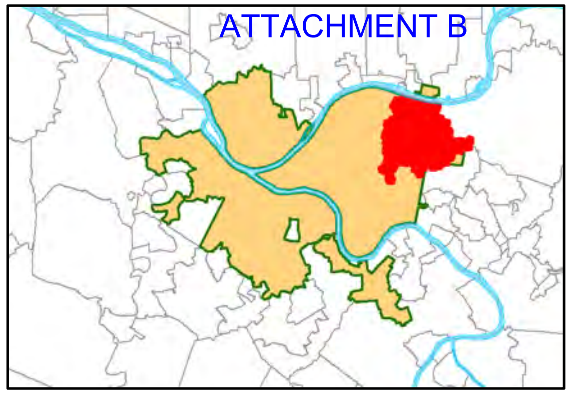
July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

●	PWSA CSO Diversion Structure
—	Trunk Sewer
—	Collector Sewer
☐	A-42 Sewershed Boundary
☐	PWSA Service Area Boundary
☐	Municipal Boundary
🟦	River

Existing ALCOSAN Interceptor

- - -	Deep Tunnel
—	Shallow Cut

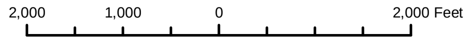


Figure 1 - 2: A-42 Negley Run Existing Facilities

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July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\NEGLEY RUN (A-42)\FIGURE 1-2_A_42Existing Overflows.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR MUNICIPALITIES TRIBUTARY TO A-42

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY		
	City of Pittsburgh	Penn Hills	Wilkinsburg
Tributary Area (Acres)	3,165	370	12
Population	25,485	1,493	87
Combined			
Inch-Miles	2,498	7	1
Linear Feet	582,500	2,500	300
Inch-Miles/Acre	0.79	0.02	0.08
Separate			
Inch-Miles	6	126	1
Linear Feet	3,300	48,600	300
Inch-Miles/Acre	0.00	0.34	0.08

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

The A-42 sewershed is split into two areas; Negley Run and Upper Nine Mile Run. Flows in the Negley Run area are managed by two ALCOSAN diversion structures, A-42 and A-42A, near the intersection of Washington Boulevard and Allegheny River Boulevard. Normal dry weather flows from the four PWSA diversion structures in the Upper Nine Mile Run area are directed into the Negley Run area of the A-42 sewershed. Wet weather flows from the Upper Nine Mile Run area are directed to the Nine Mile Run (M-47) sewershed by means of a diversion structure located at the intersection of Rosedale and Susquehanna Streets.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to A-42*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO A-42

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
122EA42	ADC122PA42	ACSO122EA42	Highland Lock and Dam	Allegheny River

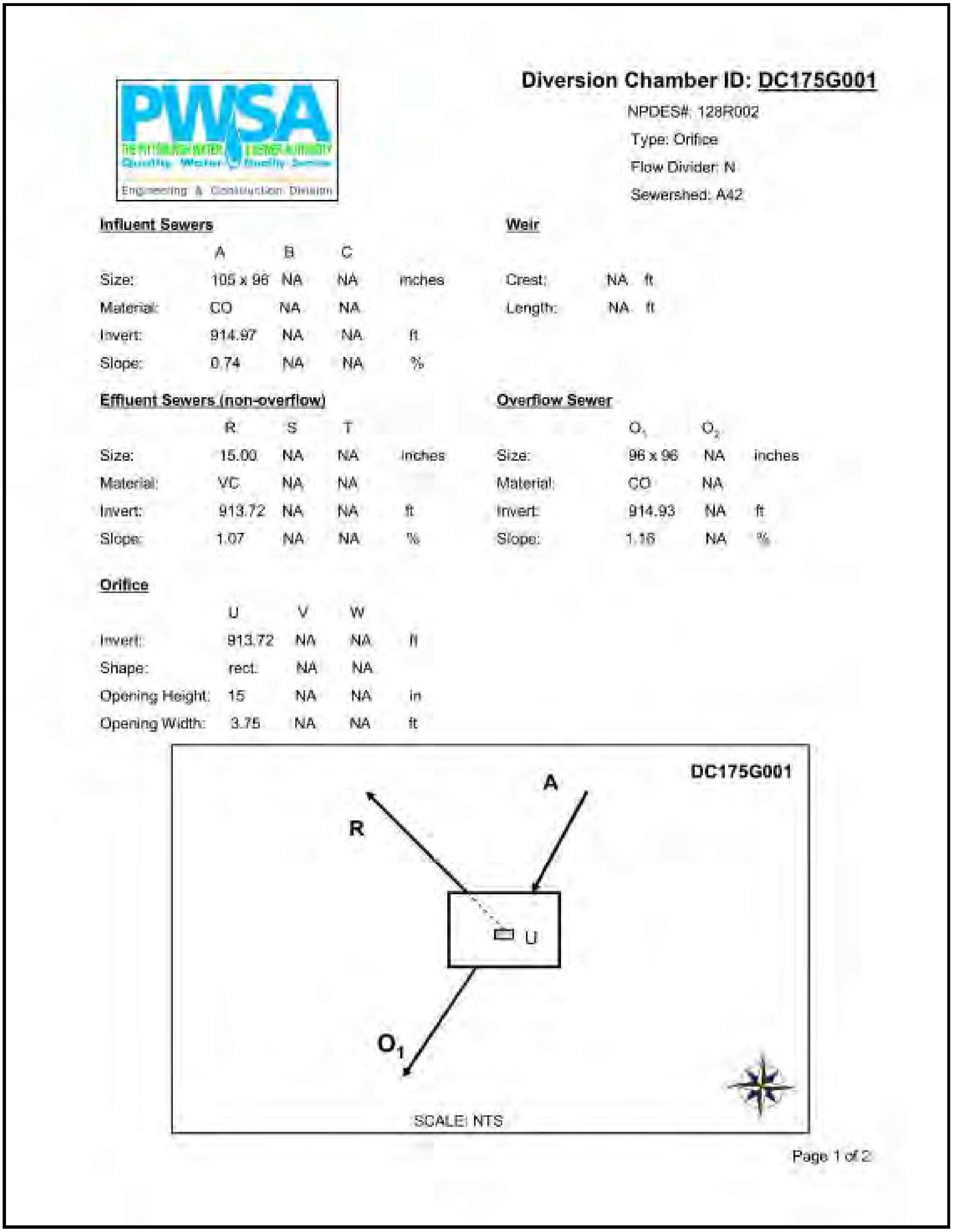
As shown in *Table 1-3: A-42 Sewershed Typical Year Overflow Statistics*, during the typical year these four structures overflow 37 times. The largest overflow volume is 6.9 million gallons per event and the total annual volume is 23.2 million gallons.

TABLE 1-3: A-42 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC175G001	37	141.93	67.78	1.88	6.94	2.39	0.03	23.21
DC175G002								
DC175L001								
DC175L002								
							Total Annual Volume	**23.21**

1.2.1 Diversion Structure Sketches

The following sketches of the A-42 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.



Engineering & Construction Division

Diversion Chamber ID: DC175G001

NPDES#: 128R002
Type: Orifice
Flow Divider: N
Sewershed: A42

Influent Sewers

	A	B	C	
Size:	105 x 96	NA	NA	inches
Material:	CO	NA	NA	
Invert:	914.97	NA	NA	ft
Slope:	0.74	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	15.00	NA	NA	inches
Material:	VC	NA	NA	
Invert:	913.72	NA	NA	ft
Slope:	1.07	NA	NA	%

Overflow Sewer

	O_1	O_2	
Size:	96 x 96	NA	inches
Material:	CO	NA	
Invert:	914.93	NA	ft
Slope:	1.16	NA	%

Orifice

	U	V	W	
Invert:	913.72	NA	NA	ft
Shape:	rect.	NA	NA	
Opening Height:	15	NA	NA	in
Opening Width:	3.75	NA	NA	ft

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PWSA Diversion Structure DC175G001
Location Map

Negley Run Run Sewershed

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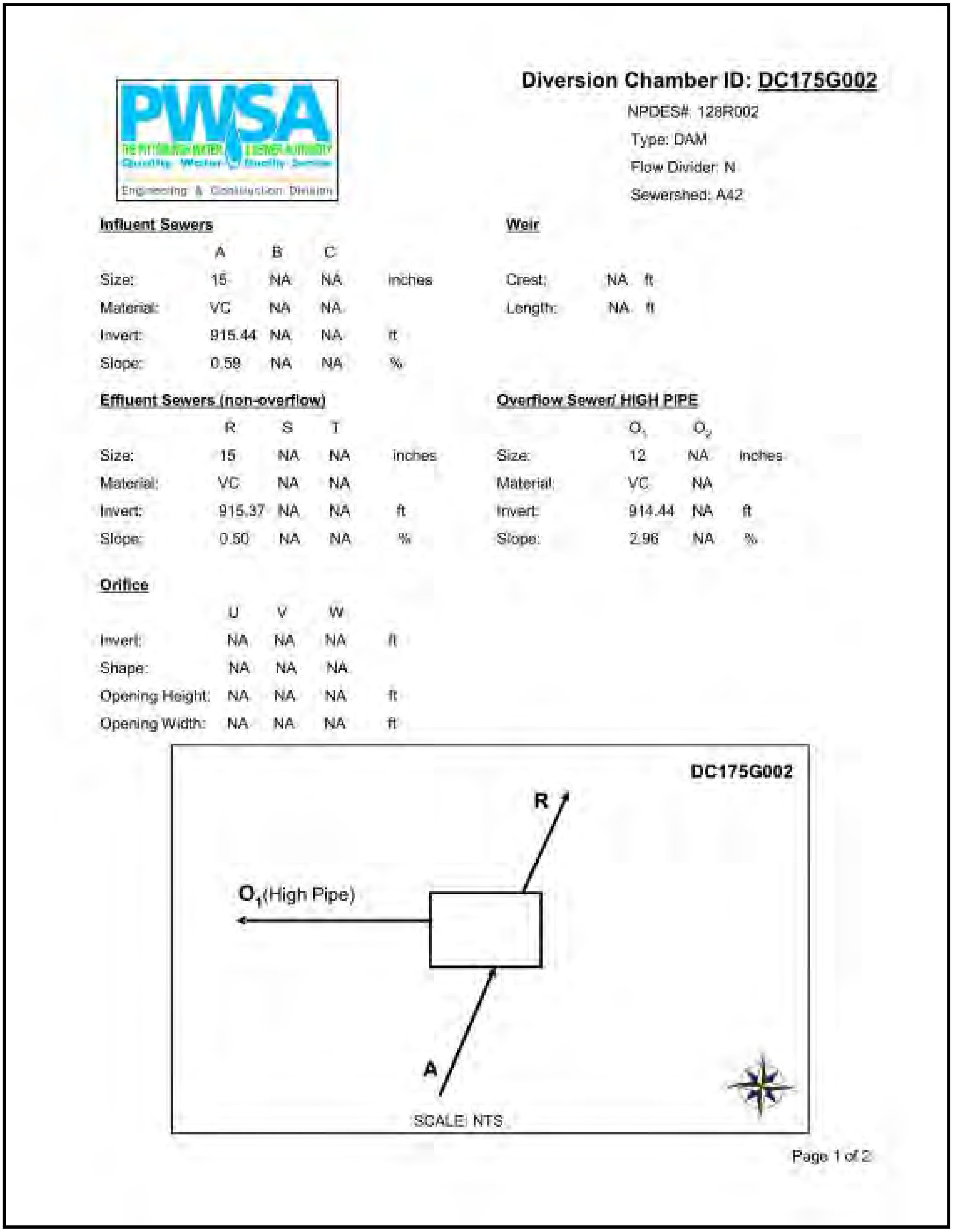

PWSA THE PITTSBURGH WATER & SEWER AUTHORITY Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC175G002

NPDES#: 128R002
Type: DAM
Flow Divider: N
Sewershed: A42

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	VC	NA	NA	
Invert:	915.44	NA	NA	ft
Slope:	0.59	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	15	NA	NA	inches
Material:	VC	NA	NA	
Invert:	915.37	NA	NA	ft
Slope:	0.50	NA	NA	%

Overflow Sewer/ HIGH PIPE

	O_1	O_2	
Size:	12	NA	inches
Material:	VC	NA	
Invert:	914.44	NA	ft
Slope:	2.96	NA	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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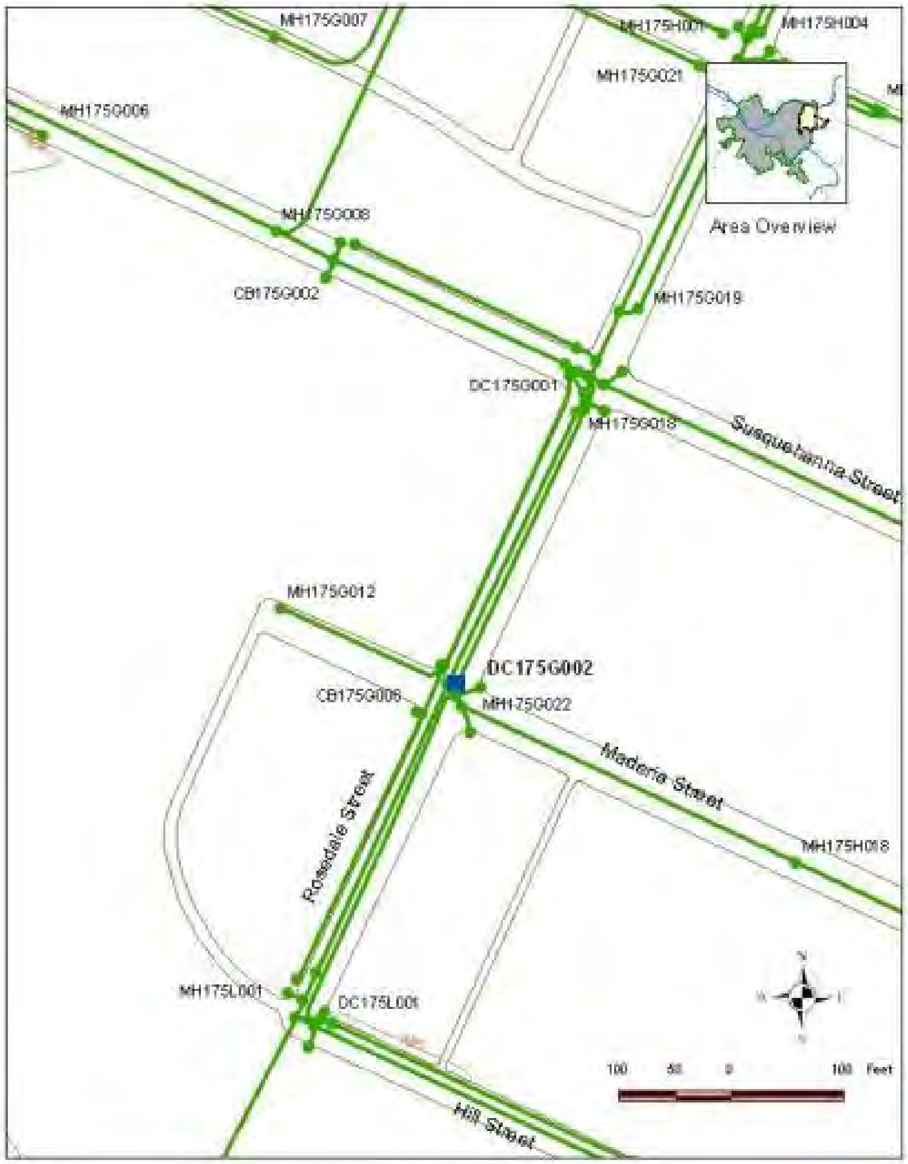

PWSA Diversion Structure DC175G002
Location Map

Negley Run Run Sewershed

PWSA

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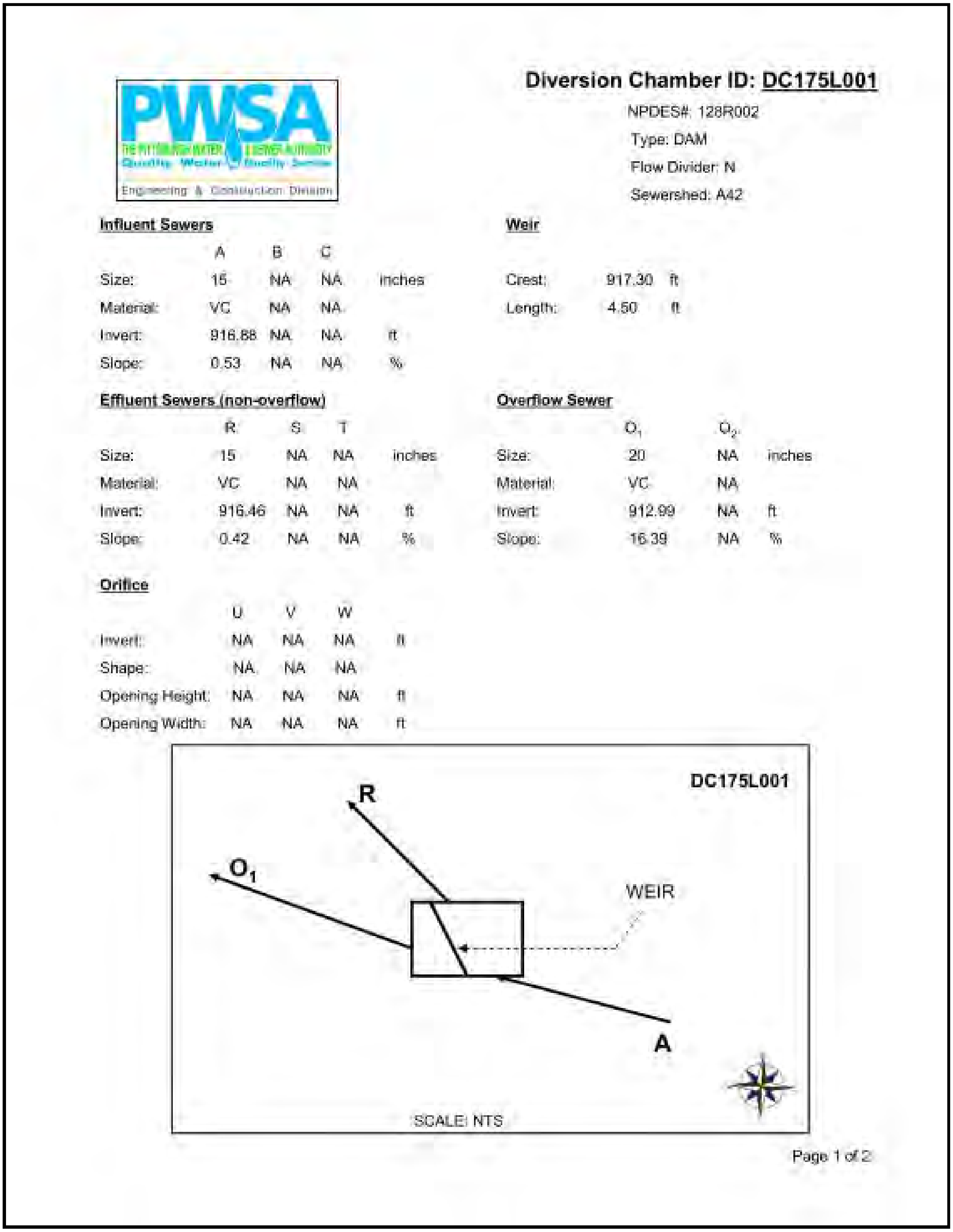

PWSA THE PITTSBURGH WATER & SEWER AUTHORITY Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC175L001

NPDES#: 128R002
Type: DAM
Flow Divider: N
Sewershed: A42

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	VC	NA	NA	
Invert:	916.88	NA	NA	ft
Slope:	0.53	NA	NA	%

Weir

Crest:	917.30	ft
Length:	4.50	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	15	NA	NA	inches
Material:	VC	NA	NA	
Invert:	916.46	NA	NA	ft
Slope:	0.42	NA	NA	%

Overflow Sewer

	O_1	O_2	
Size:	20	NA	inches
Material:	VC	NA	
Invert:	912.99	NA	ft
Slope:	16.39	NA	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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PWSA Diversion Structure DC175L001
Location Map

Negley Run Run Sewershed

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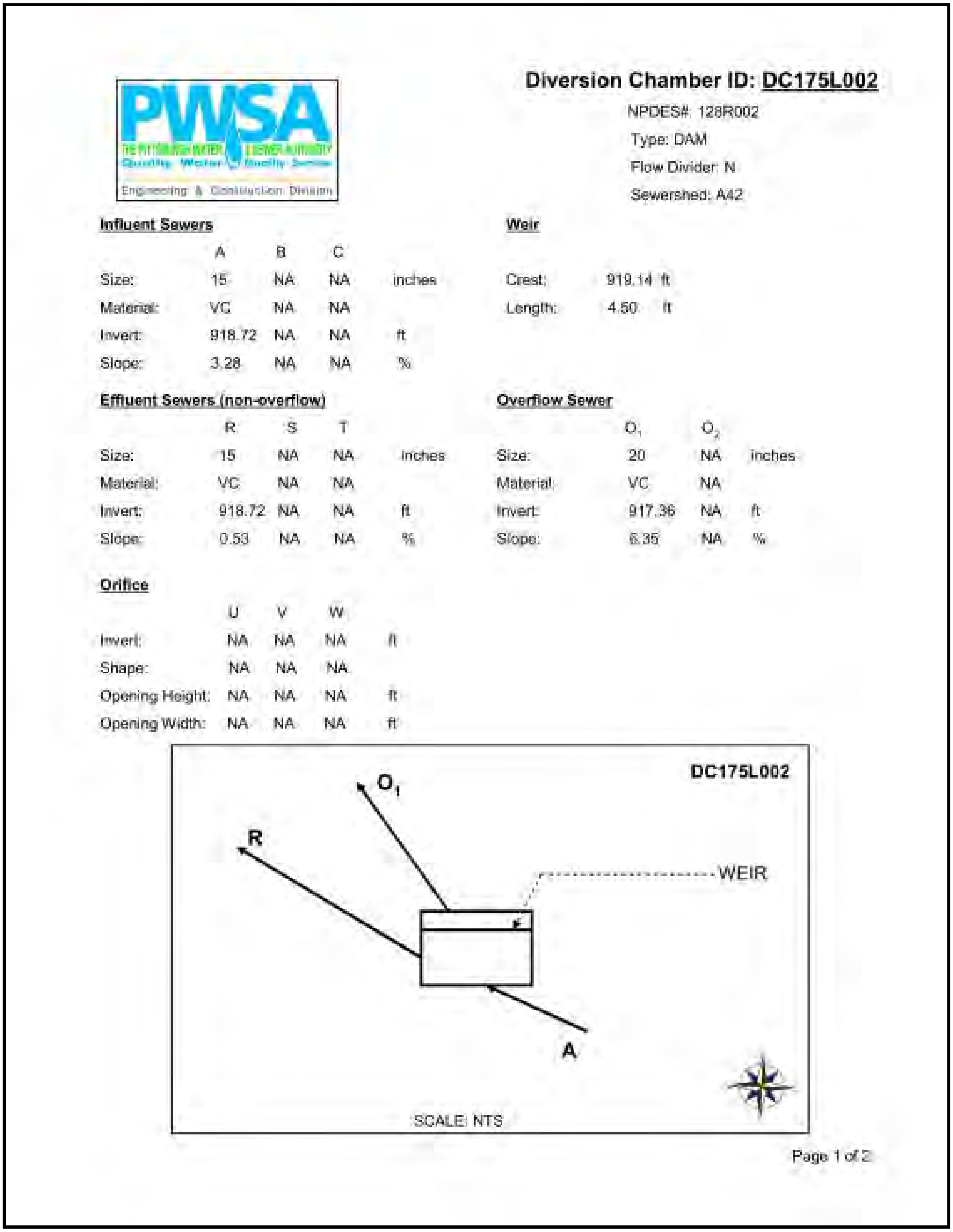

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC175L002

NPDES#: 128R002
Type: DAM
Flow Divider: N
Sewershed: A42

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	VC	NA	NA	
Invert:	918.72	NA	NA	ft
Slope:	3.28	NA	NA	%

Weir

Crest: 919.14 ft
Length: 4.50 ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	15	NA	NA	inches
Material:	VC	NA	NA	
Invert:	918.72	NA	NA	ft
Slope:	0.53	NA	NA	%

Overflow Sewer

	O_1	O_2	
Size:	20	NA	inches
Material:	VC	NA	
Invert:	917.36	NA	ft
Slope:	6.35	NA	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

SCALE: NTS

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PWSA Diversion Structure DC175L002
Location Map

Negley Run Run Sewershed

PWSA

Page 2 of 2

2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC A-42: Negley Run through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Upper Allegheny Basin Planners (UA_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for A-42.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the *Hydraulic and Hydrologic Characterization Report (September, 2008)* and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The flow monitoring data were used to help develop and calibrate the H&H model upon

which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. Ten (10) flow meters located within the A-42 sewershed were used in the RCS-FMP. Details on the ten (10) RCS-FMP flow monitors installed within the A-42 sewershed are found in Table A42-2-1.

TABLE A42-2-1: A-42 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Term[1]
A4200__-IM_-L-05_	City of Pittsburgh	L
A4200__-MB_-L-09_	City of Pittsburgh	L
A4200__-MB_-S-08_	Municipality of Penn Hills	S
A4200__-MB_-S-10_	City of Pittsburgh	S
A4200__-MM_-L-03_	City of Pittsburgh	L
A4200__-MM_-L-04_	City of Pittsburgh	L
A4200__-MM_-L-06_	City of Pittsburgh	L
A4200__-MM_-L-07_	City of Pittsburgh	L
A4200__-POC-L-01_	City of Pittsburgh	L
A4200__-POC-L-02_	City of Pittsburgh	L

[1] S=Short Term: 3-months to 6 months. L=Long Term: 1-year minimum to 21-month maximum.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).
- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.

---

[1] The flow monitor information in this Table is from a file titled "Summary of Program Monitors by Name, Type and Dates.xls". This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled "Summary and Report of Flow Monitoring June 2009".

- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.

- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the A-42 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the A-42 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.

- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The average daily flows, Peak DWF, and GWI ratio of sewer for each flow monitor within the A-42 sewershed are listed in Table A42-2-2. The GWI ratio is an estimated amount of the DWF that can be associated with GWI compared to the DWF peaking factor (i.e. Average Daily Maximum Flow vs. Average Daily Minimum Flow). Relatively high GWI ratios, up to 0.97, can be seen at some of the meters.

TABLE A42-2-2: A-42 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

Flow Monitor[1]	Average Daily Flow (ADF)		Peak DWF (mgd)	GWI Ratio (min/avg)
	(mgd)	(gpcpd)		
A4200__-IM_-L-05_	1.5	>300	2.51	0.97
A4200__-MB_-L-09_	0.23	231	0.46	0.84
A4200__-MM_-L-03_	1.11	>300	1.71	0.76
A4200__-MM_-L-04_	2.08	274	3.01	0.84
A4200__-MM_-L-06_	0.07	156	0.13	0.83
A4200__-MM_-L-07_	2.18	262	4.23	0.83
A4200__-POC-L-01_	0.71	79	1.11	0.61
A4200__-POC-L-02_	1.96	>300	3.72	0.77

[1] Some flow monitors were not included in the source document. The UA_BP determined that at least six months of monitoring data was required to reliably quantify and characterize CSO discharges from a regulated combined sewershed.

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table A42-2-3.

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[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Upper Allegheny Planning Basin – Table 4-3.

TABLE A42-2-3: A-42 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	**Future Baseline Conditions (mgd)**	**Percent Difference**
A-42	5.09	5.49	8%

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event.

RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWF for existing and future Baseline Conditions for A-42 is presented in Table A42-2-4.

TABLE A42-2-4: A-42 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	**Future Baseline Conditions (mgd)**	**Percent Difference**
A-42	870.58	866.58	-0.5%

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[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Upper Allegheny Planning Basin – Table 2.5
[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Upper Allegheny Planning Basin – Table 2.6

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and maximum typical year peak flow conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Statistics were generated for each PWSA diversion chamber and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure A42-2-1 presents the computed hydraulic profiles of the existing Negley Run west trunk sewer under projected maximum typical year peak flow conditions. As is indicated in the figures, under the current system configuration, including existing CSO diversion chamber settings, significant surcharging, including manhole flooding occurs in sections of the Negley Run East trunk sewer along Washington Boulevard. Serious flooding has occurred in the Washington Boulevard area during more severe storm conditions. Solutions to this flooding situation are being investigated separately as an urban flooding problem. The excessive surcharging at the lower end of the trunk sewer is produced by flow capacity limitations of the ALCOSAN diversion chambers and the downstream outfall sewer. For the purpose of this analysis, improvements necessary to convey the typical year flows to the ALCOSAN diversion chambers will be developed.

Figure A42-2-2 presents the computed hydraulic profiles of the existing Negley Run west trunk sewer system under projected maximum typical year peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, significant surcharging of the lower portion of the Negley Run west trunk sewer occurs under the current system configuration, including existing CSO diversion chamber settings under typical year peak flow conditions. The excessive surcharging at the lower end of the trunk sewer is produced by flow capacity limitations of the ALCOSAN diversion chambers and the downstream outfall sewer. No flooding is indicated under the modeled conditions. However, serious flooding occurs in the Washington Boulevard area during more severe storm conditions. Solutions to this flooding situation are being investigated separately as an urban flooding problem. For the purpose of this analysis, improvements necessary to convey the typical year flows to the ALCOSAN diversion chambers will be developed.

Figure A42-2-3 present the computed hydraulic profiles of the existing Upper Nine Mile Run trunk sewer system under projected maximum typical year peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, the system operates acceptably.

Computed flow hydrographs for each of the typical year peak flow condition for flows tributary to A-42 are presented in Figure A42-2-4.

FIGURE A42-2-1: A-42 NEGLEY RUN EAST TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation under Maximum Typical Year and Future Baseline Conditions

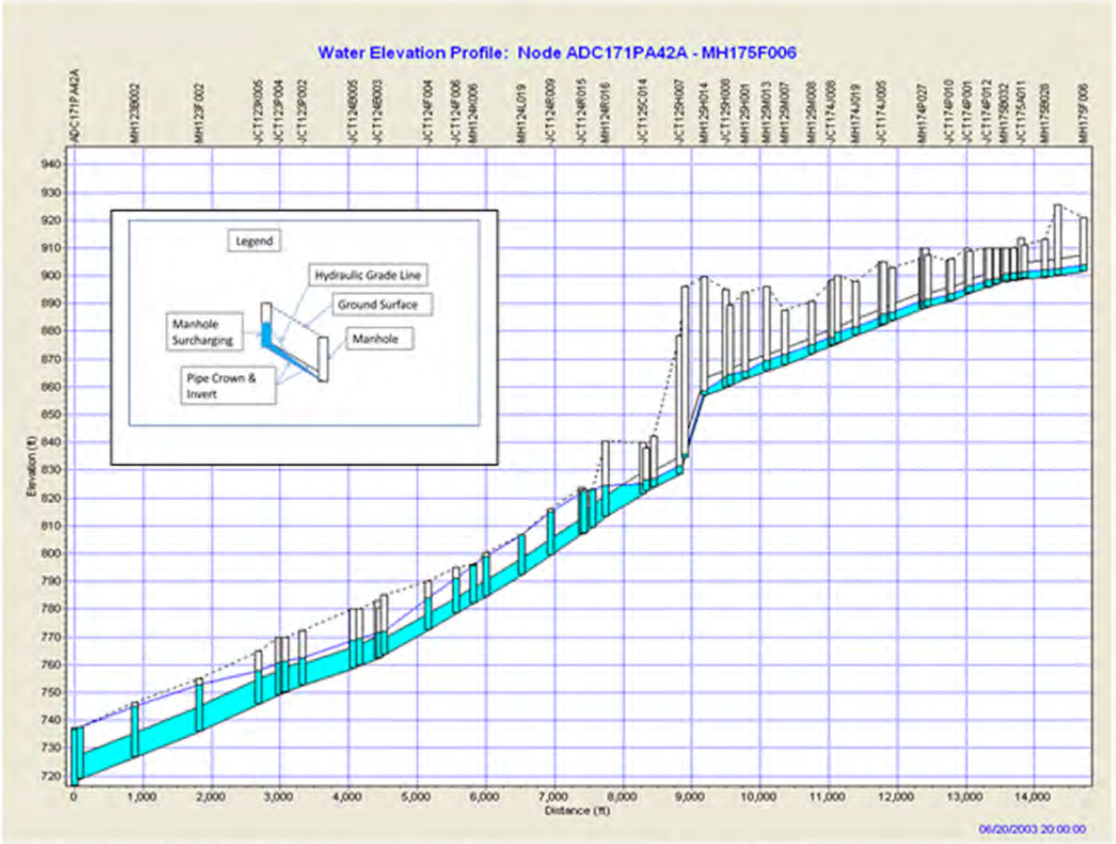

Figure 3a: Negley Run Sewershed: Negley Run East Trunk Sewer Profile – Existing System Configuration and Mode of Operation Under Maximum Typical Year Peak Flow Conditions (July 23 of the Typical Year)

FIGURE A42-2-2: A-42 NEGLEY RUN WEST TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Maximum Typical Year and Future Baseline Conditions

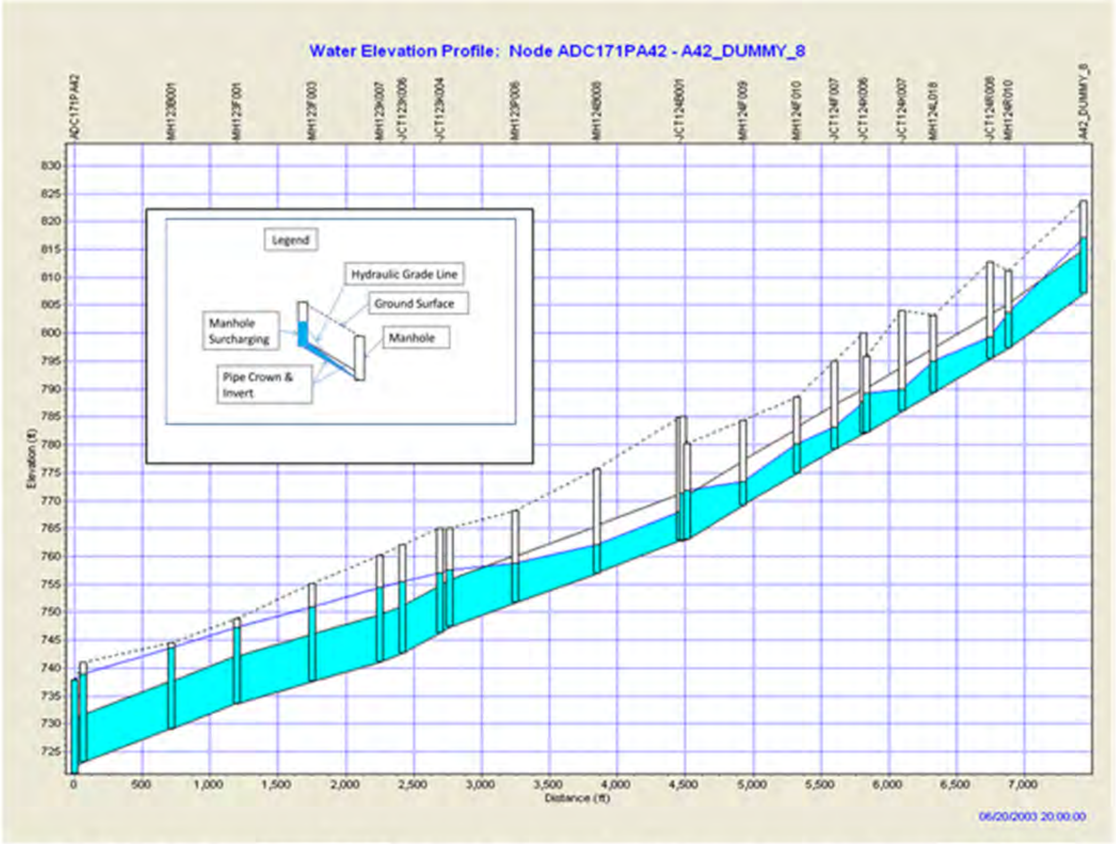

Figure 3b: Negley Run Sewershed: Negley Run West Trunk Sewer Profile – Existing System Configuration and Mode of Operation Under Maximum Typical Year Peak Flow Conditions (July 23 of the Typical Year)

FIGURE A42-2-3: A-42 SEWERSHED UPPER NINE MILE RUN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation under Maximum Typical Year and Future Baseline Conditions

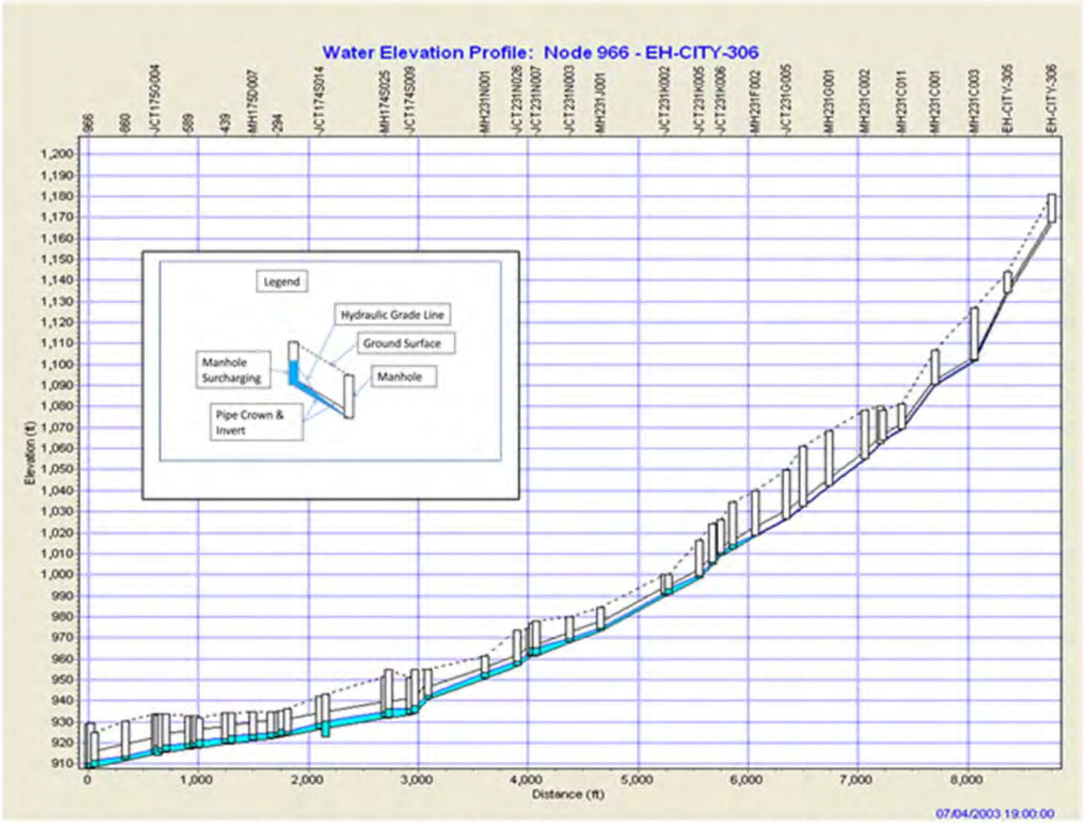

Figure 3c: Negley Run Sewershed: Negley Run Upper Nine Mile Run Trunk Sewer Profile – Existing System Configuration and Mode of Operation Under Maximum Typical Year Peak Flow Conditions (July 23 of the Typical) Year)

FIGURE A42-2-4: A-42 PEAK FLOW RATES TO ALCOSAN POC

Existing System Configuration and Mode of Operation under Maximum Typical Year and Future Baseline Conditions

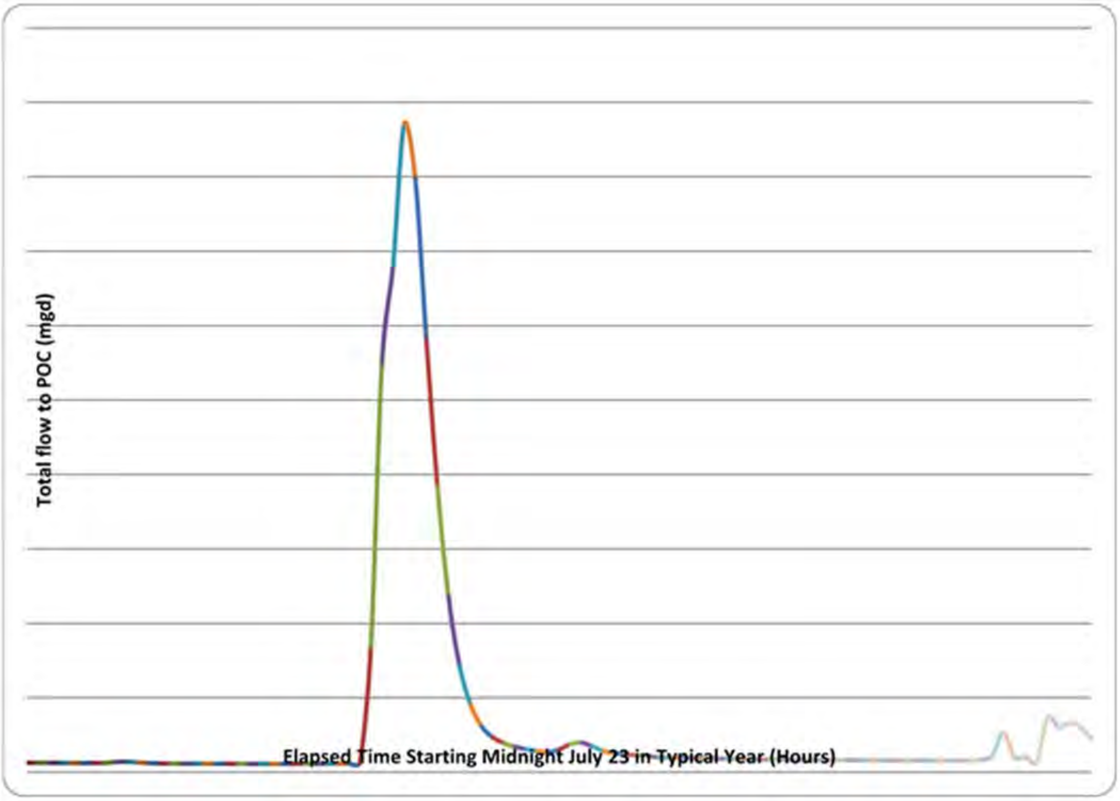

Figure 7: Negley Run Sewershed: Peak Flow Rates to ALCOSAN POC – Existing System Configuration and Mode of Operation – Maximum Peak Rate During Typical Year (July 23)

2.3.1 Existing Basement Flooding Areas–History and Locations

Table A42-2-3 presents a summary of the identified chronic basement flooding locations within the PWSA portion of the A-42 sewershed. The neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. The data presented in Table A42-2-3 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE A42-2-3: A-42 CHRONIC BASEMENT BACKUP LOCATIONS (PWSA SYSTEM)[5]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
1330 Shady Avenue	2	2009
338 S Lindon Avenue	2	2009
520 Clawson Street	2	2010
130 Kilmer Street	2	2004
7129 Race Street	2	2006
8603 Pershing Street	2	2010
7059 Chaucer Street	2	2008
6310 Stanton Avenue	2	2009
1629 Westmoreland Avenue	2	2006

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was only performed to assess the ability of the existing trunk sewer system to convey the flows to the typical year. The potential system improvements to convey the flow at the different control levels under the typical year, future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the A-42 sewer system performed by PWSA produced computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table A42-1-3.

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[5] Information from analysis of PWSA SAP system

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the A-42: Negley Run sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

> which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. One (1) of these outfalls is found within the A-42 or Negley Run Sewershed, but is located within Upper Nine Mile Run and discharges into the Nine Mile Run watershed is shown in Table A42-3-1. There are no PWSA owned outfalls from the A-42 sewershed that discharges into the Allegheny River.

TABLE A42-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE A-42: NEGLEY RUN SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF128K001	UM	M-47	Nine Mile Run	TSF[1]	N	N

As shown in the table, the one (1) PWSA owned outfall discharges into Nine Mile Run. This receiving water is classified as trout stocking fishery (TSF) and currently does not meet its assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

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[1] Trout Stocking Fishery

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.
- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical

characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompasses a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the A-42 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO

controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the A-42 sewershed, Table A42-3-2 lists the untreated CSO statistics that were computed for each control level.

TABLE A42-3-2: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE A-42: NEGLEY RUN SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
PWSA CSO Outfall 128K001	0	0	4	5.27	10	21.16
DC175G001						
DC175G002						
DC175L001						
DC175L002						
Total Volume		**0**		**5.27**		**21.16**

As will be described later in this report, the A-42 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events) under of the typical year condition.

A range of control levels for the typical year were evaluated for transport of flows. PWSA plans to use the 4 overflows per year which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

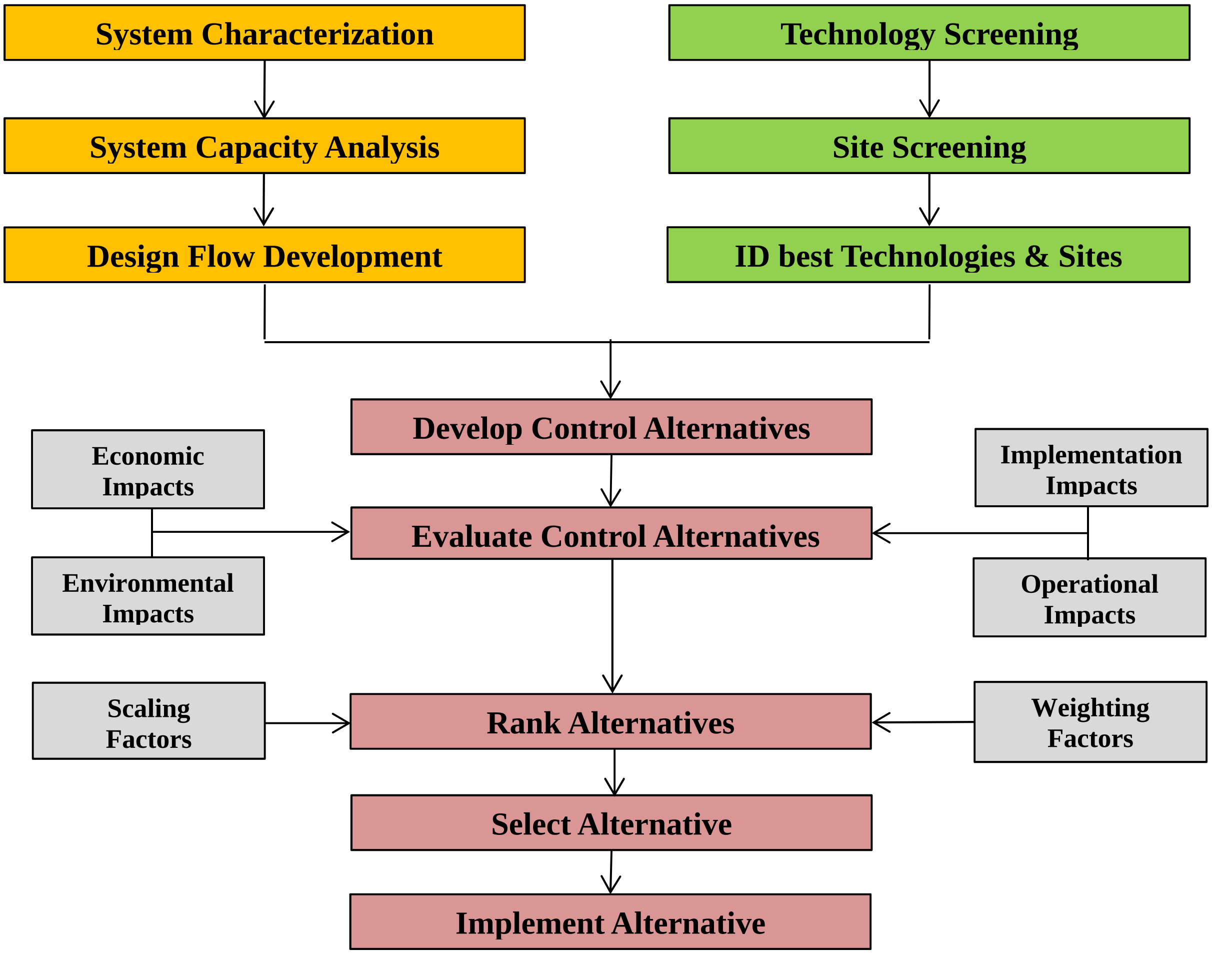
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure 4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE 4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered “feasible” for use in the A-42 and Upper Nine Mile Run sewersheds are shown below in *Table 4-1*.

TABLE 4-1: A-42 AND UPPER NINE MILE RUN TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies was identified for the A-42 sewershed and the Upper Nine Mile Run sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table 4-2.

Contributing flows from the municipalities that are tributary to the A-42 sewershed and the Upper Nine Mile Run sewershed, both of which include the Municipality of Penn Hills and Wilkinsburg Borough, were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as waterways.

CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning "Objective Scores" to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

TABLE 4-2: A-42 AND UPPER NINE MILE RUN POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 122EA42	CS4 122EA42: Sewer separation	Complete sewer separation of tributary area.
	S2-122EA42: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-122EA42: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-122EA42: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-122EA42: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-122EA42: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-122EA42: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfalls 177K001	CS4-177K001: Sewer Separation	Complete sewer separation of tributary area.
	S2-177K001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-177K001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-177K001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-177K001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-177K001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-177K001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Regional Controls – A-42: Negley Run and Upper Nine Mile Run Controls		
Outfall 122EA42	CS4-Negley Run Region: Sewer Separation	Complete sewer separation of tributary areas.
	S2-Negley Run Region: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-Negley Run Region: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-Negley Run Region: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-Negley Run Region: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-Negley Run Region: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-Negley Run Region: Screening and Disinfection	A stand-alone screening and disinfection facility.

CSO(s)	Control Alternative(s)	Description
Outfall 177K001	CS4-Upper Nine Mile Run Region: Sewer Separation	Complete sewer separation of tributary areas.
	S2- Upper Nine Mile Run Region: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4- Upper Nine Mile Run Region: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1- Upper Nine Mile Run Region: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2- Upper Nine Mile Run Region: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3- Upper Nine Mile Run Region: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4- Upper Nine Mile Run Region: Screening and Disinfection	A stand-alone screening and disinfection facility.
Sub-system Controls – Allegheny South Controls		
Outfalls 122EA42	AS-1: Tunnel Storage[2]	A 5.1 mile long tunnel collecting flow from A-1 to A-37A. The Negley Run CSO will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • Negley Run – Screening & Disinfection
	AS-2: Tunnel Storage[2]	A 6.0 mile long tunnel collecting flow from A-1 to Heths Run. The Negley Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • Negley Run – Screening & Disinfection
	AS-3: Tunnel Storage[2]	A 6.6 mile long tunnel collecting flow from A-1 to Negley Run.
Sub-system Controls – Monongahela Ohio Controls		
Outfalls 177K001	MO-1: Tunnel Storage[3]	A 2.4 mile long tunnel collecting flow from M-28 to O-25 The Becks Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • Upper Nine Mile Run – Sub-Surface Storage
	MO-2: Tunnel Storage[2]	A 2.9 mile long tunnel collecting flow from M-29 to O-25 The Becks Run CSOs will be controlled using the highest ranked outfall-

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.
[3] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

CSO(s)	Control Alternative(s)	Description
		specific and/or regional alternative(s): • Upper Nine Mile Run – Sub-Surface Storage
	MO-3: Tunnel Storage[2]	A 5.4 mile long tunnel collecting flow from M-40 to O-25. The 030N001 and 184E001 AND 185H001 outfalls will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • Upper Nine Mile Run – Sub-Surface Storage
	MO-4: Tunnel Storage[2]	A 6.1 mile long tunnel collecting flow from M-42 to O-25 The 030N001 and 184E001 AND 185H001 outfalls will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • Upper Nine Mile Run – Sub-Surface Storage
	MO-5: Tunnel Storage[2]	A 7.5 mile long tunnel collecting flow from M-47 to O-25 The 030N001 and 184E001 AND 185H001 outfalls will be controlled using the highes t ranked outfall-specific and/or regional alternative(s): • Upper Nine Mile Run – Sub-Surface Storage
	MO-6: Tunnel Storage[2]	A 5.0 mile long tunnel collecting flow from M-29 to O-25 and M-47. The Becks Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • Upper Nine Mile Run – Sub-Surface Storage

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

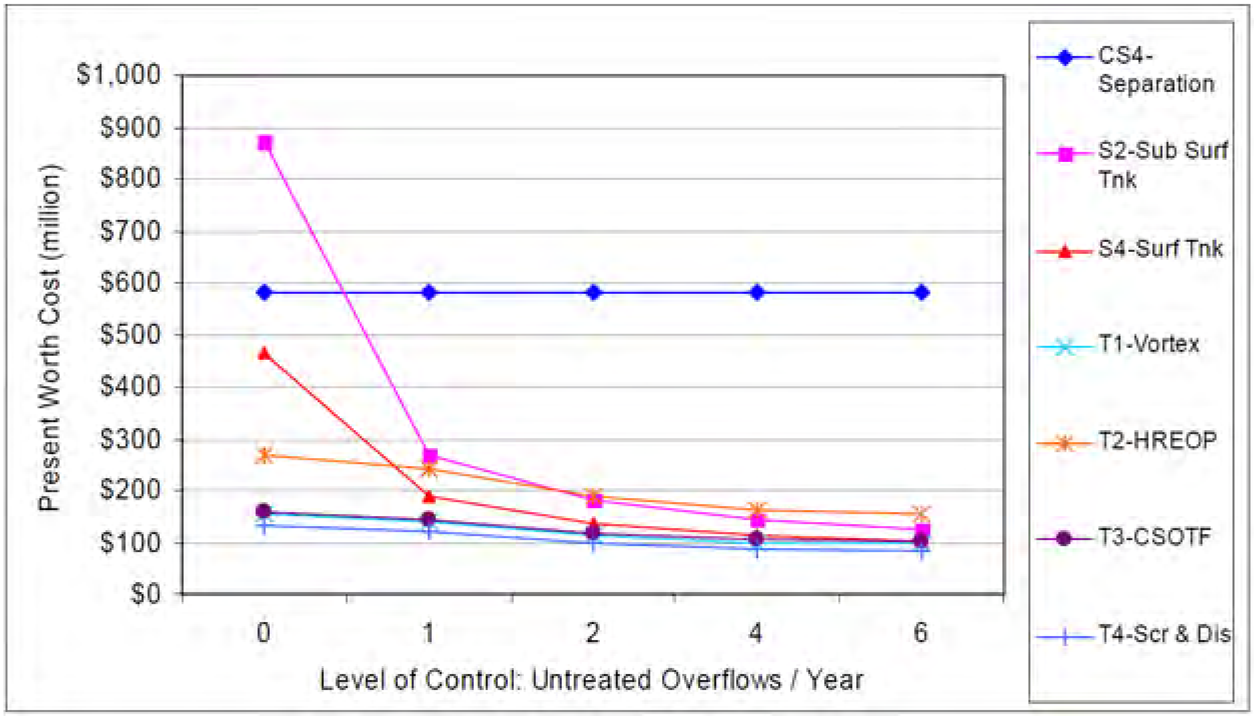
PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

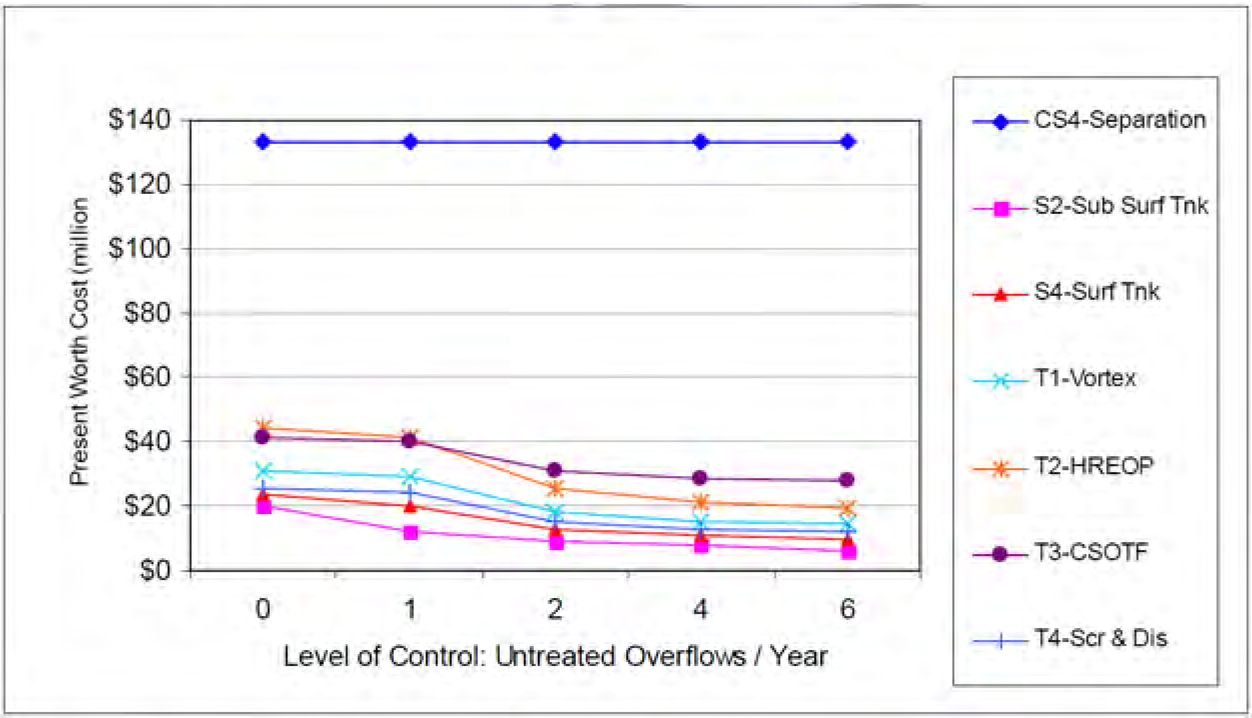
Outfall 122EA42: Cost estimates were produced for outfall-specific control alternatives CS4 122EA42: Sewer separation, S2-122EA42: Sub-Surface Storage, S4-122EA42: Surface Storage, T1-122EA42: Suspended Solids Control, T2-122EA42: High Rate End of Pipe Treatment, T3-122EA42: CSO Treatment Facility, and T4-122EA42: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2a illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2A: OUTFALL 122EA42 ALTERNATIVE COSTS



Outfalls 177K001: Cost estimates were produced for outfall-specific control alternatives CS4-177K001: Sewer separation, S2-177K001: Sub-Surface Storage, S4-177K001: Surface Storage, T1-177K001: Suspended Solids Control, T2-177K001: High Rate End of Pipe Treatment, T3-177K001: CSO Treatment Facility, and T4-177K001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2b illustrates the ranges of estimated present worth costs for these alternatives.

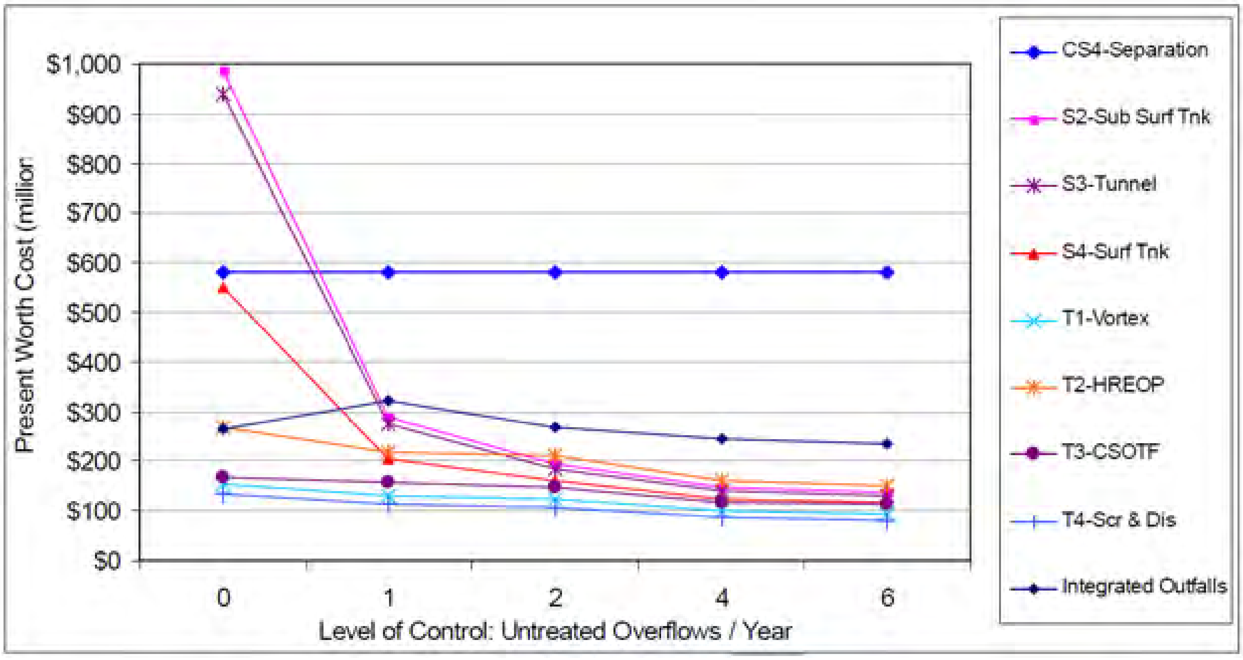
FIGURE 4-2B: OUTFALLS 177K001 ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

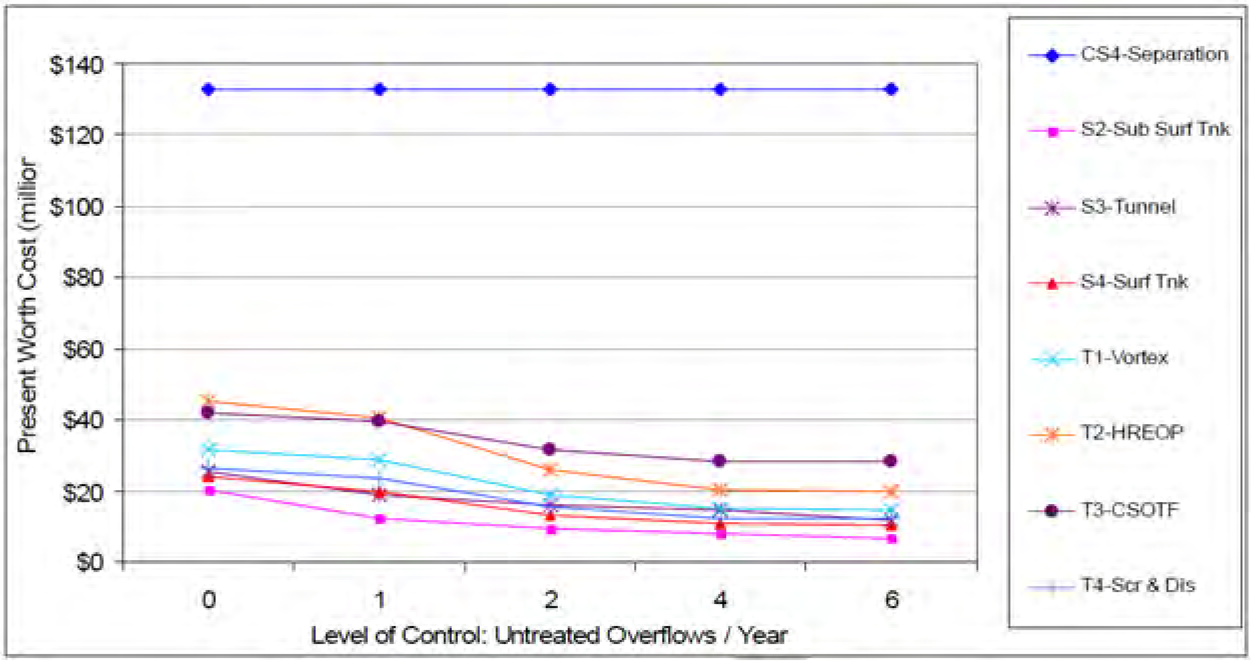
A-42: Negley Run: Cost estimates were produced for regional control alternatives developed for the A-42: Negley Run region. Figure 4-3a illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-3A: A-42: NEGLEY RUN ALTERNATIVE COSTS



Upper Nine Mile Run: Cost estimates were produced for regional control alternatives developed for the Upper Nine Mile Run region. Figure 4-3b illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-3B: UPPER NINE MILE RUN ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Allegheny South Sub-System: Cost estimates were produced for sub-system control alternatives developed for the entire Allegheny South sub-system. Table 4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Monongahela- Ohio subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE 4-3: ALLEGHENY SOUTH SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
AS-1	359.2	4.6	410.8
AS-2	373.8	4.7	426.2
AS-3	392.7	4.4	441.9

Monongahela- Ohio Sub-System: Cost estimates were produced for sub-system control alternatives developed for the entire Monongahela- Ohio sub-system. Table 4-4 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Monongahela- Ohio subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of any tunnel storage portions of these control alternatives.

TABLE 4-4: MONONGAHELA OHIO SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
MO-1	478.2	4.4	529.3
MO-2	441.4	4.2	489.2
MO-3	420.7	3.9	464.9
MO-4	435.0	4.0	479.8
MO-5	458.5	4.2	505.8
MO-6	438.4	4.2	486.9

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining "Objective Scores" relative to each evaluation criteria.

- Applying "scaling" and "weighting" factors.
- Determining "Weighted Objective Scores" relative to each evaluation criteria.
- Ranking each alternative based on the sum of its "Weighted Objective Scores".

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table 4-5.

TABLE 4-5: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

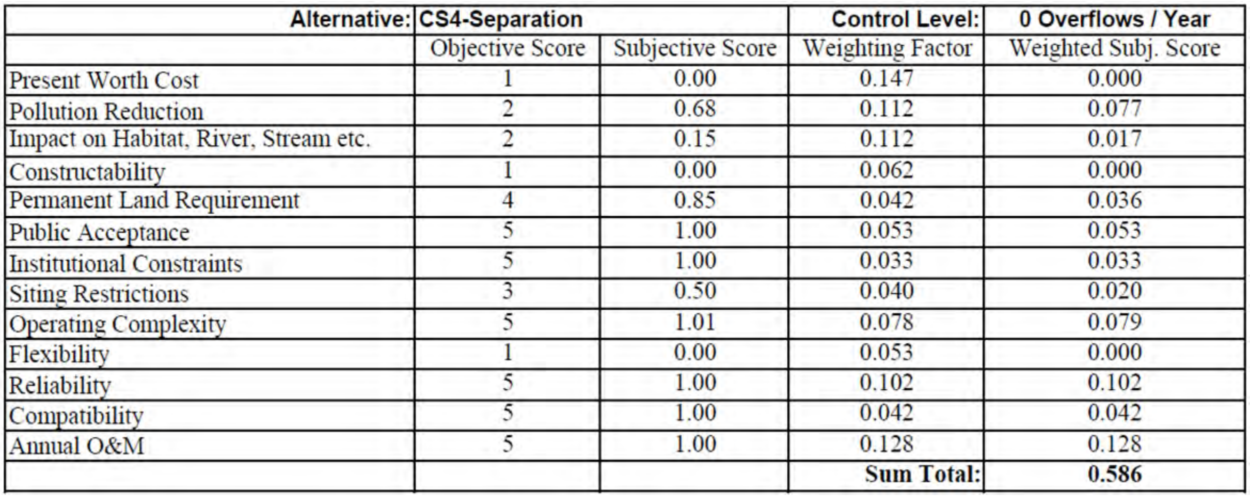
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in Table 4-6.

TABLE 4-6: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 122EA42: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in *Table 4-7.*

TABLE 4-7: WEIGHTED SUBJECTIVE SCORING - CS4 122EA42: SEWER SEPARATION



Alternative:	**CS4-Separation**		**Control Level:**	**0 Overflows / Year**
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	1	0.00	0.147	0.000
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.112	0.017
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	5	1.00	0.033	0.033
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.586**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 122EA42: The results of the control alternative evaluation process are shown in *Figure 4-4*. It is recommended that the following alternatives be carried forward to the next level of analysis:

- T4-122EA42: Screening and Disinfection. This alternative resulted in the highest score for CSO control of 0 overflows per year.
- S4-122EA42: Surface Storage. This alternative resulted in the highest score for CSO control of 1, 2, 4, and 6 overflows per year.

Outfalls 177K001: The results of the control alternative evaluation process are shown in *Figure 4-5*. It was recommended that, for all levels of control, *S2-UNMR: Sub-surface Storage.* This alternative resulted in the highest score for control level of 0, 1, 2, 4, and 6 events per year

FIGURE 4-4: ALTERNATIVE SCORING - OUTFALL 122EA42

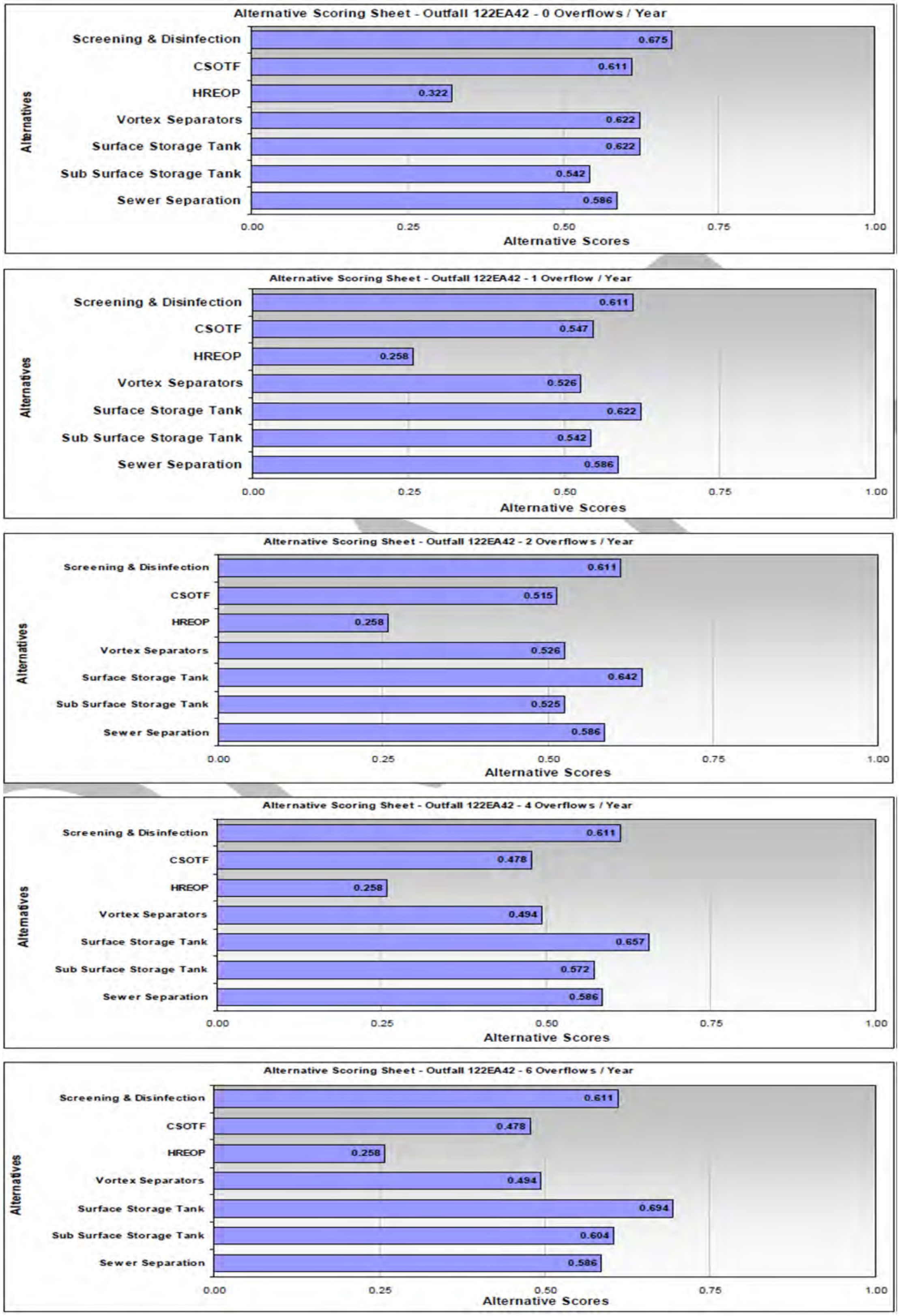
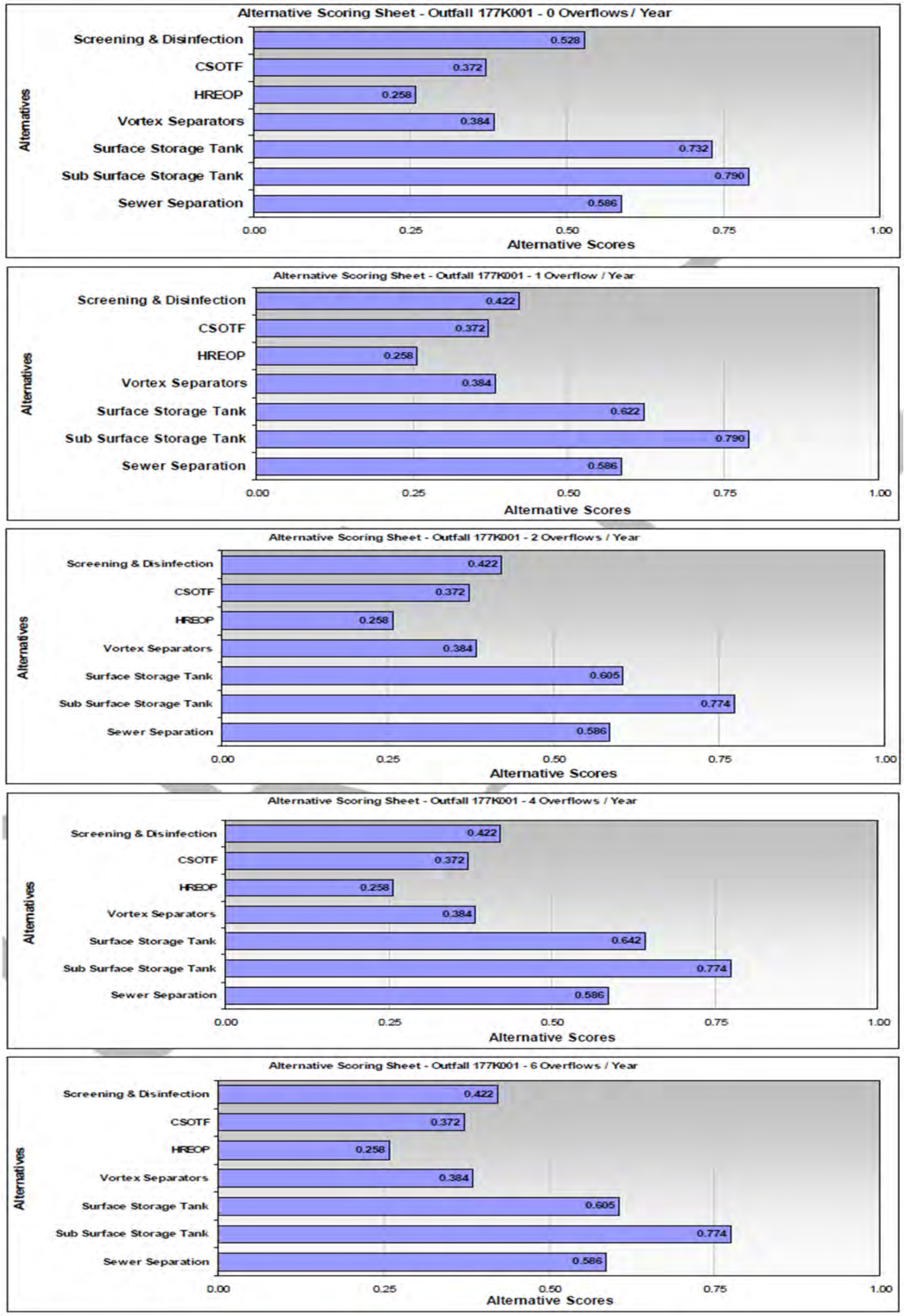


FIGURE 4-5: ALTERNATIVE SCORING - OUTFALLS 177K001



4.4.2 Regional Control Alternatives

A-42: Negley Run: The results of the regional control alternative evaluation process are shown below in Figure 4-6a. It is recommended that the following alternatives be carried forward to the next level of analysis:

- T4-NR: Screening & Disinfection: This alternative resulted in the highest scores for control levels of 0, 1, 2, 4, and 6 events per year.
- S3-NR: Tunnel Storage. This alternative resulted in the highest scores for control levels of 4 and 6 events per year.

Upper Nine Mile Run: The results of the regional control alternative evaluation process are shown below in Figure 4-6b. For all the control levels, *S2-UNMR: Sub-surface Storage* is the recommended alternative to be carried forward to the next level of analysis.

4.4.3 Sub-System Control Alternatives

Allegheny South. The results of the sub-system control alternative evaluation process are shown below in *Figure 4-7a.* As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative AS-3: Tunnel Storage* be carried forward as the Allegheny South component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative AS-3: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative AS-3* included only those components required to deliver flows to the A-42 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the A-42 POC would become the responsibility of ALCOSAN.

M**onongahela - Ohio.** The results of the sub-system control alternative evaluation process are shown below in *Figure 4-7a.* As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative MO-5: Tunnel Storage* be carried forward as the Monongahela - Ohio component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative MO-5: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative MO-5* included only those components required to deliver flows to the M-47 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the M-47 POC would become the responsibility of ALCOSAN.

FIGURE 4-6A: ALTERNATIVE SCORING - A-42: NEGLEY RUN REGION

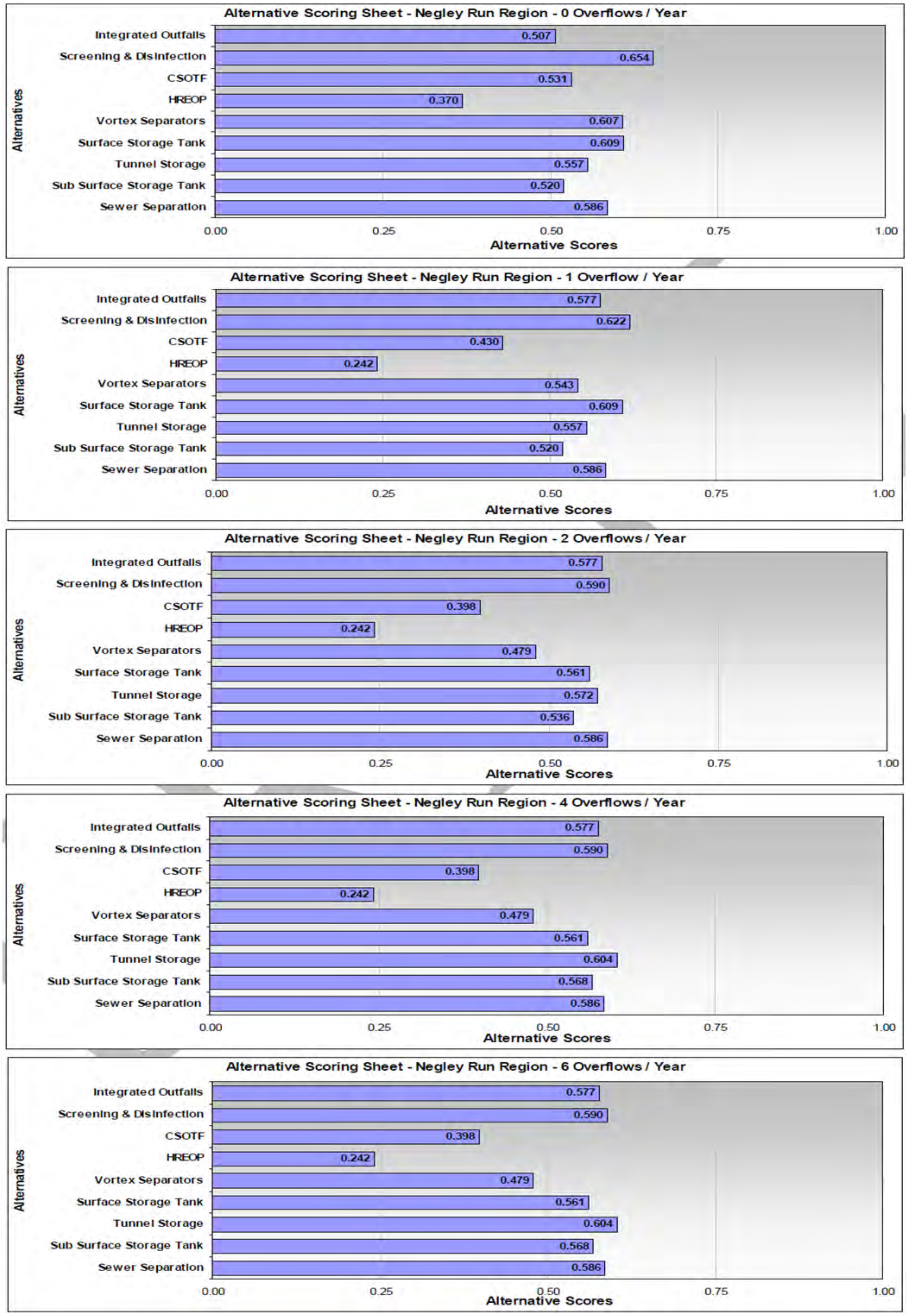


FIGURE 4-6B: ALTERNATIVE SCORING – UPPER NINE MILE RUN REGION

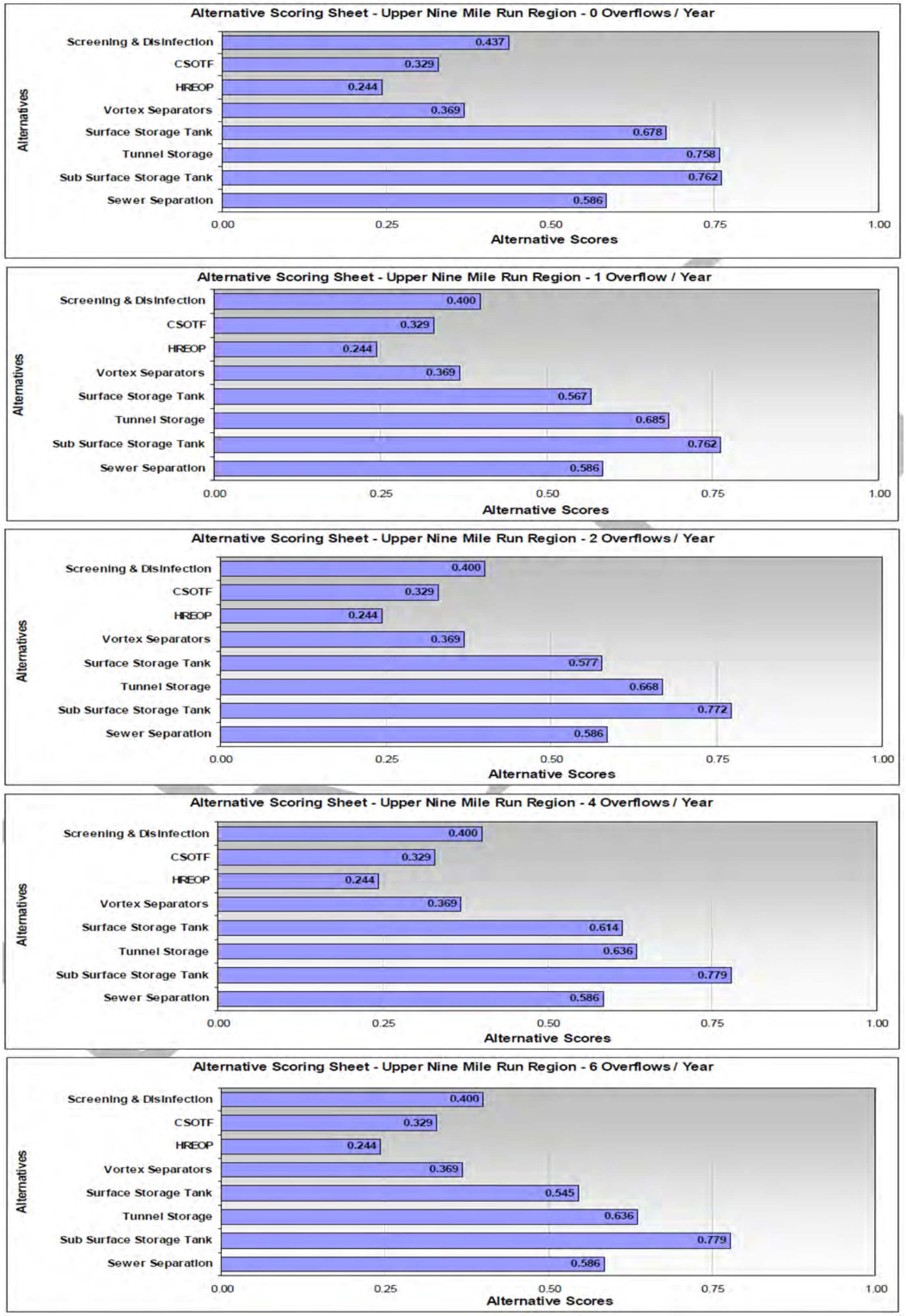
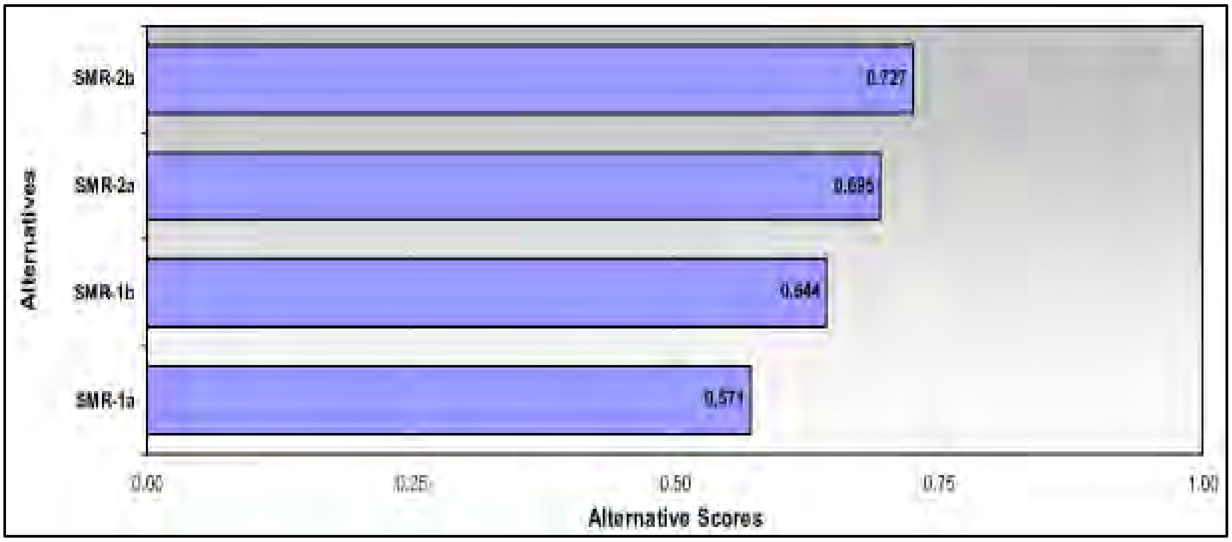


FIGURE 4-7A: ALTERNATIVE SCORING – ALLEGHENY SOUTH SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Negley Run and Upper Nine Mile Run sewersheds would best be accomplished by implementing Alternatives AS-3: Tunnel Storage and *MO-5: Tunnel Storage*. Within the Negley Run and Upper Nine Mile Run sewersheds, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the two PWSA permitted CSOs to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the A-42 POCs, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternatives AS-3 and MO-5* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-A42-C-0*, *POC-A42-C-4* and *POC-A42-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **A42 -** The POC sewershed serviced.

- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.
- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the A-42 POC without significant manhole surcharging and flooding.

It should be noted that most of the tributary municipalities did not indicate to the PWSA that they had plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows. The Municipality of Penn Hills informed PWSA that they have no plans to implement wet weather controls within their tributary sewer system that would result in reductions to the projected flows.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the A-42 sewershed is four untreated overflows per year. The recommended control alternative for the A-42 Negley Run sewershed has been designated as POC-A42-TNK-4. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **A42** The A-42 POC sewershed is being serviced.
- **TNK** A storage tank is the primary control technology.
- **4** The selected level of control is four untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of four (4) untreated overflows per year, the required tankage and conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-A42-TNK-4 are summarized in Table A42-5-1.

TABLE A42-5-1: ALTERNATIVE POC-A42-TNK-4 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
A-42	DC175G001	177K001	TNK*	4
	DC175G002			
	DC175L001			
	DC175L002			

*Additional conveyance piping is also planned along Washington Boulevard to eliminate surcharging.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, any stream removal projects that may be included, its integration with the ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-A42-TNK-0 and/or POC-A42-TNK-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. Both analyses determined that the optimal method of increasing the level of control of CSO overflows in the A-42 sewershed would be to reduce the number of overflows by conveying the additional wastewater to the ALCOSAN point of connection. To accomplish this, the PWSA and/or their tributary municipalities must:

- Modify, if required, existing diversion structures to achieve desired level(s) of control.
- Construct additional consolidation piping to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

The 2008 Draft Feasibility Study determined that the optimal method of increasing the level of control of the PWSA CSO overflows in Negley Run Sewershed is to provide wet weather storage to control discharges to PWSA outfall 177K001 from diversion chambers DC175G001, DC175G0002, DC175L001 and DC175L002. Existing flow control settings at the diversion chambers will not be changed.

Table A42-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control.

TABLE A42-5-2: ALTERNATIVE POC-A42-TNK-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC175G001	None	No Change	No Change	No Change
DC175G002	None	No Change	No Change	No Change
DC175L001	None	No Change	No Change	No Change
DC175L002	None	No Change	No Change	No Change

* Discharges from the storage facility will receive screening prior to discharge.

5.1.2 Consolidation Piping

The Draft Feasibility Study determined that the optimal method of increasing the level of control of the PWSA CSO overflows in Negley Run Sewershed is to provide wet weather storage to control discharges to PWSA outfall 177K001 from upstream diversion chambers. Existing flow control settings at the diversion chambers will not be changed.

It was anticipated that the required increase in conveyance capacity would be achieved by constructing wet weather storage facilities and relief sewer(s) designed to convey flows associated with four overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Note that the upstream municipalities of the Municipality of Penn Hills and the Borough of Wilkinsburg have not reported any plans to modify their systems to reduce their tributary flows.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table A42-5-3 and in Figure A42-5-1.

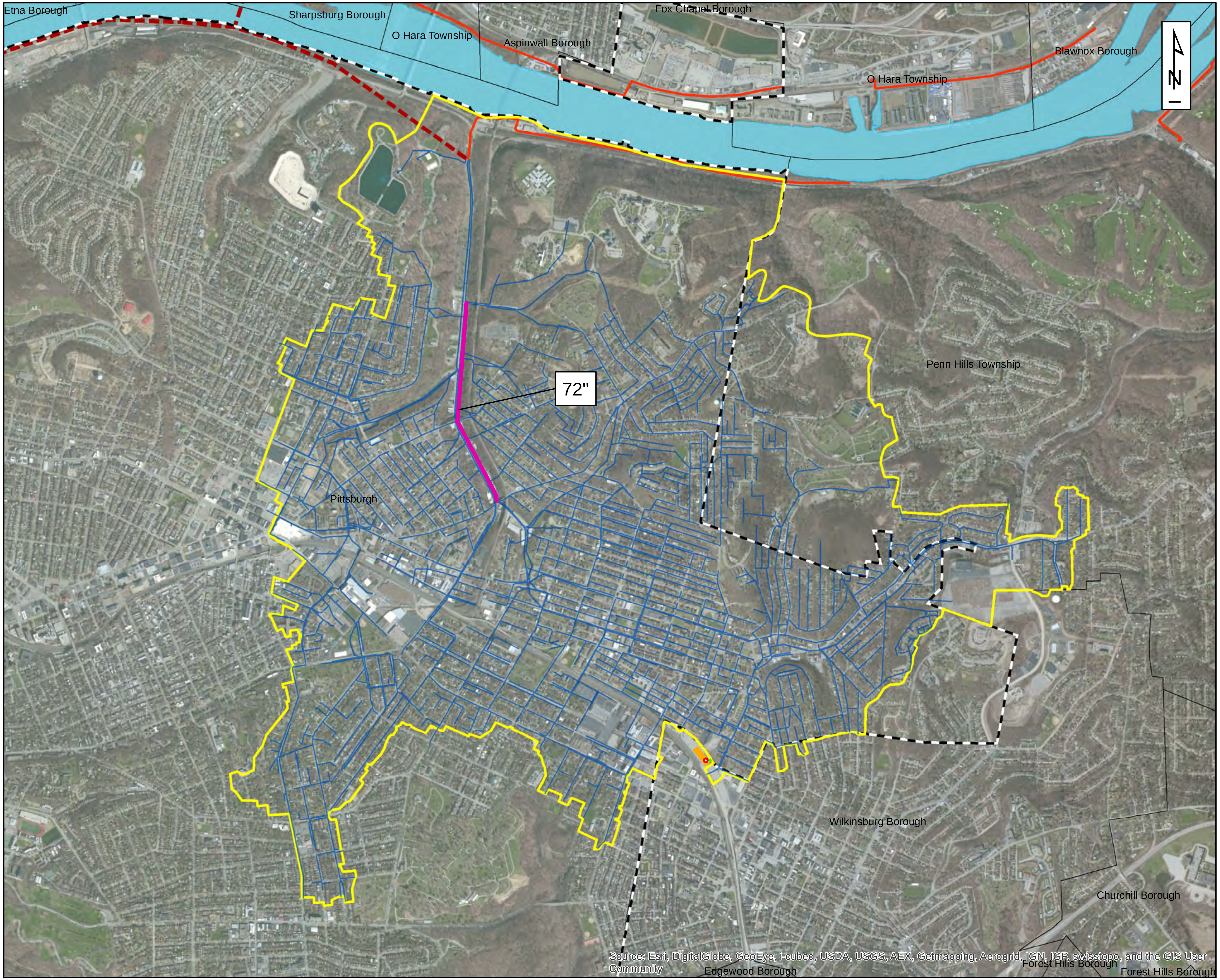
TABLE A42-5-3: POC-A42-TNK-4 CONSOLIDATION PIPING

Diameter (in)	Length (ft)
24	750
72	3,250

*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

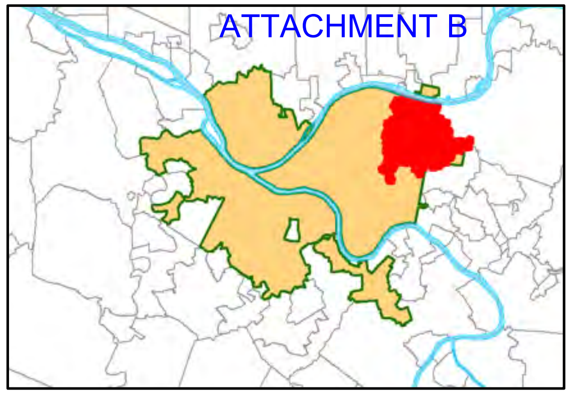
5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table A42-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 23 MG in the typical year.



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

- ○ PWSA Diversion Structure Modification
- ━ Washington Blvd. Relief Sewer
- 🟧 2.25 MG Storage Tank
- 🟩 Pumping Station
- ─ Collector Sewer
- ☐ A-42 Sewershed Boundary
- ⬚ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ━ ━ Deep Tunnel
- ━ Shallow Cut

2,000 1,000 0 2,000 Feet

Figure A42-5-1: POC A42-TNK-4 Storage and Conveyance

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\NEGLEY RUN (A-42)\FIGURE 5-1_A_42.mxd

TABLE A42-5-4: A-42 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name						
	Outfall	POC-A42-TNK-0		POC-A42-TNK-4		POC-A42-TNK-10	
		No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)
DC175G001	177K001	0	0	4	5.3	10	21.2
DC175G002							
DC175L001							
DC175L002							
Total Volume			**0**		**5.3**		**21.2**

5.1.4 Anticipated Flow Rates To The ALCOSAN POC

The 2008 Draft Feasibility Study determined that the optimal method of increasing the level of control of CSO overflows from the PWSA diversion chambers in the Negley Run Sewershed was to construct a wet weather detention storage facility sized as necessary to limit/achieve the 0 overflows per typical year (6.10-million gallons), 4 overflows per typical year (2.25-million gallons) and 10 overflows per typical year (0.20-million gallons) CSO control levels.

General arrangements illustrating the wet weather storage facilities and the Washington Boulevard relief sewer facilities are presented in Figure A42-5-1. The Washington Boulevard relief sewer is sized to convey the maximum typical year peak flow rate. There currently are studies in progress in the City of Pittsburgh that are investigating flooding conditions. These studies may recommend other sewer improvements designed for larger storms. It is anticipated that future improvements to the ALCOSAN facilities will increase the capacity of the diversion chambers and downstream piping sufficiently to eliminate backwater effects in the PWSA trunk sewers.

The storage facilities illustrated in Figure A42-5-1 are located in at an existing Port Authority of Allegheny County parking area at 450 Brushton Avenue. It is anticipated that the storage and associated effluent pumping facilities will be constructed underground and will have a minimal surface footprint. Once construction of the wet weather storage facilities is completed most of the existing parking facility can be returned to use as a parking lot.

Based on an analysis that computed peak flows delivered to the ALCOSAN POC A-42 diversion chambers under the range of levels of control, the CSO controls accomplished wet weather storage without changing the current control settings of the PWSA diversion chambers. Therefore, there will be no change to the peak flow rates from the Upper Nine Mile Run portion of the Negley Run sewershed to the ALCOSAN A-42 and A-42A. However, the relief sewer along Washington Boulevard will increase the conveyance capacity to the diversion chambers. This will result in an increase in the flows reaching that location.

Peak flow rates to the A-42 POC were computed during the typical year. It was not necessary to compute them during the 2-year, 5-year and 10-year design storm conditions since the sewershed is predominately combination flow.

Typical year peak flow rates associated with alternatives POC-A42-TNK-0, POC-A42-TNK-4 and POC-A42-TNK-10 are presented in Figure A42-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates. Design storm peak flow rates and volumes conveyed to the A-42 POC during the 2-yr, 5-yr and 10-yr design storm conditions were not computed. As a result Table A42-5-5 is populated with N/A.

FIGURE A42-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE A-42 POC

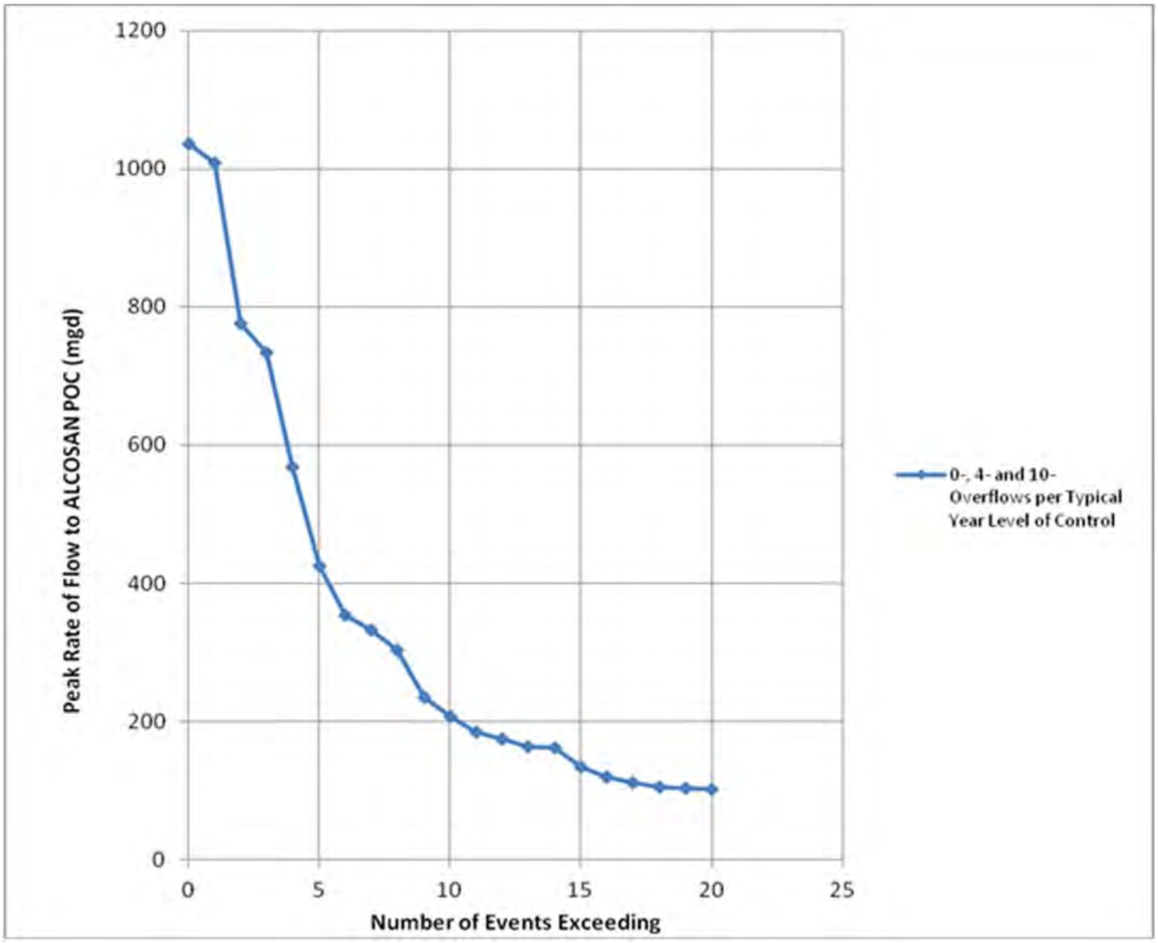


TABLE A42-5-5: A-42 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-A42-TNK-0	N/A	N/A	N/A	N/A	N/A	N/A
POC-A42-TNK-4	N/A	N/A	N/A	N/A	N/A	N/A
POC-A42-TNK-10	N/A	N/A	N/A	N/A	N/A	N/A

5.1.5 Recommended Control Alternative Integration

In the spring of 2013, 3 Rivers Wet Weather facilitated a series of meetings between the PWSA and the municipalities tributary to this sewershed. All associated parties in the POC sewershed have participated in these planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. The Municipality of Penn Hills has not voiced their agreement with the cost allocations.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing trunk sewer system does not have sufficient capacity to convey the flows resulting from implementation of alternative POC-A42-TNK-4 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring wet weather storage facilities and increases in conveyance capacity to be achieved through the construction of relief sewer(s) designed to convey flows associated with four overflows per typical year, under 2-year design storm conditions (4 OF/yr; 2-yr storm), without manhole surcharging.

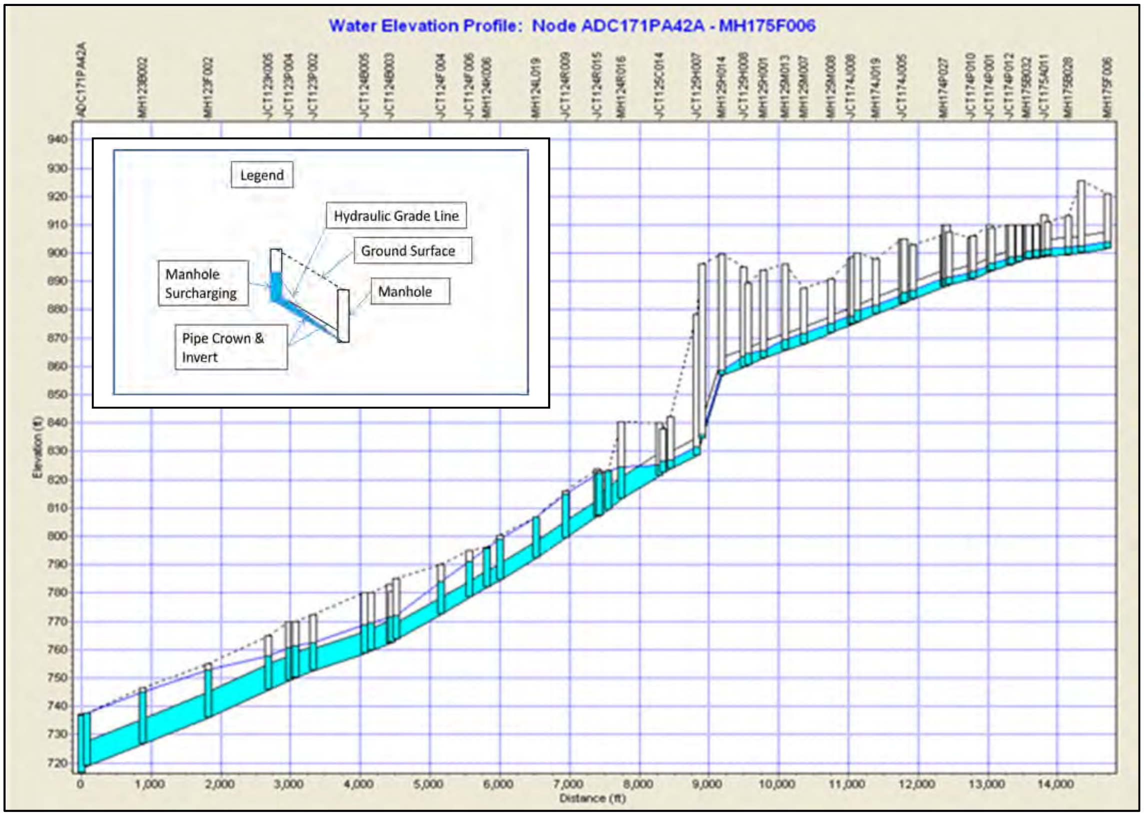
The following paragraphs discuss the hydraulic capacity characteristics of the A-42 sewershed, both before and after implementation of the recommended alternative:

- Peak flow hydraulic grade line (HGL) of the trunk sewer system
- 2046 peak flows and volumes to the A-42 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

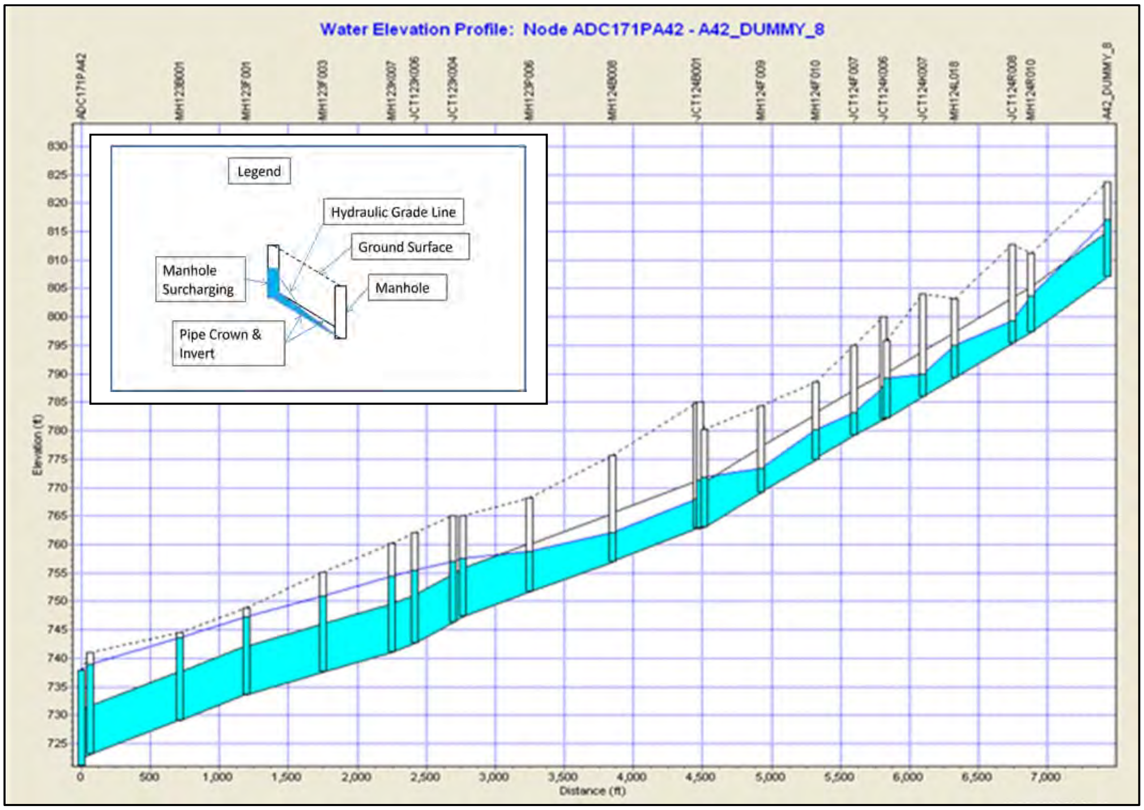
Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figures 3a, 3b, and 3c from that report presented profiles of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. These figures are reproduced below as Figure A42-5-3a, Figure A42-5-3b, and Figure A42-5-3c.

FIGURE A42-5-3A: A-42 EAST TRUNK SEWER HGL (EXISTING CONDITIONS)



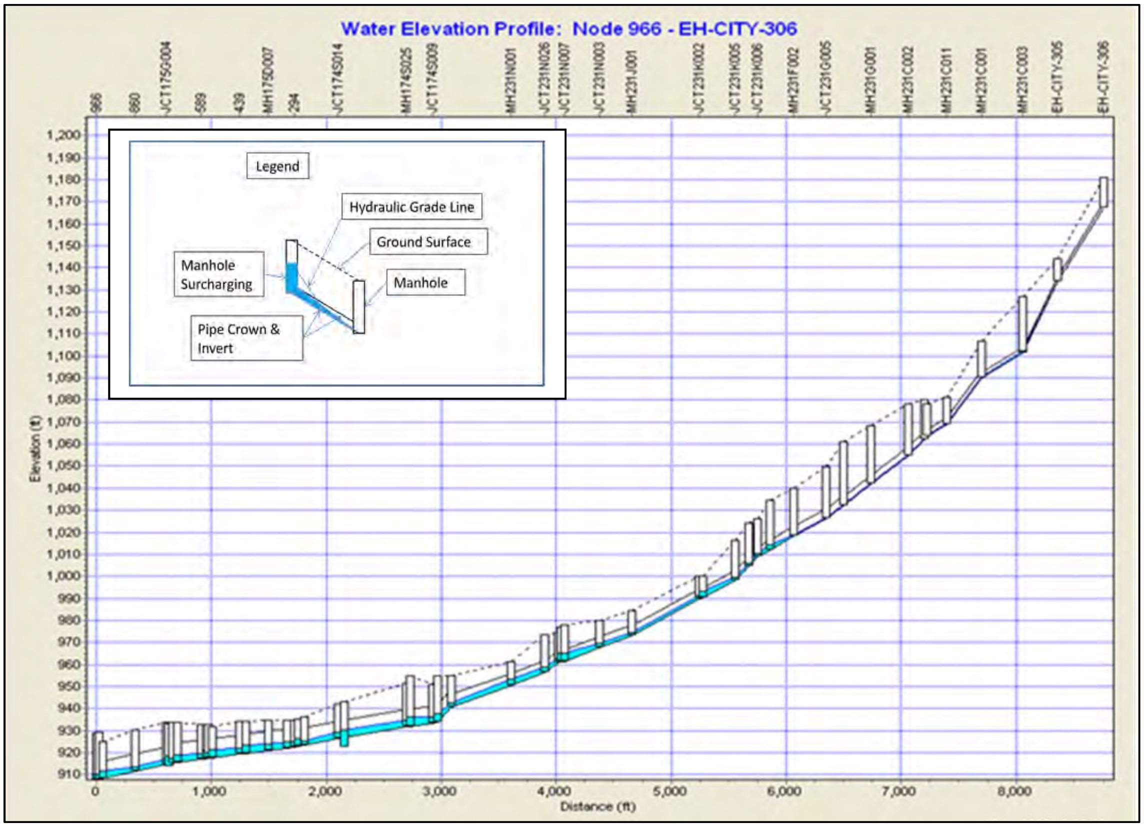
As is indicated in Figure A41-5-3a, significant surcharging, including manhole flooding occurs in sections of the Negley Run East trunk sewer along Washington Boulevard during peak typical year flow conditions (June 20th of the typical year). Serious flooding has occurred in the Washington Boulevard area during more severe storm conditions. Solutions to this flooding situation are being investigated separately as an urban flooding problem. The excessive surcharging at the lower end of the trunk sewer is produced by flow capacity limitations of the ALCOSAN diversion chambers and the downstream outfall sewer. For the purpose of this analysis, improvements necessary to convey the typical year flows to the ALCOSAN diversion chambers will be developed. It is anticipated that future improvements to the ALCOSAN facilities will increase the capacity of the diversion chambers and downstream piping sufficiently to eliminate backwater effects in the PWSA trunk sewers.

FIGURE A42-5-3B: A-42 WEST TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure A42-5-3b, significant surcharging of the lower portion of the Negley Run west trunk sewer occurs under the current system configuration, including existing CSO diversion chamber settings under typical year peak flow conditions. The excessive surcharging at the lower end of the trunk sewer is produced by flow capacity limitations of the ALCOSAN diversion chambers and the downstream outfall sewer. No flooding is indicated under the modeled conditions. However, serious flooding occurs in the Washington Boulevard area during more severe storm conditions. Solutions to this flooding situation are being investigated separately as an urban flooding problem. For the purpose of this analysis, improvements necessary to convey the typical year flows to the ALCOSAN diversion chambers will be developed. It is anticipated that future improvements to the ALCOSAN facilities will increase the capacity of the diversion chambers and downstream piping sufficiently to eliminate backwater effects in the PWSA trunk sewers.

FIGURE A42-5-3C: A-42 UPPER NINE MILE RUN TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure A42-5-3c, the Negley Run Upper Nine Mile Run trunk sewer operates acceptably under the current system configuration, including existing CSO diversion chamber settings under typical year peak flow conditions.

5.2.2 2046 Peak Flows and Volumes to A-42 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the PWSA system. ALCOSAN made similar assumptions[1], and once flows had been

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative provides wet weather storage facilities to achieve four overflows per typical year, as well as additional relief sewer piping to convey increased flows to the A-42 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the A-42 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances From ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year.

The control alternatives developed and evaluated by both ALCOSAN and PWSA, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the A-42 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from the Municipality of Penn Hills and the Borough of Wilkinsburg indicate that each of them plan to convey all their flows to the A-42 trunk sewer system for the duration of the planning period. They have no plans to implement controls that would alter the modeled flows upon which the recommended alternative was based. This information is summarized in Table A42-5-6.

TABLE A42-5-6: A-42 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

Tributary Municipality	Volume*		
	Captured	Treated	Conveyed
Borough of Wilkinsburg	N/A	N/A	All modeled flows
Municipality of Penn Hills	N/A	N/A	All modeled flows

*Following implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative provides wet weather storage facilities to achieve four overflows per typical year, as well as additional relief sewer piping to convey increased flows to the A-42 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

The storage tank(s) are sized for the computed required storage volume (4 overflows per typical year at 2.25-million gallons) and are assumed to be underground and drained by a pump station sized to drain the full volume of the tank in a 24-hour period.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of wet weather storage facilities and relief sewer facilities designed to control CSOs from the PWSA diversion structures to four overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the A-42 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-A42-TNK-4 are consolidation piping, CSO screening facilities, storage, and pumping facilities. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment A42-5-1.

5.4.1 Consolidation Piping

In the A-42 sewershed, additional conveyance capacity was provided through the use of relief sewer(s) to convey flows to the A-42 POC. As detailed earlier, relief sewer(s) were added to areas of the system that exhibited manhole flooding or surcharging at any time during the 24-hour design storm events. All improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewer.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street
- Other values included in the cost – Trench excavations and backfill, rock excavation, trench wall support, street opening, clearing and grubbing, street restoration, flow maintenance, traffic maintenance

5.4.2 CSO Screening Facilities

It was assumed that screening will be installed at the storage tank prior to discharging. The unit cost associated with the installation of the screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

There are no diversion structure modifications included in the recommended alternative.

5.4.4 Storage and Pumping

As previously stated in Section 5.2.7, the storage tank is assumed to be below grade and sized for the computed required storage volume (4 overflows per typical year at 2.25-million gallons) and drained by a pump station sized (2.25-million gallons per day) to drain the full volume of the tank in a 24-hour period.

5.4.5 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure A42-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible “knee of the curve” is evident from this data.

These costs are also presented in a tabular format in Table A42-5-7.

The selected level of CSO control - 4 OF/yr - was determined based upon the costs anticipated and the expectation of meeting water quality standards. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities.

The capital improvements to be included in alternative POC-A42-TNK-4 are summarized in Table A42-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE A42-5-4: A-42 COSTS OF IMPROVEMENTS VS. NUMBER OF OVERFLOWS

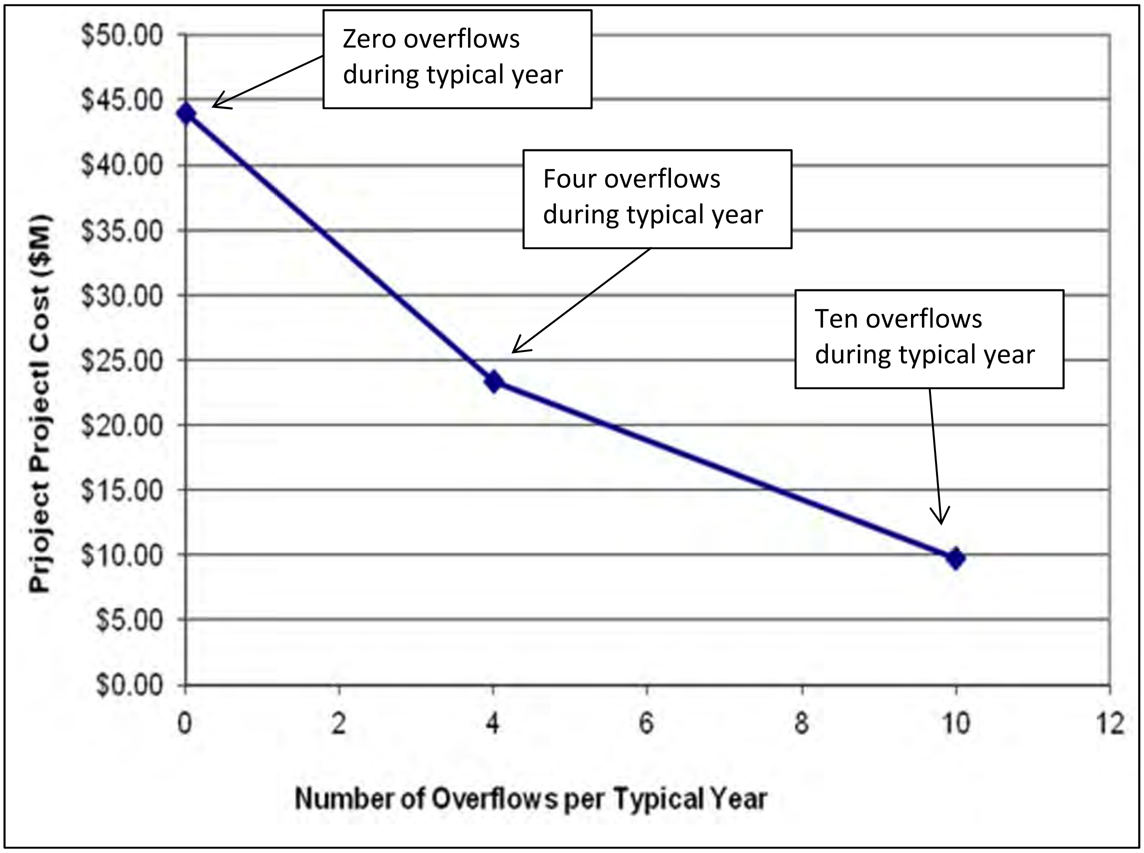


TABLE A42-5-7: A-42 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control				
	Untreated CSO Volume (MG)	CSO Control Level (OF/yr)	PW Capital Cost ($MM)	PW O&M Cost* ($MM)	TPW CSO Control ($MM)
POC-A42-TNK-0	0	0	$43.1	$0.9	$44.0
POC-A42-TNK-4	5.3	4	$22.7	$0.6	$23.3
POC-A42-TNK-10	21.2	10	$9.3	$0.5	$9.8
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-A42-TNK-0	0	2-year	$0	$0	$0
POC-A42-TNK-4	0	2-year	$0	$0	$0
POC-A42-TNK-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE A42-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-A42-TNK-4

Capital Improvements	Size/ Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Construct storage facility	2.25 Mgal	$12.32	$12.32	$12.64
Construct screening at storage facility	68 mgd overflow rate	$0.45	$0.45	$0.46
Construct pump station at storage facility	2.25 mgd	$3.02	$3.02	$3.22
Conveyance piping	24-in dia.	$0.75	$0.75	$0.77
Conveyance piping	72-in dia.	$6.14	$6.14	$6.22

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA and their tributary municipalities have agreed that the basis of allocation for future operation and maintenance costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the A-42 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant improvements (WWTP), a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, Storage Tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new

wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC A-42 overflow is intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the “Selected Plan” to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the “Recommended Plan”. This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the “Selected Plan” is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

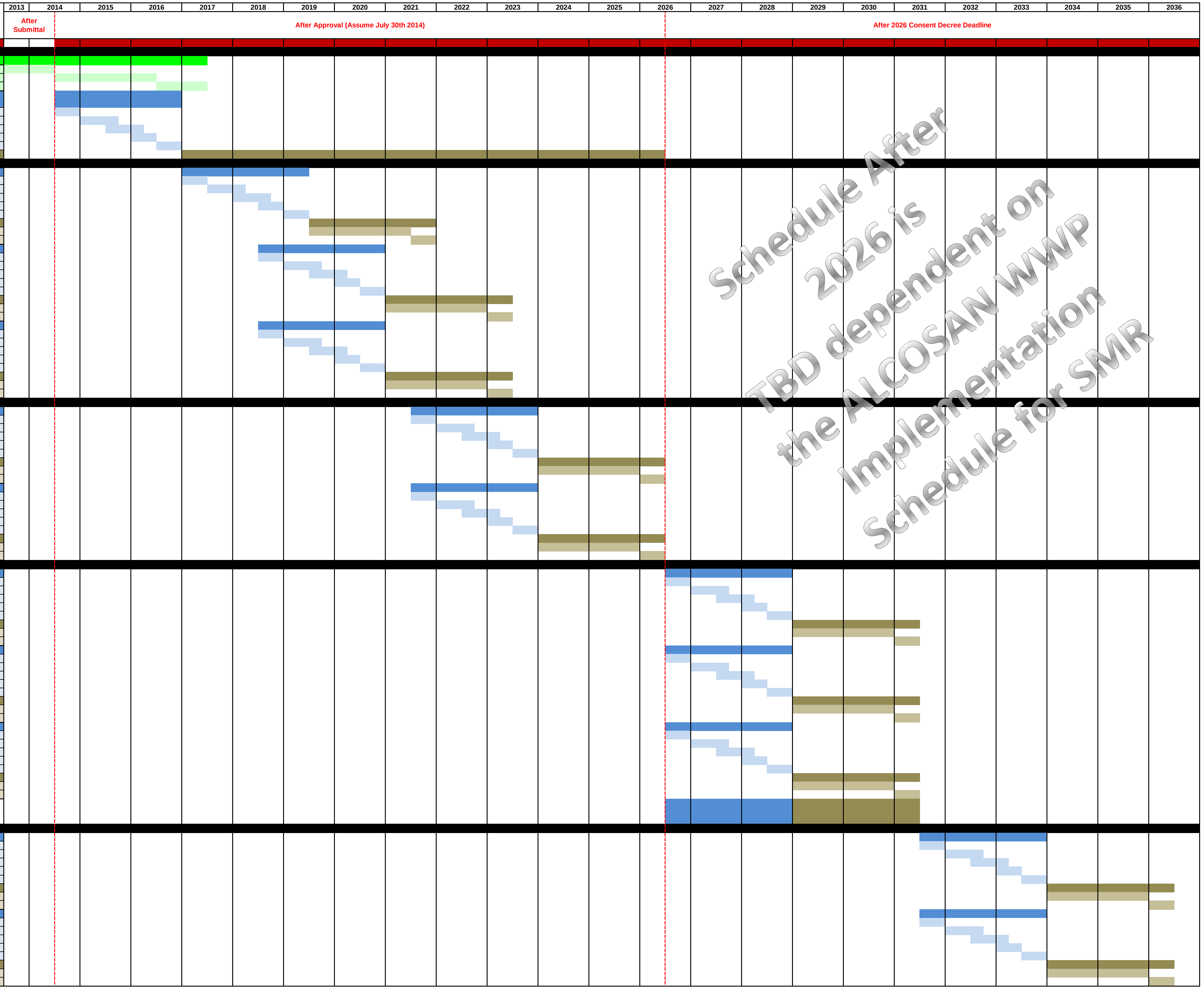
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it’s important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements be up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the Allegheny River tunnel segment extending toward A-42 portion of the regional plan is being implemented by the end of 2024. Per PWSA's implementation schedule, A-42 is included in Phase 2 (2017 to mid 2023) due to the preference to follow the design /construction of the ALCOSAN Allegheny River tunnel segment as well as to apply considerations for balanced distribution of costs and resources throughout the duration of the implementation schedule.

ATTACHMENT B

FIGURE A42-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the A-42 sewershed. These considerations include Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Municipality of Penn Hills, Wilkinsburg Borough, and the Pittsburgh Water and Sewer Authority. Other considerations regarding the A-42 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the "2-year design storm" for the municipal separate sanitary system portions and "4 OF/ typical year" for the PWSA's combined system outside of Saw Mill Run where "0 OF/ typical year" is proposed.

A set of guiding principles were produced for use in developing cost allocation procedures. These principles form the basis of a DRAFT Memorandum of Understanding by and between the Municipality of Penn Hills, Wilkinsburg Borough, and the Pittsburgh Water and Sewer Authority, and include:

- The major goal is to develop a fair and equitable cost allocation process.
- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.

- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.
- Cost allocations should be simple and easy to calculate in the future.
- The final cost allocation methodology should encourage efficiencies between municipalities.
- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.
- Unless agreed to by all parties, existing contracts should not form the only basis for cost allocations.

6.1.1 Cost Sharing Concept and Method

Two distinctive categories of cost allocations will need to be addressed by the PWSA and their tributary municipalities: capital cost allocations and O&M cost allocations. A number of methods for capital cost allocation were considered, based on the following:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution
- Proportion of internal municipal costs

All of these approaches could be modified by the addition of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc. The following discussion describes each of these methodologies.

"Agreed Upon" Basis: This approach could be as simple as each party agreeing to a fixed share of each element of cost or all costs across the board. Negotiation of the basis of the percent share is left to the discretion of the involved parties. Shares could be fixed for the term of the agreement, or they could be adjustable on a scheduled or otherwise agreed to basis. This approach is usually successful where

there are existing agreements or a long history of collaboration between the affected parties.

Capacity Basis: Capacity based cost sharing is predicated on the design capacity of the shared facilities and the portion that is allocable to the various parties to the Agreement. For the types of facilities being evaluated, wet weather flow rate and volume would be the primary capacity parameters. A Design Engineer's Report, normally submitted as part of the construction permitting process, should clearly specify and set forth the flow rate and volumetric design basis, as well as the capacity needs associated with all municipal entities. This information can serve as the basis for pro rata distribution of cost elements such as Debt Service and initial costs. One issue that should be addressed is how and whether unused and/or excess capacity utilized by "others" will be subject to cost reimbursement.

Expected Annual Flow Contribution: This method would utilize estimated flow rates for a predetermined average year as the basis for the evaluation of cost allocations. This may work well for systems where a hybrid approach of wet weather flow rate and volume is desired.

Proportion of Internal Municipal Cost: This approach requires municipalities to evaluate their own internal projects. This evaluation would include outlining control alternatives and selecting the highest ranked alternative for their internal solution. The municipalities' share of the combined project becomes a "not-to-exceed" or proportional value of its internal cost to the total regional cost.

6.1.2 Evaluation and Selection of Capital Cost Allocation Methodology

Four sewersheds, not including the A-42 POC sewershed, were selected by 3RWW and their PM Team as pilot sewersheds for cost allocation evaluations. Monthly meetings were held at which the meeting attendees selected the methodologies that they thought were appropriate, and the 3RWW/PM Team provided the necessary statistics for use in evaluating and selecting the best methodology.

Statistics intended to support the various allocation methodologies were developed and discussed with each POC participant. Over the course of several meetings, the major point of discussion was the identification of ways to ensure the allocation was fair and equitable by assigning the costs proportionally to the cost-causative items. In addition, participants agreed with the idea that it would not be fair for

downstream municipalities pay for upstream sections of the project, given that they did not contribute flows directly into that sewer.

Following these discussions, the first decision regarded the need to use peak wet weather flows as the basis for the cost allocation. The PM Team evaluated three main types of peak flow based analysis:

Percentage of Flow at POC: In this approach, the total flows at the POC and at each connection point tributary to the POC are obtained from the H&H Model. The flow rate for each connection point is then divided by the total POC flow to obtain its ratio. This represents the connection point's portion of the total cost of the regional project. It should be noted that portions of the project dedicated to a single municipality would be subtracted from the total cost of the regional project.

Percentage by Length of Use: In this approach, the distance from the POC is used as a "weighing factor" in the cost allocation calculation.

Segmental: In this approach, areas that are tributary to a project or a portion of a project would divide the cost based on peak wet weather flow rates from each tributary area.

In all of the cost allocation procedures, the calibrated ALCOSAN H&H Model was the accepted tool for determining peak flow rates. In some cases where two or more municipalities were combined into one loading point, the agreement was to use the model to affect the required split through RTK and area adjustments (if separate) and area adjustment (if combined).

6.1.3 Operation & Maintenance Cost Allocation

In the development of O&M cost allocation methods, it is important to define what constitutes O&M. The following is a general list of those items considered for each POC sewershed:

- Sewer Inspection
- CCTV and cleaning
- Utilities and power requirements for pump stations and storage basins
- Chemical costs for CSO facilities

- Minor repair and rehabilitation
- Staff salaries, wages and fringe benefits
- Replacement costs (sewers and structures - 100 years; mechanical equipment – 25 years)
- SSO Response Plan

The next step was to categorize these expenses into at least groups – those items impacted by peak flow (such as CCTV and sewer cleaning) and those items impacted by volume of wastewater (such as storage basins). Once categorized, various methodologies for O&M cost allocation could be investigated. A number of approaches to O&M cost allocation were considered, and three of those chosen for capital cost allocation were also chosen for O&M cost allocations:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution

As was the case for the capital cost allocation methods, each of these approaches can be modified by the application of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc.

6.1.4 Selected Capital Cost Allocation Method

The selected methods of capital cost allocation between the PWSA and their tributary municipalities are based upon the percentage distribution of peak wet weather flows and annual storage volume for the relief sewer and storage tank portions of the improvements, respectively.

Using this approach, each municipality contributing to the new sewer would divide the cost based on peak wet weather flow rates from each municipal tributary area. Also, each municipality contributing to the new tank would divide the cost based on annual storage volume contribution from each tributary municipality. The calibrated ALCOSAN H&H Model was the accepted tool for use in determining those peak flow rates.

For the purposes of this Feasibility Study, alternative POC-A42-BTNK-4 has been divided into two (2) portions: The Storage Tank and the Relief Sewer. Each of the two (2) portions is considered multi- municipal. General locations of the two (2) portions of the recommended alternative are illustrated in Figure A42-5-1.

It is anticipated that the conceptual capital cost allocation estimates for each segment will be based on the municipal peak wet weather flow percentages shown in Table A42-6-1.

TABLE A42-6-1: MUNICIPAL PERCENTAGES OF DESIGN ANNUAL STORED VOLUME AND AREA BASED PEAK WET WEATHER FLOW (4 OF PER TYPICAL YEAR)

Municipality/ Authority	Storage Tank Based Percent Distribution of Design Volumes (For Storage Tank)	Area Based Percent Distribution of Peak Flows (For Relief Sewer)
PWSA	57.42	95.86
Municipality of Penn Hills	41.92	7.11
Wilkinsburg Borough	0.65	0.03

If work is done by a municipality to reduce flow below the flows currently predicted and the municipality wants to revise these percentages, that municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties prior to the commencement of design. It should also be noted that the Municipality of Penn Hills has not agreed to the cost allocation and the approach to this allocation.

6.1.5 Selected O&M Cost Allocation Method

The selected methods of O&M cost allocation between the PWSA and their tributary municipalities are based upon the percentage distribution of Equivalent Dwelling Unit (EDU) based peak wet weather flows and annual POC volume for the relief sewer and storage tank portions of the improvements, respectively.

Using this approach, each municipality contributing to the new sewer would divide the cost based on peak wet weather flow rates from each number of EDUs in a municipal tributary area. Also, each municipality contributing to the new tank would divide the cost based on annual POC volume percentage contribution from each tributary municipality. The use of the calibrated ALCOSAN H&H Model was the accepted tool for use in determining those peak flow rates.

It is anticipated that the conceptual O&M cost allocation estimates for each segment will be based on the municipal peak wet weather flow percentages shown in Table A42-6-2.

TABLE A42-6-2: MUNICIPAL PERCENTAGES OF DESIGN ANNUAL POC VOLUME AND EDU BASED PEAK WET WEATHER FLOW (4 OF PER TYPICAL YEAR)

Municipality/ Authority	POC Based Percent Distribution of Design Volumes (For Storage Tank)	EDU Based Percent Distribution of Peak Flows (For Relief Sewer)
PWSA	47.67	89.95
Municipality of Penn Hills	51.53	9.93
Wilkinsburg Borough	0.80	0.12

If work is done by a municipality to reduce flow below the flows currently predicted and the municipality wants to revise these percentages, that municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties prior to the commencement of design. It should also be noted that the Municipality of Penn Hills has not agreed to the cost allocation and the approach to this allocation.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

One of the early steps taken to facilitate the development of up-to-date and relevant MOUs and/or inter-municipal agreements is to determine whether or not there were any existing, applicable MOUs or service agreements. 3RWW, working with the University of Pittsburgh, collected many of the existing agreements. The FSWG also formed an inter-municipal agreements subcommittee to review those existing agreements, develop an agreement outline for use by the municipalities, and prepare draft agendas for use in multi-municipal meetings.

The various inter-municipal agreements that have been compiled by 3RWW were reviewed for the purpose of summarizing the provisions that are relevant to allowable flow contributions. The results of this review are presented below. All specific references to "sanitary sewers", "sanitary sewage" or other characterizations of the tributary sewer systems were extracted and presented below. In addition, specific information regarding cost sharing arrangements was also extracted from the agreements. There were no agreements identified from this search that involved the tributary municipalities Penn Hills and Wilkinsburg Borough, however Penn Hills believes that there are existing agreements related to A-42. An agreement involving Penn Township was located and is presented below.

1. In an agreement dated April 8, 1963 the City of Pittsburgh and Penn Township reached an agreement. Relevant terms of that agreement are:
   - City permits the township to discharge storm and sanitary drainage from an area of 47 acres (Gladefield Sewer District) the Nine Mile Run Trunk Sewer.
   - Township pays the City $12,000.
   - City to maintain and repair the Negley Run Sewer System from the City/Township line to the Allegheny River and the Township agrees to pay 1.6% of costs of said work as determined by the City.
   - City reserves the right to revoke permission granted by this agreement on 90 day notice.

It should be emphasized that this 1963 agreement is not anticipated to be used as the inter-municipal agreement for this project. The draft MOU developed per the following subsections would serve as an initial understanding of what would form a new future agreement between the municipalities.

6.2.1 Development of MOU and Inter-Municipal Agreements

When more than one municipality is involved in the design, construction and operation of wet weather control facilities, it is intended that they will develop inter-municipal agreements to outline their mutual understanding of the project as well as their municipal, customer and legal responsibilities. These responsibilities include, but are not limited to, joint permitting, joint ownership, joint cost sharing, and who will operate and maintain the facility on a long term basis.

In addition, it is the PWSA's position that any agreements or MOUs should contain provisions for periodic review and amendment as necessary by the respective parties and their solicitors. It should be noted that the Municipality of Penn Hills has not agreed to the methodology used to propose projects.

6.2.2 MOU and Inter-Municipal Agreements

A Memorandum of Understanding (MOU) has not been drafted yet.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

A draft MOU has not been drafted yet, but cost allocation evaluations have taken place. A preliminary estimate of total cost to be expended on the inter-municipal segments of the recommended alternative is $22,680,000. This cost represents the cost associated with the elements of the required improvements in the sewershed that provide multi-municipal service (i.e. convey or otherwise handle flows generated by more than one municipality). The calculation of allocated costs for each portion of the alternative is shown in attachment A42-6-1 and is based on percentage of peak flow and annual stored volume contribution multiplied by the preliminary estimated total cost of the relief sewer and storage tank, respectively. This calculation is shown in the attachments.

It is intended that an agreement will be entered into by all parties after an implementation order has been issued by the PADEP and/or the ACHD. Such an order would indicate that the cost to each party would be based on the cost of each segment, to be adjusted for changes in costs made during construction.

The cost allocation calculation which is shown in attachment A42-6-1 resulted in the preliminary estimate of the percentage and amount of the total cost of implementation from each municipality and is as indicated in Table A42-6-3.

TABLE A42-6-3 PRELIMINARY CAPITAL AND O&M COST DISTRIBUTION ESTIMATES

Municipality	**Capital Costs**		**O/M Costs**	
	Percentage (%)	**Amount ($)**	**Percentage (%)**	**Amount ($)**
Municipality of Penn Hills	31.35	7,110,000	43.35	65,600
Wilkinsburg Borough	0.47	105,700	0.70	1,000
The Pittsburgh Water and Sewer Authority	68.19	15,470,000	53.95	78,064

The draft MOU is not available at this time. When an MOU is made available and if the MOUs are signed and provided by the municipalities, the signed copies of the MOU would be provided in Addendum A42-6-1 to this POC report.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended A-42 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after A-42 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

- Phase I 2013 through 2017
- Phase II 2017 through 2023

- Phase III 2021 through 2026
- Phase IV TBD
- Phase V TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure A42-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the A-42 shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

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[1] Text is derived from "A Guide for Preparing Act 537 Update Revisions, 2003".

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

6.3.2 Joint Municipal Planning and Implementation

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. The draft MOU contains provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

The specific municipal tasks and efforts necessary to effect implementation of the Feasibility Study involve the completion of the Storage Tank and Relief Sewer portions as listed above in Table A42-6-1.

All associated parties in the POC sewershed have participated in planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. Signature pages of executed MOUs or other expressions of agreement as provided by the municipalities are attached as Addendum A42-6-1 to this POC report.

At this time, Penn Hills disagreement with the cost allocations could delay or impede the development and signing of the MOU.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$22,680,000
- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance
- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table A42-6-4. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. According to Table A42-6-2, the total cost for PWSA customers will be tripled from an estimated $399 for the current system in 2012 to a total of $1,113 during the first full year of operation (assume 2027). Projected PWSA cost per household will total $306, including about $98 for Wet Weather Program improvements. The addition of the projected $808 in ALCOSAN to the projected $305 in PWSA system costs results in an estimated cost per household in 2027 of $1,113. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE A42-6-4: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638
Municipality of Penn Hills	$702	$1,414	Not Available
Wilkinsburg Borough	Not Available	Not Available	Not Available

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

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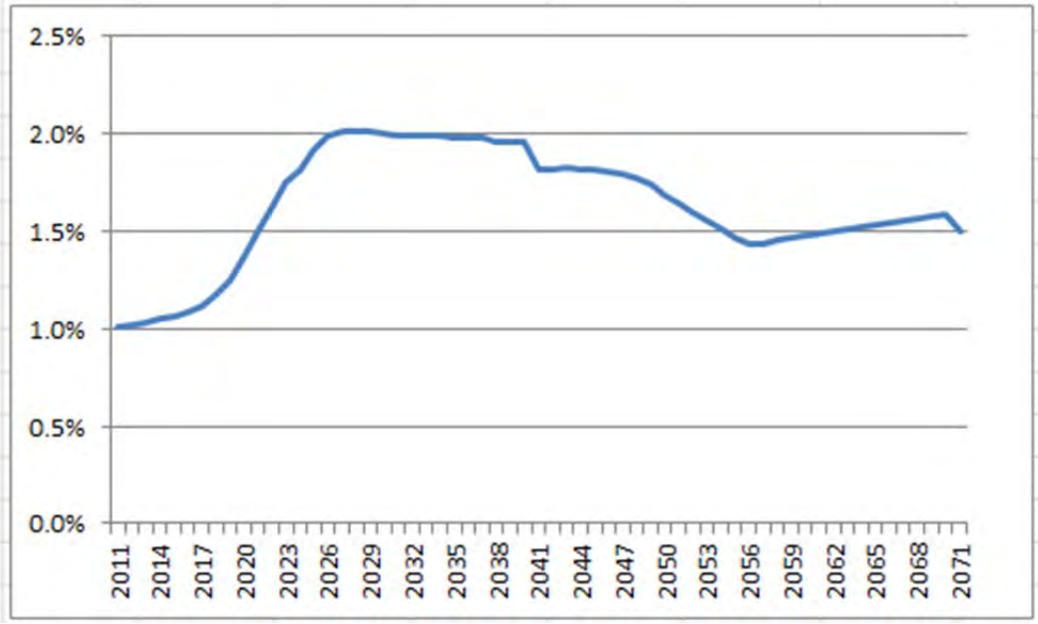
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.

[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure A42-6-1.

FIGURE A42-6-1 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.

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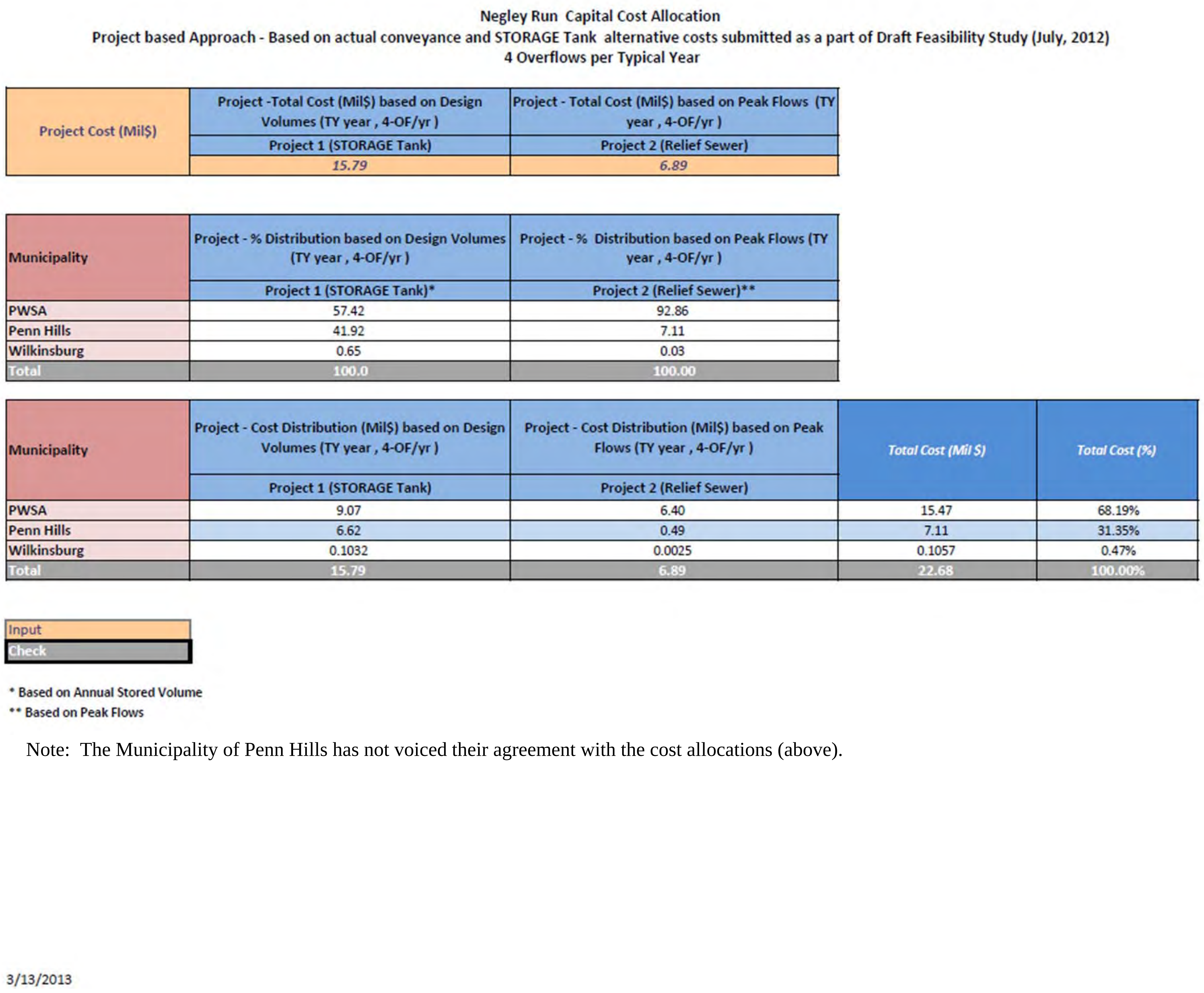

Negley Run Capital Cost Allocation
Project based Approach - Based on actual conveyance and STORAGE Tank alternative costs submitted as a part of Draft Feasibility Study (July, 2012)
4 Overflows per Typical Year

Project Cost (Mil$)	Project -Total Cost (Mil$) based on Design Volumes (TY year , 4-OF/yr)	Project - Total Cost (Mil$) based on Peak Flows (TY year , 4-OF/yr)
	Project 1 (STORAGE Tank)	Project 2 (Relief Sewer)
	15.79	*6.89*

Municipality	Project - % Distribution based on Design Volumes (TY year , 4-OF/yr)	Project - % Distribution based on Peak Flows (TY year , 4-OF/yr)
	Project 1 (STORAGE Tank)*	Project 2 (Relief Sewer)**
PWSA	57.42	92.86
Penn Hills	41.92	7.11
Wilkinsburg	0.65	0.03
Total	100.0	100.00

Municipality	Project - Cost Distribution (Mil$) based on Design Volumes (TY year , 4-OF/yr)	Project - Cost Distribution (Mil$) based on Peak Flows (TY year , 4-OF/yr)	*Total Cost (Mil $)*	*Total Cost (%)*
	Project 1 (STORAGE Tank)	Project 2 (Relief Sewer)		
PWSA	9.07	6.40	15.47	68.19%
Penn Hills	6.62	0.49	7.11	31.35%
Wilkinsburg	0.1032	0.0025	0.1057	0.47%
Total	15.79	6.89	22.68	100.00%

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* Based on Annual Stored Volume
** Based on Peak Flows

Note: The Municipality of Penn Hills has not voiced their agreement with the cost allocations (above).

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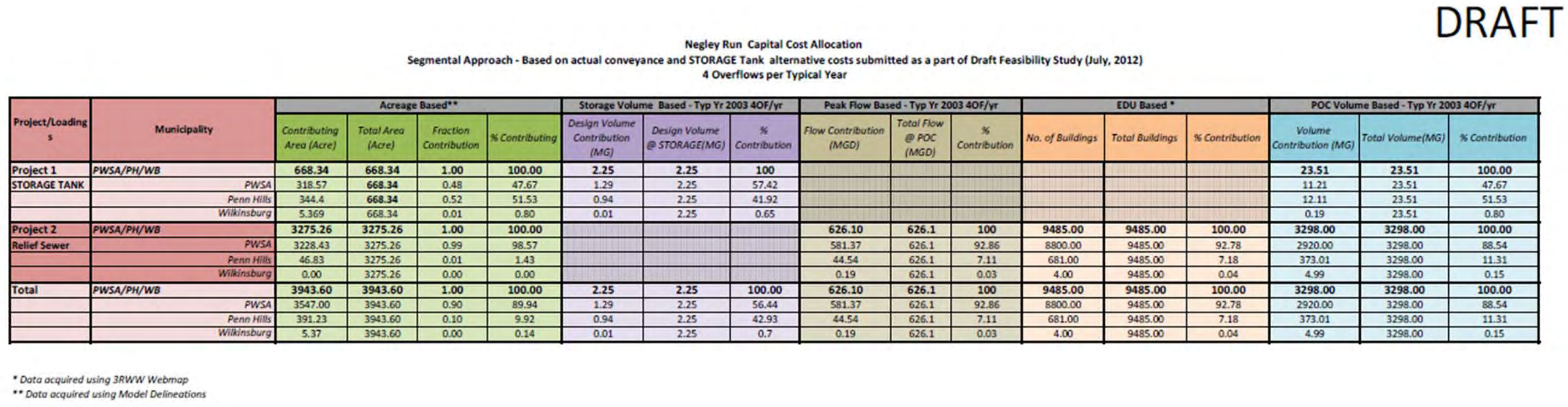

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Negley Run Capital Cost Allocation
Segmental Approach - Based on actual conveyance and STORAGE Tank alternative costs submitted as a part of Draft Feasibility Study (July, 2012)
4 Overflows per Typical Year

Project/Loadings	Municipality	Acreage Based**				Storage Volume Based - Typ Yr 2003 4OF/yr			Peak Flow Based - Typ Yr 2003 4OF/yr			EDU Based *			POC Volume Based - Typ Yr 2003 4OF/yr		
		Contributing Area (Acre)	Total Area (Acre)	Fraction Contribution	% Contributing	Design Volume Contribution (MG)	Design Volume @ STORAGE(MG)	% Contribution	Flow Contribution (MGD)	Total Flow @ POC (MGD)	% Contribution	No. of Buildings	Total Buildings	% Contribution	Volume Contribution (MG)	Total Volume(MG)	% Contribution
Project 1	***PWSA/PH/WB***	**668.34**	**668.34**	**1.00**	**100.00**	**2.25**	**2.25**	**100**							**23.51**	**23.51**	**100.00**
STORAGE TANK	*PWSA*	318.57	**668.34**	0.48	47.67	1.29	2.25	57.42							11.21	23.51	47.67
	Penn Hills	344.4	**668.34**	0.52	51.53	0.94	2.25	41.92							12.11	23.51	51.53
	Wilkinsburg	5.369	668.34	0.01	0.80	0.01	2.25	0.65							0.19	23.51	0.80
Project 2	***PWSA/PH/WB***	**3275.26**	**3275.26**	**1.00**	**100.00**				**626.10**	**626.1**	**100**	**9485.00**	**9485.00**	**100.00**	**3298.00**	**3298.00**	**100.00**
Relief Sewer	*PWSA*	3228.43	3275.26	0.99	98.57				581.37	626.1	92.86	8800.00	9485.00	92.78	2920.00	3298.00	88.54
	Penn Hills	46.83	3275.26	0.01	1.43				44.54	626.1	7.11	681.00	9485.00	7.18	373.01	3298.00	11.31
	Wilkinsburg	0.00	3275.26	0.00	0.00				0.19	626.1	0.03	4.00	9485.00	0.04	4.99	3298.00	0.15
Total	***PWSA/PH/WB***	**3943.60**	**3943.60**	**1.00**	**100.00**	**2.25**	**2.25**	**100.00**	**626.10**	**626.1**	**100**	**9485.00**	**9485.00**	**100.00**	**3298.00**	**3298.00**	**100.00**
	PWSA	3547.00	3943.60	0.90	89.94	1.29	2.25	56.44	581.37	626.1	92.86	8800.00	9485.00	92.78	2920.00	3298.00	88.54
	Penn Hills	391.23	3943.60	0.10	9.92	0.94	2.25	42.93	44.54	626.1	7.11	681.00	9485.00	7.18	373.01	3298.00	11.31
	Wilkinsburg	5.37	3943.60	0.00	0.14	0.01	2.25	0.7	0.19	626.1	0.03	4.00	9485.00	0.04	4.99	3298.00	0.15

** Data acquired using 3RWW Webmap*
*** Data acquired using Model Delineations*

Note: The Municipality of Penn Hills has not voiced their agreement with the cost allocations (above).

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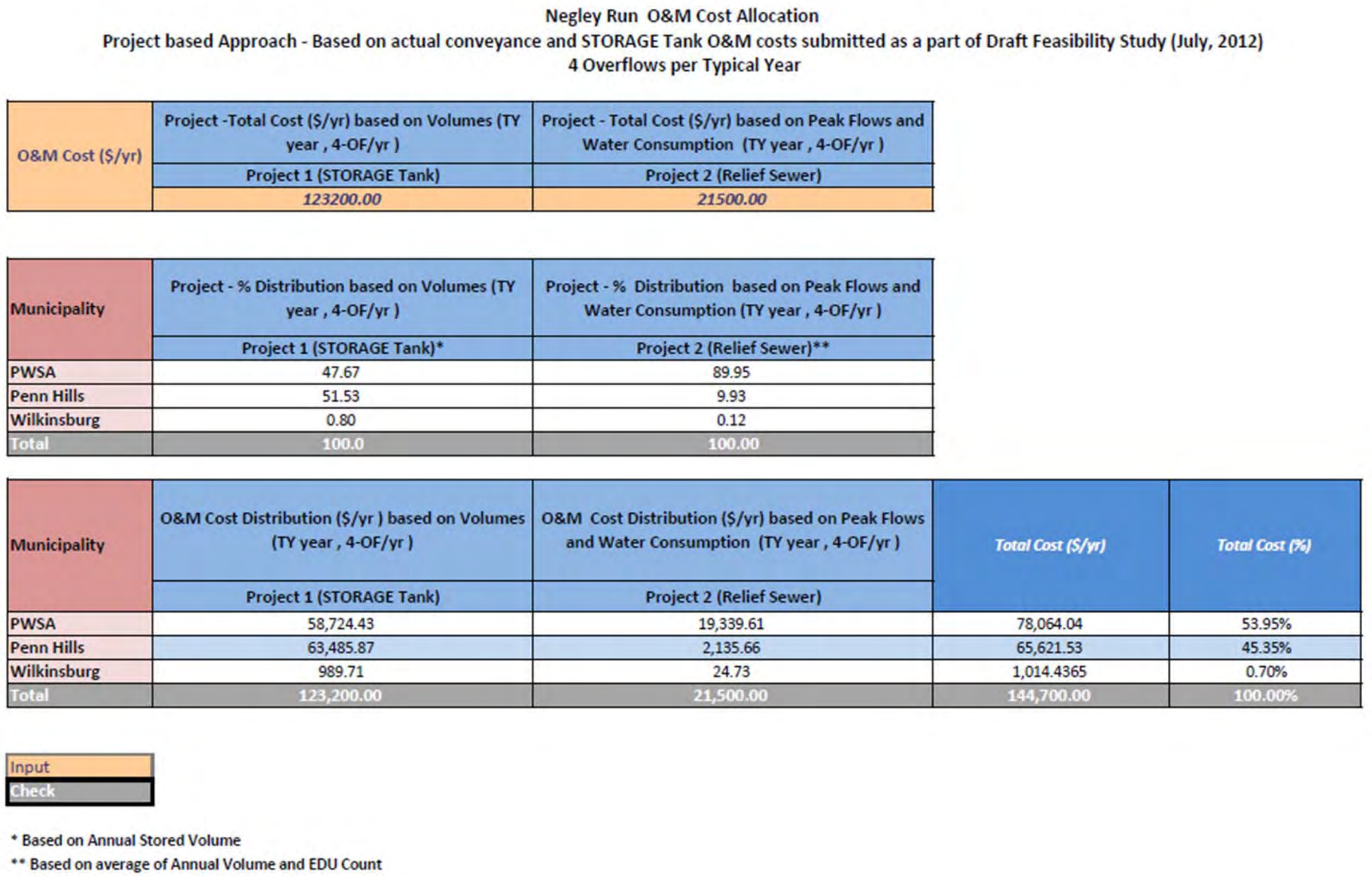

Negley Run O&M Cost Allocation
Project based Approach - Based on actual conveyance and STORAGE Tank O&M costs submitted as a part of Draft Feasibility Study (July, 2012)
4 Overflows per Typical Year

O&M Cost ($/yr)	Project -Total Cost ($/yr) based on Volumes (TY year , 4-OF/yr)	Project - Total Cost ($/yr) based on Peak Flows and Water Consumption (TY year , 4-OF/yr)
	Project 1 (STORAGE Tank)	Project 2 (Relief Sewer)
	123200.00	*21500.00*

Municipality	Project - % Distribution based on Volumes (TY year , 4-OF/yr)	Project - % Distribution based on Peak Flows and Water Consumption (TY year , 4-OF/yr)
	Project 1 (STORAGE Tank)*	Project 2 (Relief Sewer)**
PWSA	47.67	89.95
Penn Hills	51.53	9.93
Wilkinsburg	0.80	0.12
Total	100.0	100.00

Municipality	O&M Cost Distribution ($/yr) based on Volumes (TY year , 4-OF/yr)	O&M Cost Distribution ($/yr) based on Peak Flows and Water Consumption (TY year , 4-OF/yr)	*Total Cost ($/yr)*	*Total Cost (%)*
	Project 1 (STORAGE Tank)	Project 2 (Relief Sewer)		
PWSA	58,724.43	19,339.61	78,064.04	53.95%
Penn Hills	63,485.87	2,135.66	65,621.53	45.35%
Wilkinsburg	989.71	24.73	1,014.4365	0.70%
Total	123,200.00	21,500.00	144,700.00	100.00%

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* Based on Annual Stored Volume
** Based on average of Annual Volume and EDU Count

Note: The Municipality of Penn Hills has not voiced their agreement with the cost allocations (above).

3/13/2013

7.0 STAKEHOLDER INVOLVEMENT

Stakeholder meetings titled POC Sewershed Coordination Meetings, facilitated by 3RWW, were held during the site and technology selection and alternative development processes. These meetings facilitated cooperation, information exchange and consensus building between the PWSA, its stakeholders and tributary municipalities essential to the development of the PWSA Feasibility Study Report and supporting POC-based feasibility studies. For the meetings listed in Table 7-1, POC A-42 was the focus of the discussion and representatives from municipalities' tributary to the Negley Run sewershed were in attendance. Meeting topics included source reduction and green infrastructure, alternatives analysis, affordability and implementation schedule, and cost allocation. Other stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

The Wet Weather Feasibility Study Coordination Meeting, led by the PWSA, facilitated stakeholder participation between the PWSA and the Municipality of Penn Hills community tributary to the Negley Run watershed. The purpose of this meeting was to coordinate the development of planning information specific to the multi-municipal sewershed, reach a consensus agreement on the recommended improvements and receive authorization to submit the results.

TABLE 7-1. A-42: NEGLEY RUN POC MEETINGS

Title/Purpose	Date	Time	Location
WW Feasibility Study Coordination	3/27/12	1:30 PM	PWSA Office
POC Sewershed Coordination	2/19/13	2:00 PM	PWSA Office
POC Sewershed Coordination	3/6/13	10:00 AM	PWSA Office
POC Sewershed Coordination	3/12/13	9:30 AM	PWSA Office

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
A-51: EAST STREET

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

TABLE OF CONTENTS

6.0 Financial and Institutional Considerations

7.0 Stakeholder Involvement

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.
- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.
- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.
- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.

- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.

- Section 7.0 describes how stakeholders were included in the development of the plan.

1.2 EXISTING SYSTEM DESCRIPTION

This POC FS Report addresses POC A-51, also known as part of the East Street Valley. The A-51 sewershed is located in the Main Rivers Planning Basin. The Main Rivers basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

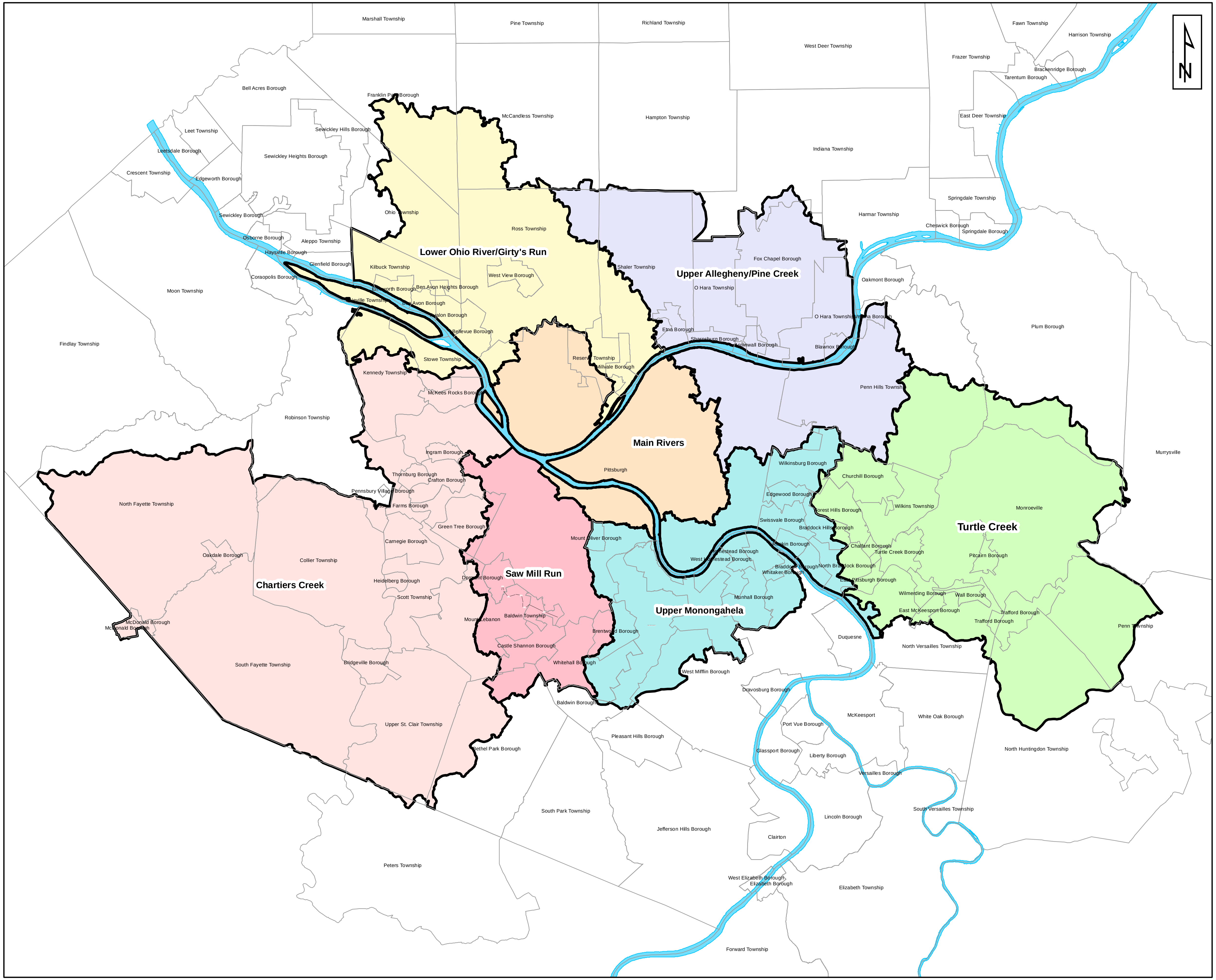
The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: A-51 East Street Valley Existing Facilities Map*. The primary East Street trunk sewer system consists of two parallel lines, one owned by PennDOT and one owned by the PWSA. The PWSA line flows in a southward direction beginning at the interchange between I-279 and McKnight Road and runs along the I-279 corridor. At the intersection of East Street and Hazlett Street it begins to follow East Street to the intersection of Progress Way and Madison Way where the size increases to 102-inches in diameter. This 102-inch diameter sewer connects to ALCOSAN diversion chamber ADC009EA58. The PennDOT storm line starts at the Ivory Avenue and McKnight Road intersection, running southward along I-279 until it reaches the PennDOT diversion chamber PADC024A001 near Valette Street. From this diversion chamber, the storm line flows to CSO009E001 as a 120-inch by 144-inch line.

There are 3 PWSA flow diversion chambers and 21 PWSA flow dividers (redistribute wastewater flows to improve conveyance and reduce the likelihood of overflows) that divert wet weather flow from the Madison Avenue combined sewer systems to the PennDOT storm sewer upstream PennDOT diversion chamber PADC024A001. The 2 PWSA flow diversion chambers (DC023D001 and DC023H001) divert wet weather flow from the A-51 combined sewer system to the PennDOT storm sewer downstream PennDOT diversion chamber PADC024A001. PennDOT diversion chamber diverts portions of the flows in the PennDOT sewer to the Madison Avenue trunk sewer. These facilities discharge to ALCOSAN POC A-58, ACSO0098EAA58 and CSO009E001.

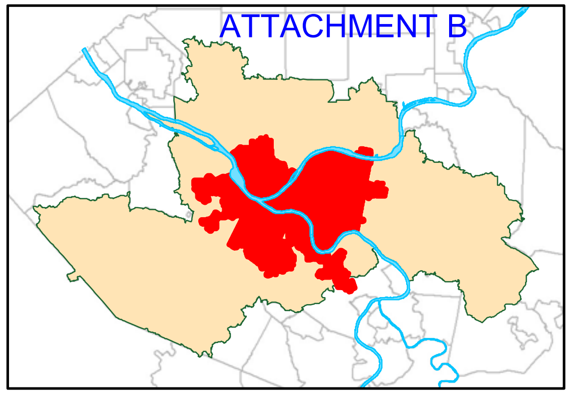
An approximately 24-acre area in the Troy Hill Road area of the upper portion of the East Street sewershed flows to PWSA diversion chamber DC163L001. Wet weather flows from this structure are diverted from the Madison Avenue trunk sewer system to CSO outfall 163G001.

The Evergreen Pump Station is located within the East Street sewershed on Evergreen Road in the Summer Hill section of the City. The pump station serves a sanitary sewershed area containing approximately 25 residences.

The East Street sewershed encompasses at total of approximately 1,079 acres (1,059 acres of the City of Pittsburgh, 17 acres of Ross Township and approximately 3 acres of Reserve Township). Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to A-51* for specific information on this POC.



ATTACHMENT B



ALCOSAN Service Area Overview

Legend

☐	Municipal Boundary
🟥	Chartiers Creek
🟨	Lower Ohio River / Girty's Run
🟧	Main Rivers
🟥	Saw Mill Run
🟩	Turtle Creek
🟪	Upper Allegheny / Pine Creek
🟦	Upper Monongahela
🟦	River

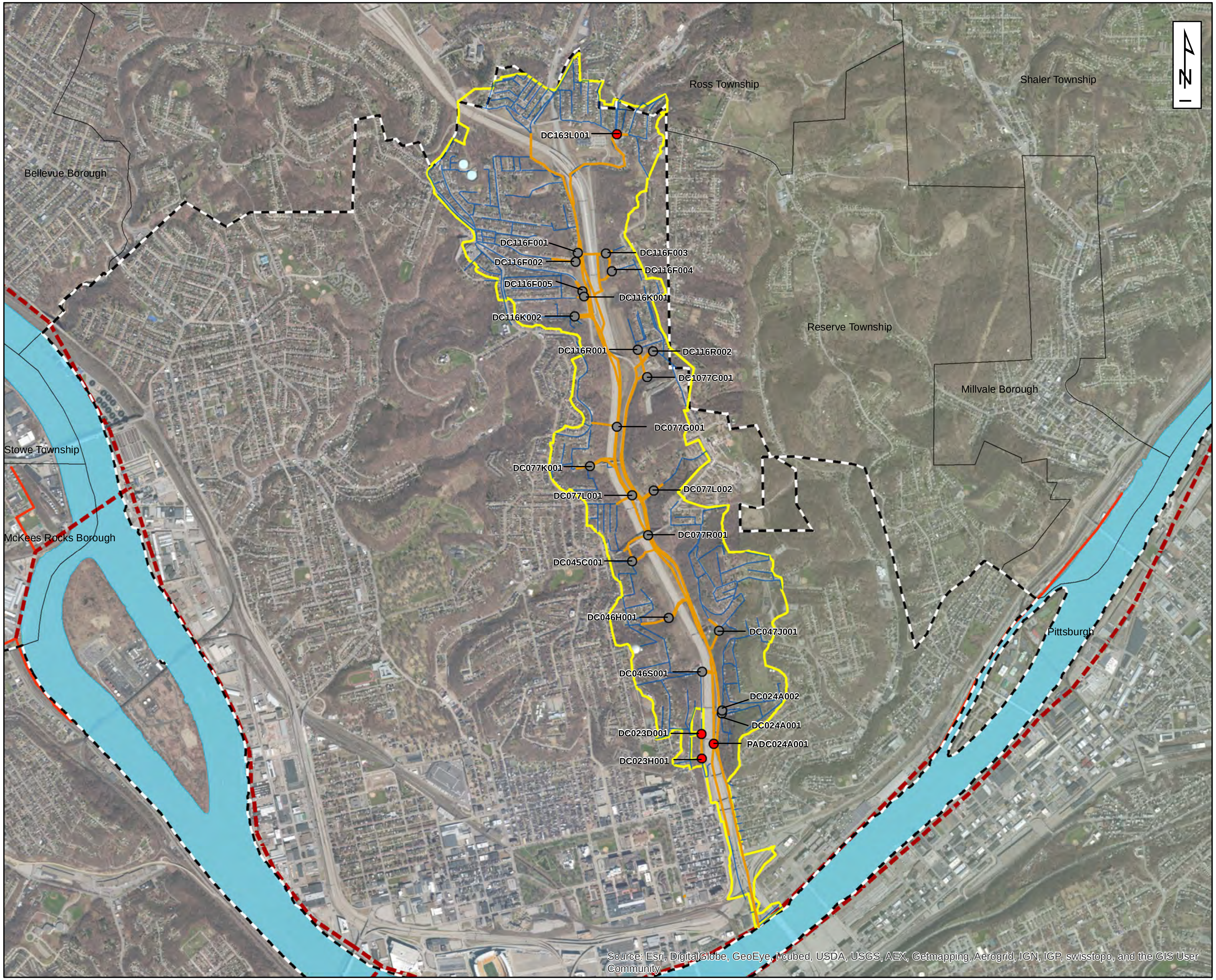
14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

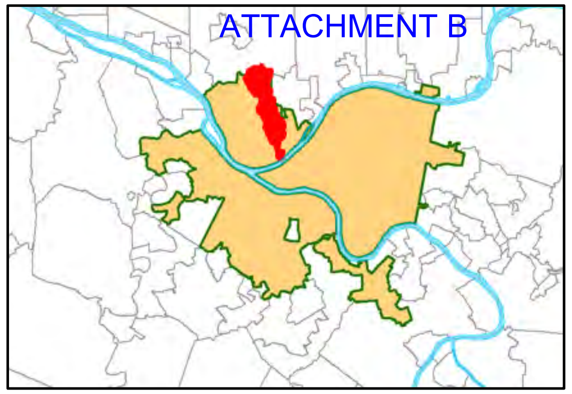
July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

- ● PWSA CSO Diversion Structure
- ● PWSA Flow Divider Structure
- ― Collector Sewer
- ☐ A-51 Sewershed Boundary
- ⬚ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ‒ ‒ Deep Tunnel
- ― Shallow Cut

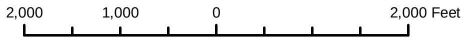


Figure 1 - 2: A-51
East Street Valley
Existing Facilities

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July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\EAST STREET VALLEY (A-51)\FIGURE 1-2_A_51Existing Overflows.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR AREA TRIBUTARY TO A-51 (A-58)

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY		
	City of Pittsburgh	Ross Township	Reserve Township
Tributary Area (Acres)	1,059	17	3
Population	6,893	0	21
Combined			
Inch-Miles	593	0	1
Linear Feet	173,210	0	164
Inch-Miles/Acre	0.56	0	0.33
Separate			
Inch-Miles	20	3	0
Linear Feet	9,224	1,373	0
Inch-Miles/Acre	0.02	0.18	0

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows that are not released to the environment by the upstream PWSA diversion structures are regulated by the A-51 ALCOSAN CSO diversion structure located at the intersection of River Avenue and Voeghtly Street.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to A-51*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO A-51

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
163G001	DC163L001	CSO163001	Evergreen and Ivory Avenue	Girty's Run
009E001	DC023D001 DC023H001 PADC024A001	CSO009E001	River Avenue and Voeghtly Street	Allegheny River

As shown in *Table 1-3: A-51 Sewershed Typical Year Overflow Statistics*, during the typical year these structures overflow 163 times. The largest overflow volume is approximately 11 million gallons per event and the total annual volume is approximately 111 million gallons.

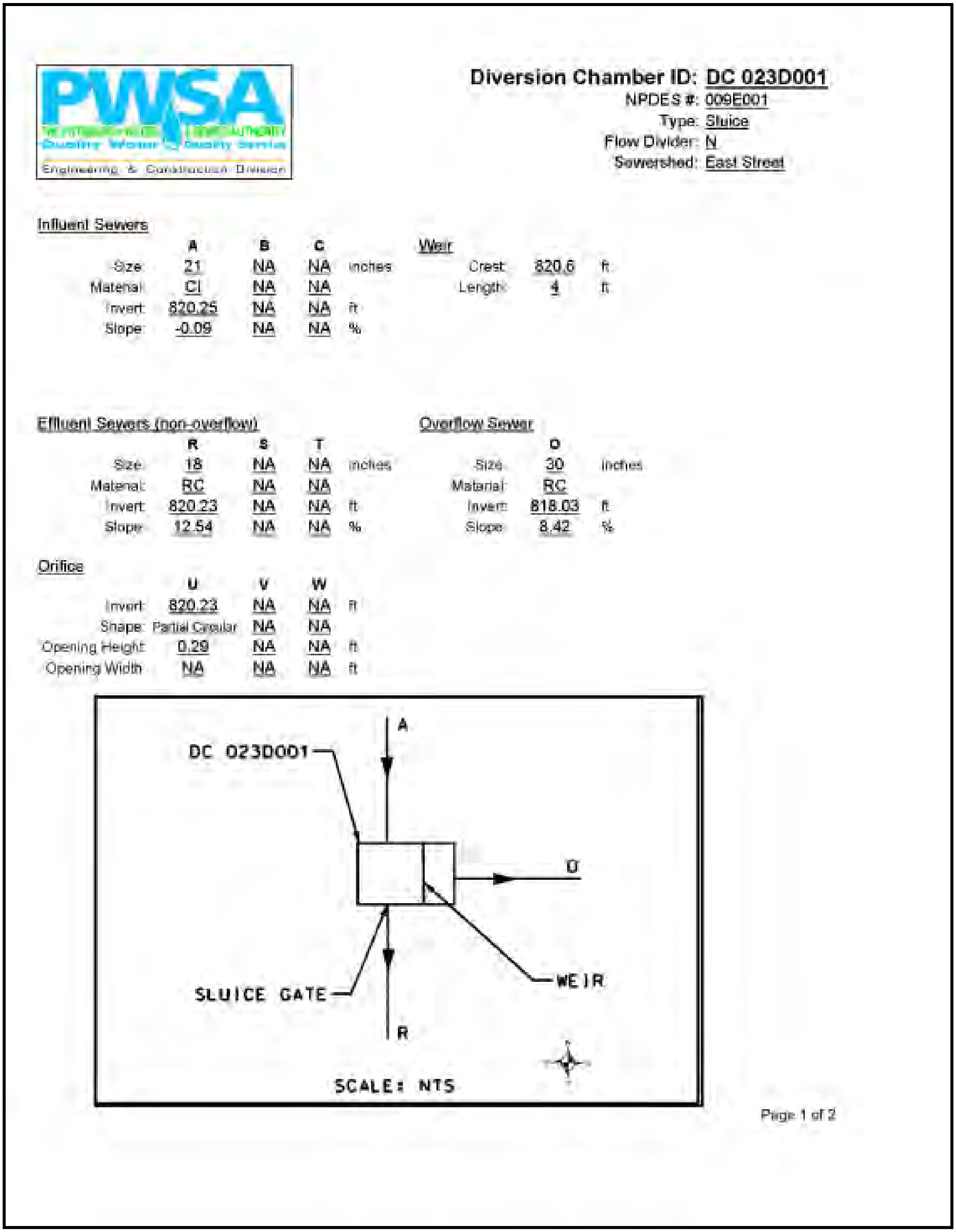
TABLE 1-3: A-51 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Typical Year Overflow Statistics								
Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC163L001	65	5.66	1.42	0.97	0.20	0.10	0.04	1.76
DC023D001 DC023H001	29	5.20	1.94	0.50	0.12	0.03	0.01	0.48
PADC024A001 *DC116F001 *DC116F002 *DC116F003 *DC116F004 *DC116F005 *DC116K001 *DC116K002 *DC116R001 *DC116R002 *DC077C001 *DC077G001 *DC077K001 *DC077L001 *DC077L002 *DC077R001 *DC046C001 *DC046H001 *DC046S001 *DC047J001 *DC024A002 *DC024A001	69	102.39	85.65	34.94	11.37	5.65	3.04	109.15
							Total Annual Volume	**111.39**

*Flow dividers not diversion structures/chambers

1.2.1 Diversion Structure Sketches

The following sketches of the A-51 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.



PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 023D001
NPDES #: 009E001
Type: Sluice
Flow Divider: N
Sewershed: East Street

Influent Sewers

	A	B	C	
Size:	21	NA	NA	inches
Material:	CI	NA	NA	
Invert:	820.25	NA	NA	ft
Slope:	-0.09	NA	NA	%

Weir

Crest:	820.6	ft
Length:	4	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	18	NA	NA	inches
Material:	RC	NA	NA	
Invert:	820.23	NA	NA	ft
Slope:	12.54	NA	NA	%

Overflow Sewer

	O	
Size:	30	inches
Material:	RC	
Invert:	818.03	ft
Slope:	8.42	%

Orifice

	U	V	W	
Invert:	820.23	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.29	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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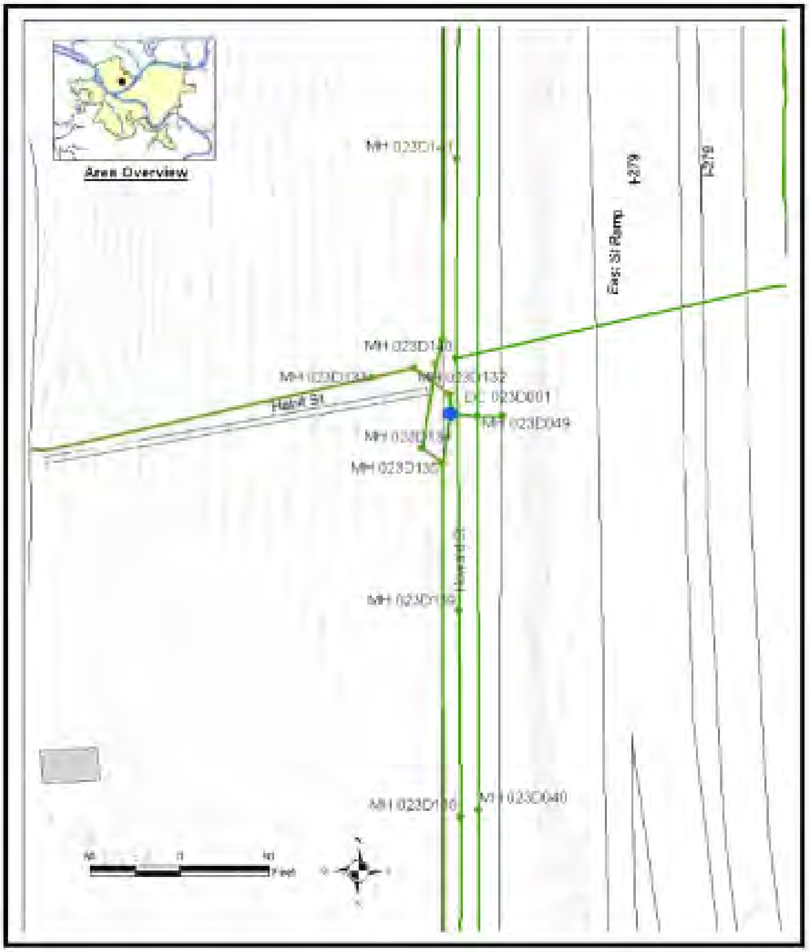
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 023D001



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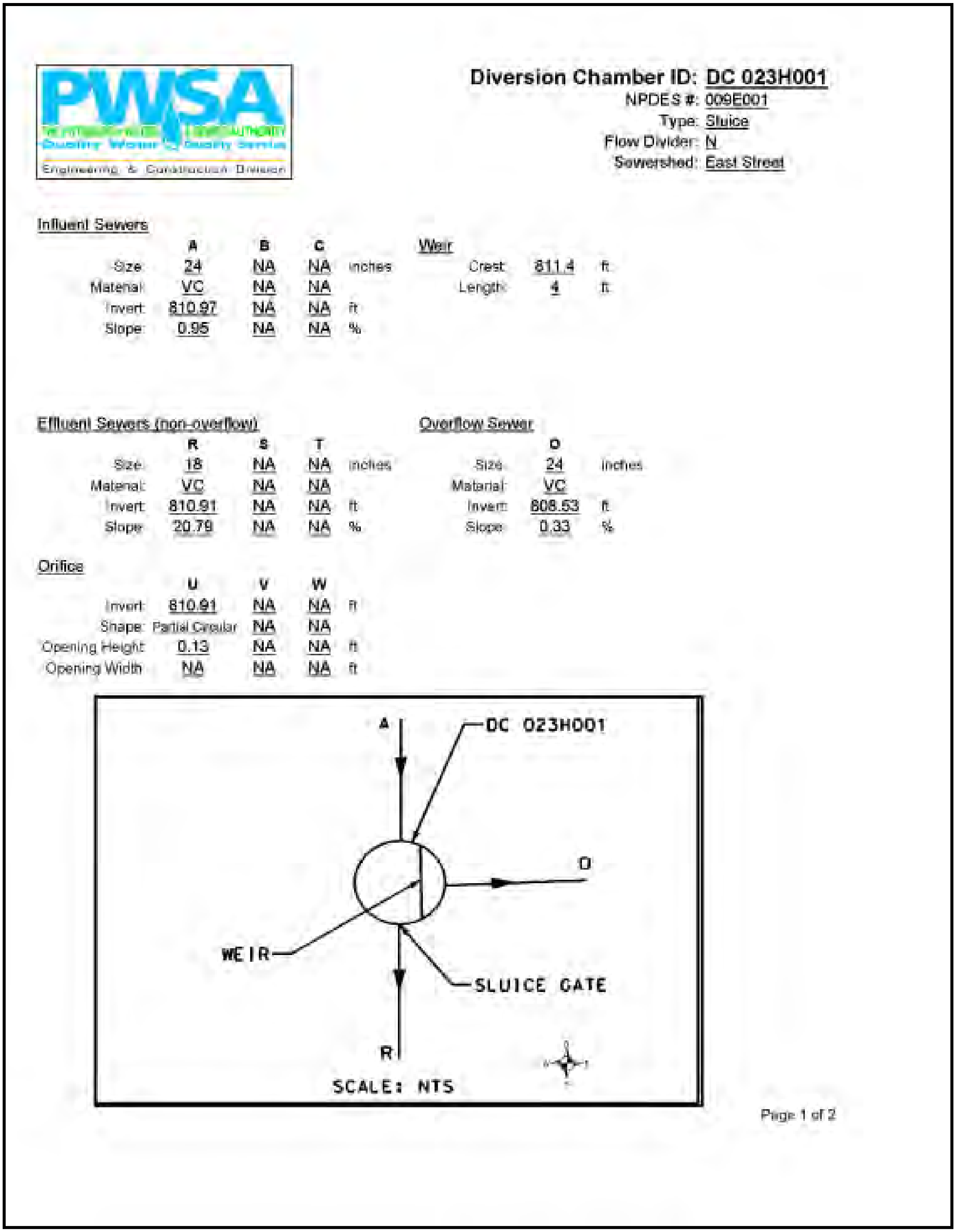

PWSA
The Pittsburgh Water & Sewer Authority
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 023H001
NPDES #: 009E001
Type: Sluice
Flow Divider: N
Sewershed: East Street

Influent Sewers

	A	B	C	
Size:	24	NA	NA	inches
Material:	VC	NA	NA	
Invert:	810.97	NA	NA	ft
Slope:	0.95	NA	NA	%

Weir

Crest:	811.4	ft
Length:	4	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	18	NA	NA	inches
Material:	VC	NA	NA	
Invert:	810.91	NA	NA	ft
Slope:	20.79	NA	NA	%

Overflow Sewer

	O	
Size:	24	inches
Material:	VC	
Invert:	808.53	ft
Slope:	0.33	%

Orifice

	U	V	W	
Invert:	810.91	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.13	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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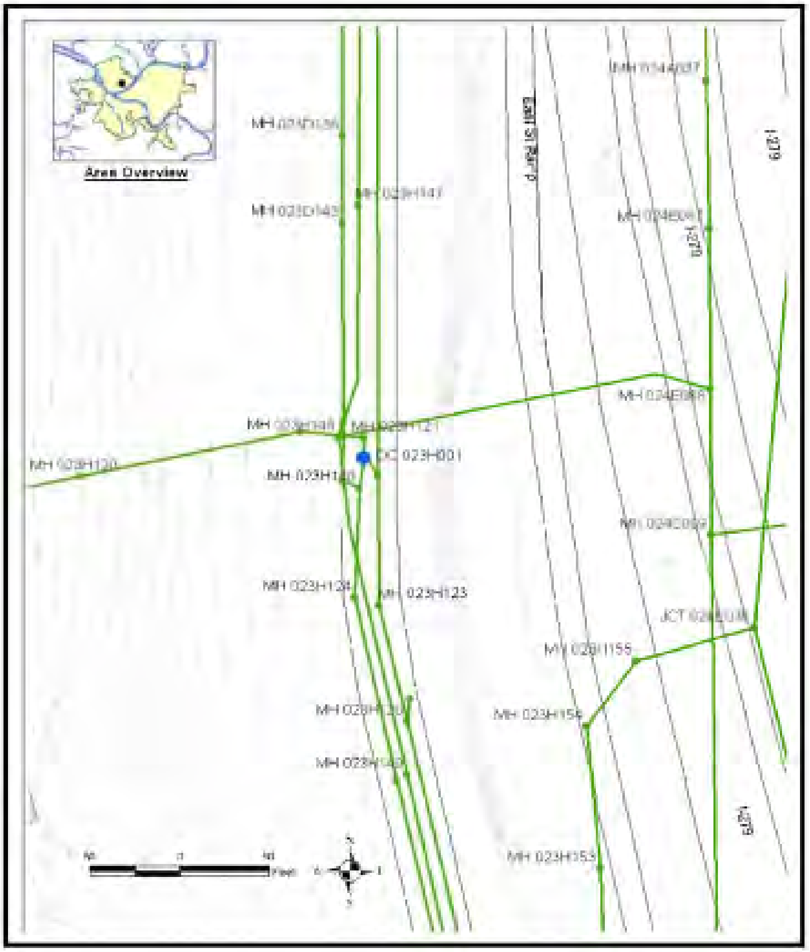
Engineering & Construction Division

Diversion Chamber ID: DC 023H001



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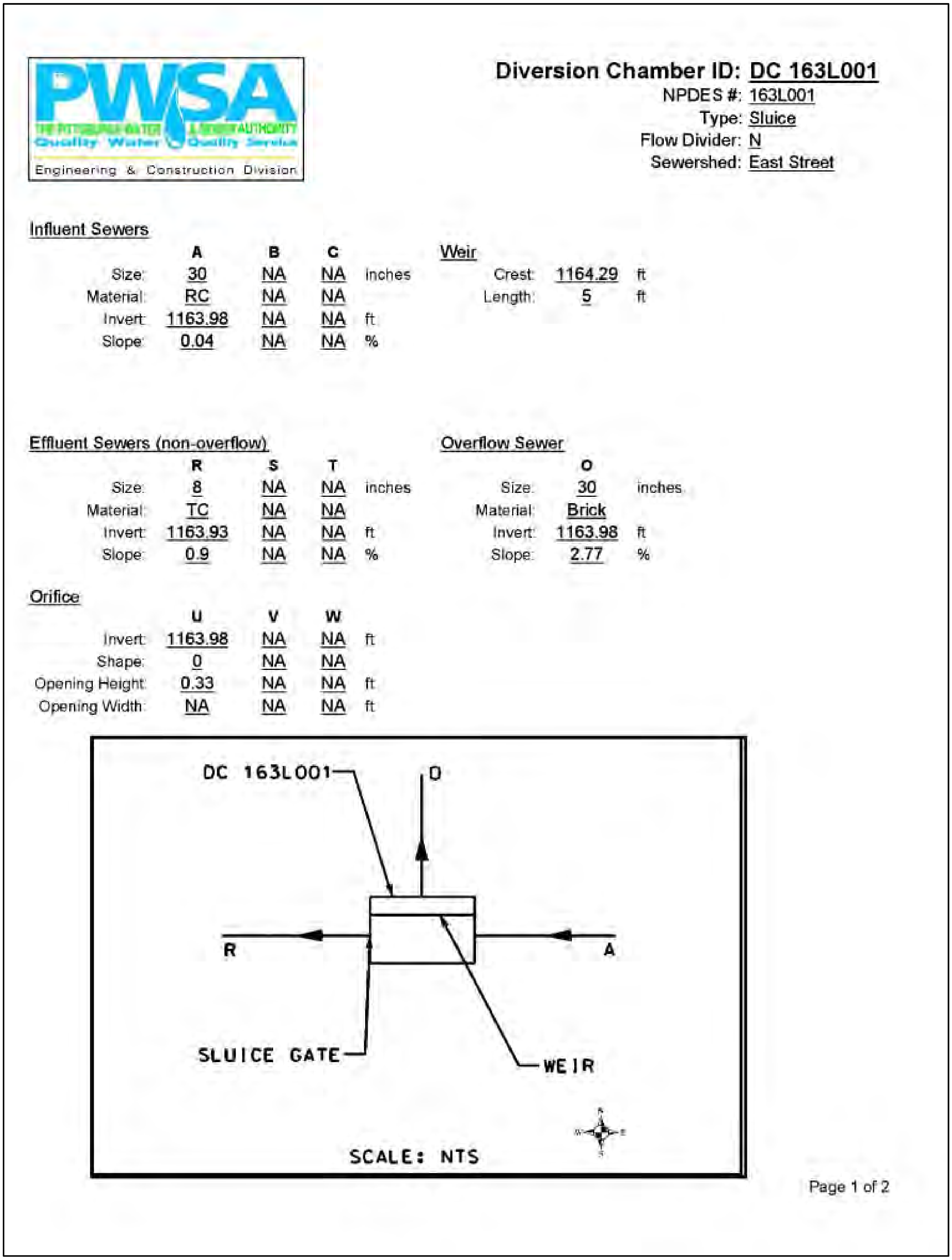


PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 163L001
NPDES #: 163L001
Type: Sluice
Flow Divider: N
Sewershed: East Street

Influent Sewers

	A	B	C	
Size:	30	NA	NA	inches
Material:	RC	NA	NA	
Invert:	1163.98	NA	NA	ft
Slope:	0.04	NA	NA	%

Weir

Crest:	1164.29	ft
Length:	5	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1163.93	NA	NA	ft
Slope:	0.9	NA	NA	%

Overflow Sewer

	O	
Size:	30	inches
Material:	Brick	
Invert:	1163.98	ft
Slope:	2.77	%

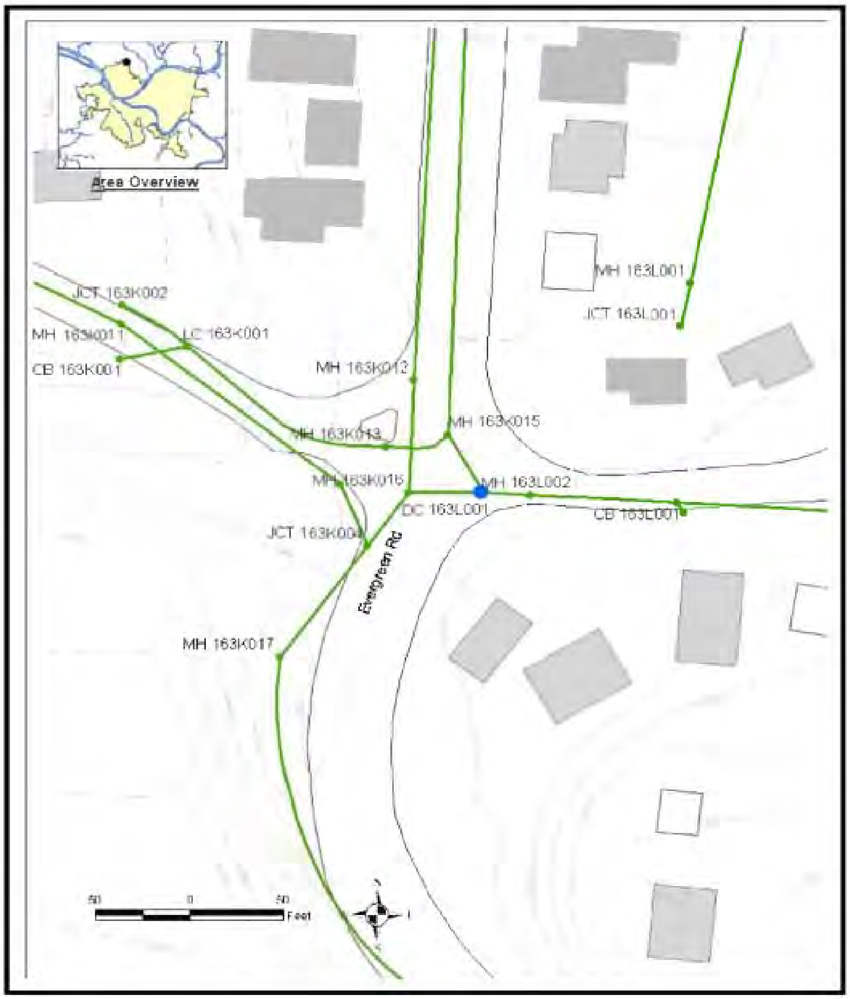
Orifice

	U	V	W	
Invert:	1163.98	NA	NA	ft
Shape:	0	NA	NA	
Opening Height:	0.33	NA	NA	ft
Opening Width:	NA	NA	NA	ft

Page 1 of 2

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 163L001



Page 2 of 2

2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC A-51: East Street through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Main Rivers Basin Planners (MR_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for A-51.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The flow monitoring data were used to help develop and calibrate the H&H model upon

which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. Twenty two (22) flow meters located within the East Street sewershed were used in the RCS-FMP. Details on the twenty two (22) RCS-FMP flow monitors installed within the East Street sewershed are found in Table A51-2-1.

TABLE A51-2-1: EAST STREET SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Term[1]
A-51-00	City of Pittsburgh	L
A5100__-OSC-M-04_	City of Pittsburgh	M
A5100__-OSC-M-06_	City of Pittsburgh	M
A-56-00	City of Pittsburgh	L
A5800__-IM_-S-02_	City of Pittsburgh	S
A5800__-IM_-S-03_	City of Pittsburgh	S
A5800__-MPS-L-21_	City of Pittsburgh	L
A5800__-OSC-M-07_	City of Pittsburgh	M
A5800__-OSC-M-08_	City of Pittsburgh	M
A5800__-OSC-M-09_	City of Pittsburgh	M
A5800__-OSC-M-10_	City of Pittsburgh	M
A5800__-OSC-M-11_	City of Pittsburgh	M
A5800__-OSC-M-12_	City of Pittsburgh	M
A5800__-OSC-M-13_	City of Pittsburgh	M
A5800__-OSC-M-14_	City of Pittsburgh	M
A5800__-OSC-M-15_	City of Pittsburgh	M
A5800__-OSC-M-16_	City of Pittsburgh	M
A5800__-OSC-M-17_	City of Pittsburgh	M
A5800__-OSC-M-18_	City of Pittsburgh	M
A5800__-OSC-M-19_	City of Pittsburgh	M
A5800__-OSC-M-20_	City of Pittsburgh	M
A5800__-POC-L-01_	City of Pittsburgh	L

[1] S=Short Term: 3-months to 6 months. M=Medium Term: 6 months to 9 months. Long Term: 1-year minimum to 21-month maximum.

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[1] The flow monitor information in this table is from a file titled "Summary of Program Monitors by Name, Type and Dates.xls". This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled "Summary and Report of Flow Monitoring June 2009".

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).
- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.
- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.
- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the East Street Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the A-51 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.
- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The DWF statistics is explained in detail in the MR_BP *Hydrologic & Hydraulic Model Validation and Characterization Report (May, 2010).*

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table A51-2-2.

TABLE A51-2-2: A-51 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[2]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
A-51	1.05	1.07	1.57%

---

[2] ALCOSAN Wet Weather Program, Basin Facility Plan, Main Rivers Planning Basin – Table 2.4

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event.

RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for A-51 are presented in Table A51-2-3.

TABLE A51-2-3: A-51 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[3]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
A-51	50.7	50.7	0.0%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and the Typical Year conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics

---

[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Main Rivers Planning Basin – Table 2.5

were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure A51-2-1 present the computed hydraulic profiles of the existing A-51 main trunk sewer system under Typical Year peak flow conditions. As is indicated in the figures, under the current system configuration, including existing CSO diversion chamber settings, moderate surcharging occurs in sections of the Madison Avenue trunk sewer under maximum typical year flow conditions. The surcharging does not reach flooding levels.

Computed flow hydrograph for the typical year condition at the A-51 POC is presented in Figure A51-2-2.

FIGURE A51-2-1: A-51 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak Typical Year and Future Baseline Conditions

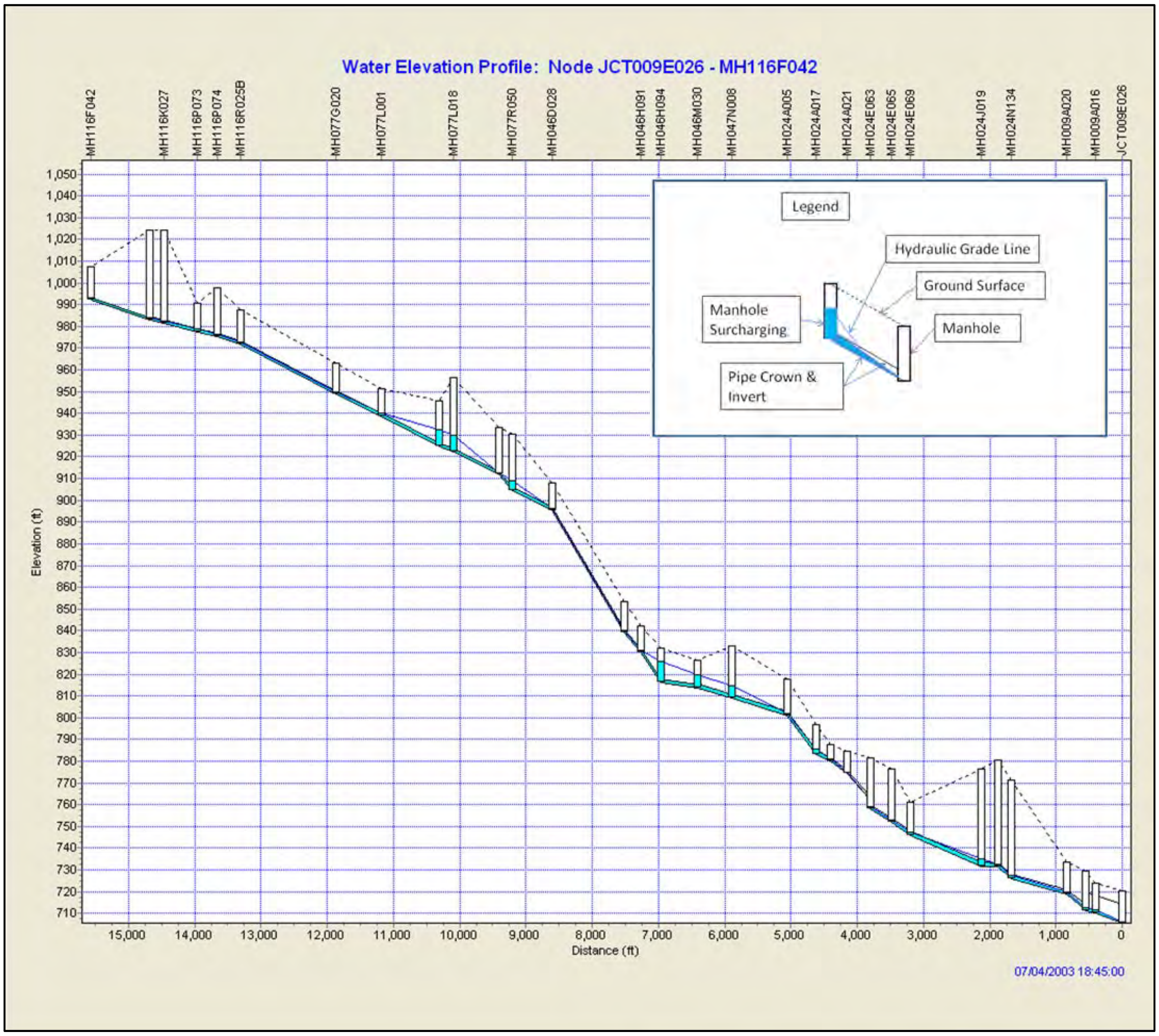
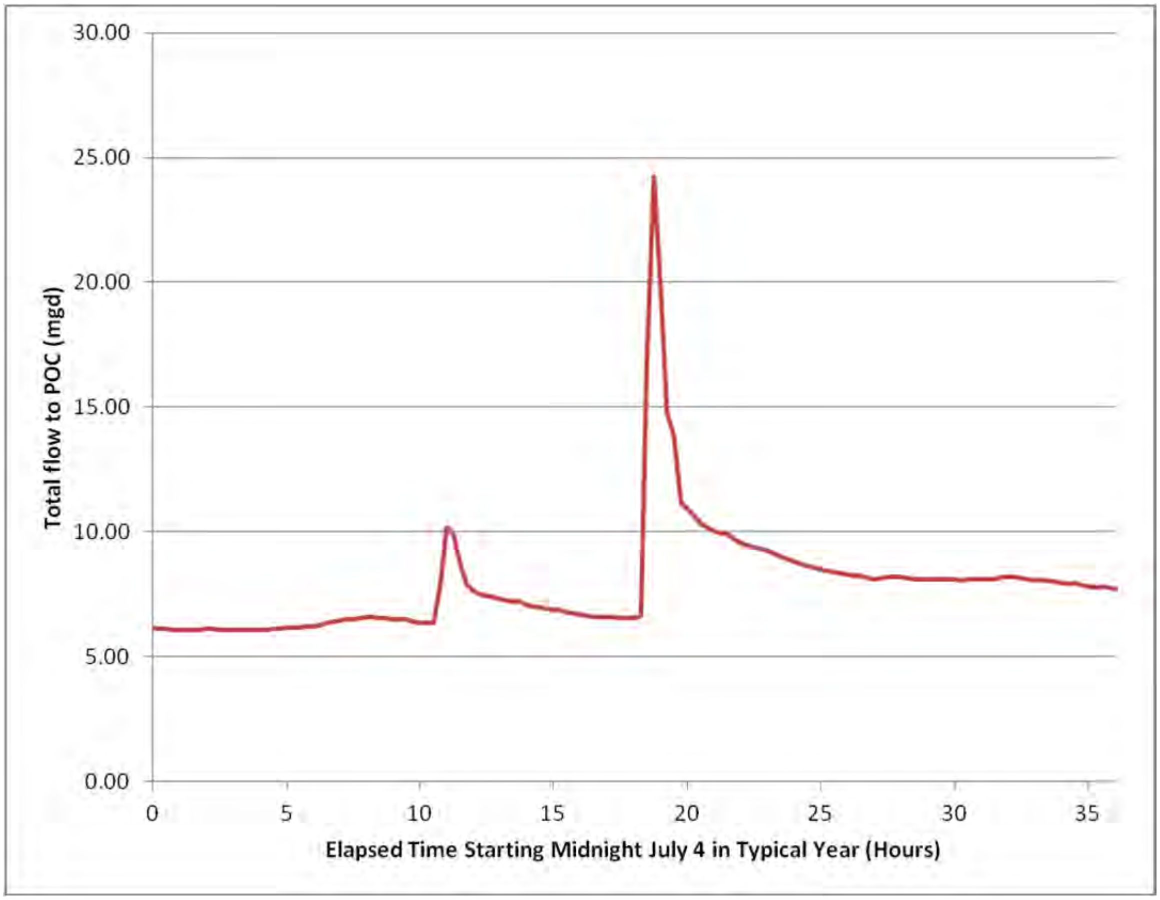


FIGURE A51-2-2: A-51 SEWERSHED PEAK FLOW RATES TO THE POC

Existing System Configuration and Mode of Operation Under Typical Year and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

Table A51-2-4 presents a summary of the identified chronic basement flooding locations within the PWSA portion of the A-51 sewershed. The neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. The data presented in Table A51-2-4 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.
- Eliminating repeat complaints from the same address for the same incident.
- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE A51-2-4: A-51 CHRONIC BASEMENT BACKUP LOCATIONS (PWSA SYSTEM)[4]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
3619 Baytree St	2	2007
Baytree & Evergreen Rd	2	2005
3612 Baytree St	2	2007
104 Waldorf St	2	2006

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was only performed to assess the ability of the existing trunk sewer system to convey the flows to the typical year. The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the A-51 sewer system performed by PWSA produced the following computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table A51-1-3.

---

[4] Information from analysis of PWSA SAP system

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the A-51: East Street sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

> which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. Three (3) of these outfalls are found within the A-58 sewershed which is one of the East Street sewersheds, which is explained in Section 3 of the Wet Weather Feasibility Study. These outfalls are shown below in Table A51-3-1. No PWSA owned outfalls are found in the A-51 sewershed.

TABLE A51-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE EAST STREET SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF009E001	MR	A-58-00	Allegheny River	WWF[1]	N	Y
OF163G002	MR	A-58-00	Girty's Run	WWF	N	N
OF163G001	MR	A-58-00	Girty's Run	WWF	N	N

As shown in the table, these three (3) PWSA owned outfalls discharge into either Girty's Run or the Allegheny River. Both receiving waters are classified as warm water fisheries (WWF) and currently do not meet their assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

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[1] Warm Water Fishery

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.
- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL.

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan*, *January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal Coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the A-51 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO

controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the East Street sewershed, Table A51-3-3 lists the untreated CSO statistics that were computed for each control level.

TABLE A51-3-3: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE EAST STREET SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC163L001	0	0	0	0	0	0
Relocated PADC024A001	29	0	5	0.43	9	5.20
DC023H001 DC023H001 DC116F001 DC116F002 DC116F003 DC116F004 DC116F005 DC116K001 DC116K002 DC116R001 DC116R002 DC077C001 DC077G001 DC077K001 DC077L001 DC077L002 DC077R001 DC046C001 DC046H001 DC046S001						

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC047J001						
DC024A002						
DC024A001						
DC163L001						
DC023D001						
DC023H001						
DC116F001						
DC116F002						
DC116F003						
DC116F004						
DC116F005						
DC116K001						
DC116K002						
DC116R001						
DC116R002						
DC077C001						
DC077G001						
DC077K001						
DC077L001						
DC077L002						
DC077R001						
DC046C001						
DC046H001						
Total Volume		**0**		**0.43**		**5.20**

As will be described later in this report, the analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under the Typical Year.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

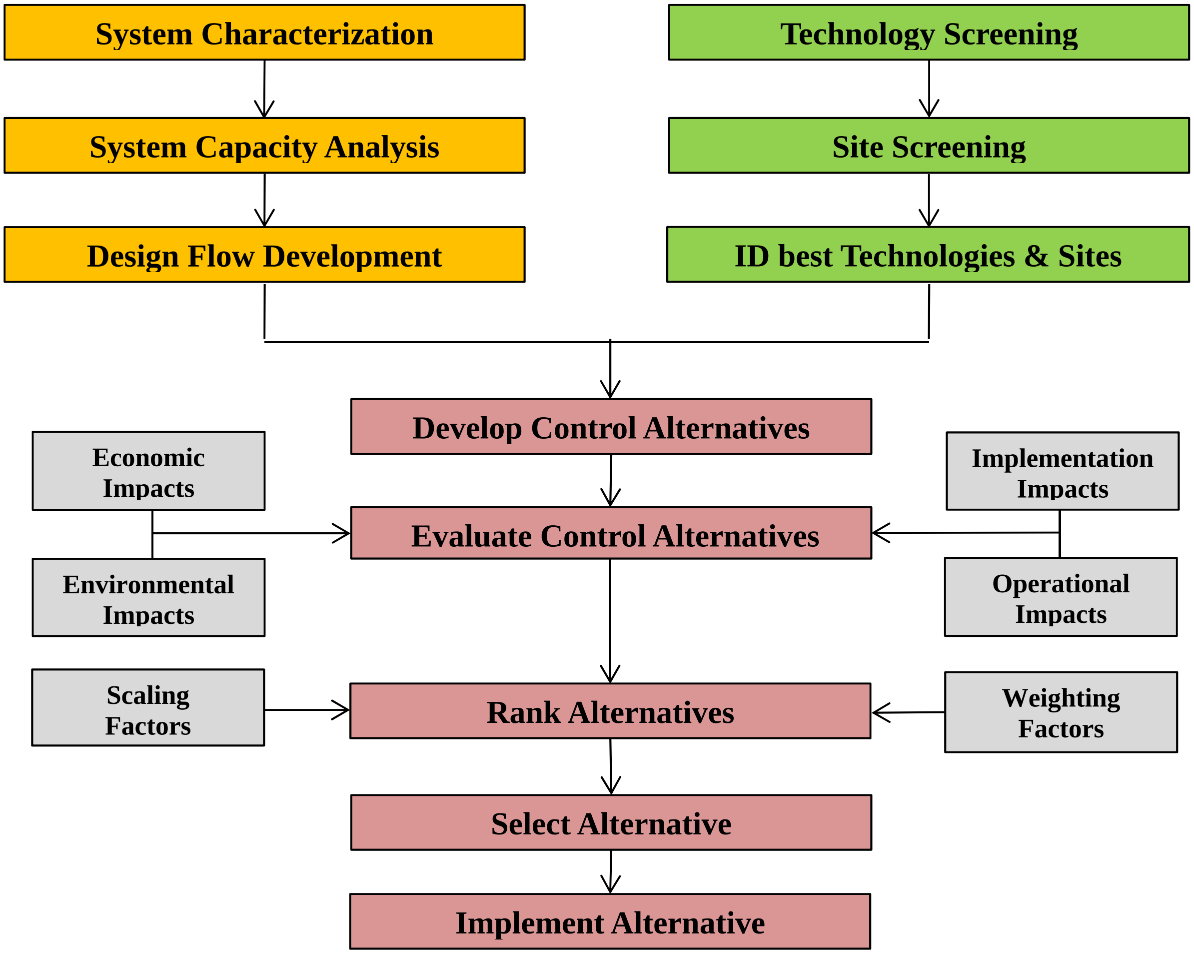
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure A51-4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation..

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE 4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of the Wet Weather Feasibility Study.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered “feasible” for use in the A-51 sewershed are shown below in Table A51-4-1.

TABLE A51-4-1: A-51 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies were identified for the A-51 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table A51-4-2.

Contributing flows from the municipalities that are tributary to the A-58 sewershed, which include Reserve Township were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as the waterways.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning "Objective Scores" to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

TABLE A51-4-2: EAST STREET POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Consolidated Outfall-Specific Controls		
Consolidated Outfalls 009EA56, 009EA58, 009BA59, 009BA59A, and 009E001	CS4 A-56 to A-59A: Sewer separation	Complete sewer separation of tributary area.
	S2-A-56 to A-59A: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-A-56 to A-59A: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-A-56 to A-59A: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-A-56 to A-59A: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-A-56 to A-59A: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-A-56 to A-59A: Screening and Disinfection	A stand-alone screening and disinfection facility.
Regional Controls – A-51: A-47 to A-59A Region Controls		
Outfalls 009EA56, 009EA58, 009BA59, 009BA59A, and 009E001	CS4-A-47 to A-59A: Sewer Separation	Complete sewer separation of tributary areas.
	S2-A-47 to A-59A: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-A-47 to A-59A: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-A-47 to A-59A: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-A-47 to A-59A: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-A-47 to A-59A: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-A-47 to A-59A: Screening and Disinfection	A stand-alone screening and disinfection facility.
Sub-system Controls – North Allegheny Sub-System Controls		
Outfalls 009EA56, 009EA58, 009BA59, 009BA59A, and 009E001	AN-1: Tunnel Storage[2]	A 1.4 mile long tunnel A-47 to A-59A. The East Street Valley CSOs will be conveyed to the tunnel.
	AN-2: Tunnel Storage[2]	A 2.8 mile long tunnel A-47 to A-66. The East Street Valley CSOs will be conveyed to the tunnel.

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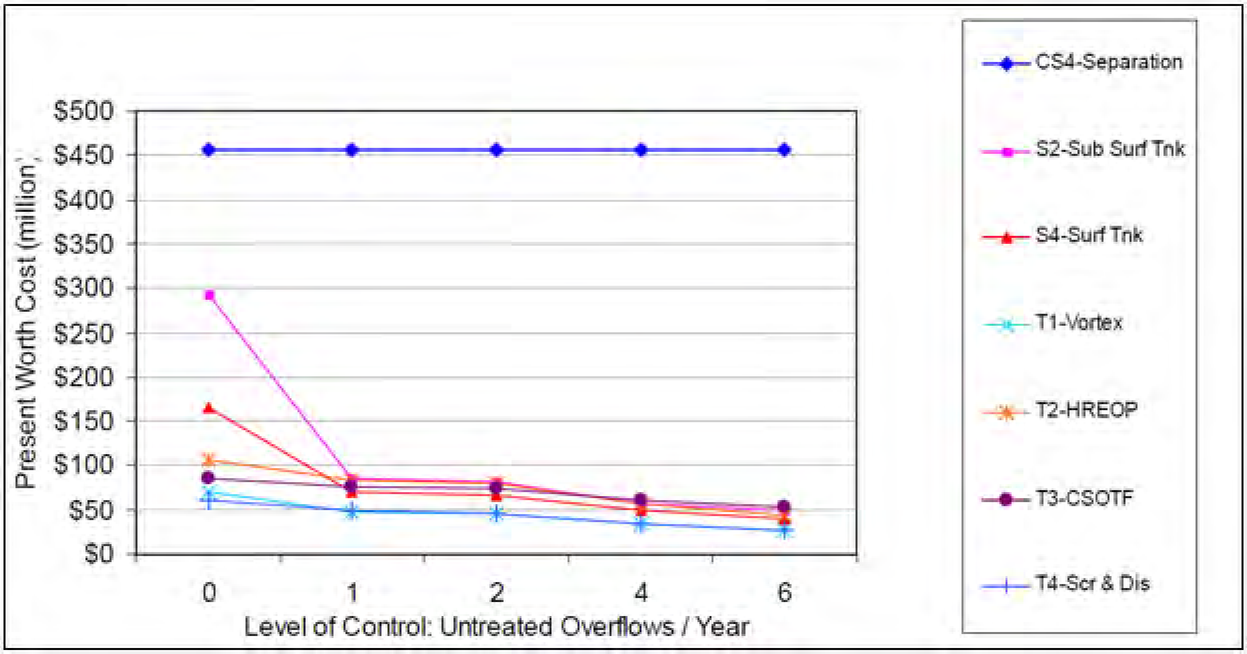
[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

4.2.1 Consolidated Outfall-Specific Control Alternatives

Outfall A-56 to A-59A: Cost estimates were produced for consolidated outfall-specific control alternatives CS4 A-56 to A-59A: Sewer separation, S2-A-56 to A-59A: Sub-Surface Storage, S4-A-56 to A-59A: Surface Storage, T1-A-56 to A-59A: Suspended Solids Control, T2-A-56 to A-59A: High Rate End of Pipe Treatment, T3-A-56 to A-59A: CSO Treatment Facility, and T4-A-56 to A-59A: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure A51-4-2 illustrates the ranges of estimated present worth costs for these alternatives.

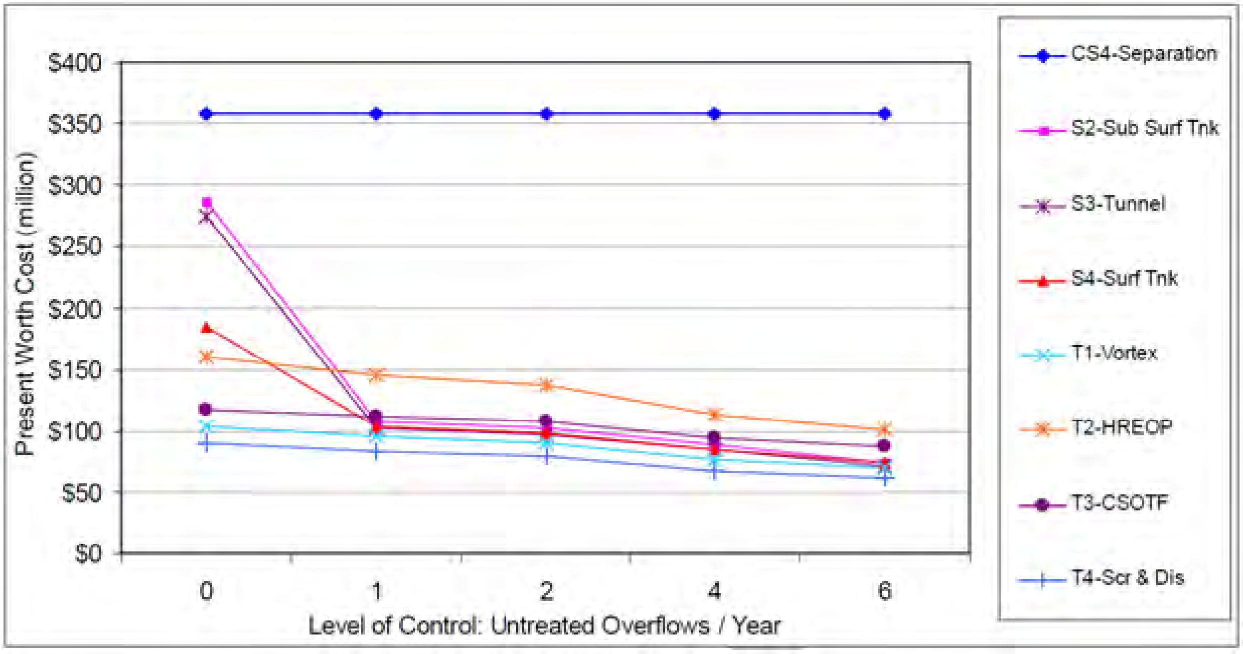
FIGURE A51-4-2: OUTFALL A-56 TO A-59A ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

Cost estimates were produced for regional control alternatives developed for the A-47 to A-59A region. Figure A51-4-3 illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE A51-4-3: A-47 TO A-59A REGION ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Allegheny North sub-system. Table A51-4-4 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Allegheny North subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of any tunnel storage portions of these control alternatives.

TABLE A51-4-3: ALLEGHENY NORTH SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
AN-1	126.7	1.7	145.7
AN-2	157.4	1.7	176.4

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the “highest ranked alternative” for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining “Objective Scores” relative to each evaluation criteria.
- Applying “scaling” and “weighting” factors.
- Determining “Weighted Objective Scores” relative to each evaluation criteria.
- Ranking each alternative based on the sum of its “Weighted Objective Scores”.

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a

score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table A51-4-4.

TABLE A51-4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

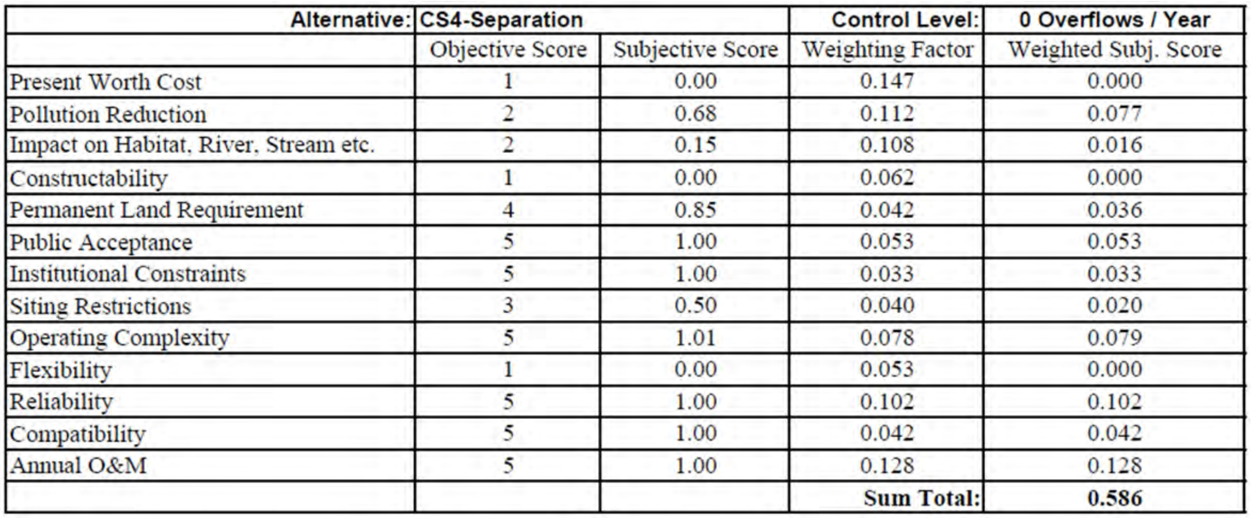
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in Table A51-4-5.

TABLE A51-4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 A-56 to A-59A: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in Table A51-4-6.

TABLE A51-4-6: WEIGHTED SUBJECTIVE SCORING - CS4 A-56 to A-59A: SEWER SEPARATION



Alternative:	CS4-Separation		Control Level:	0 Overflows / Year
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	1	0.00	0.147	0.000
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.108	0.016
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	5	1.00	0.033	0.033
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.586**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

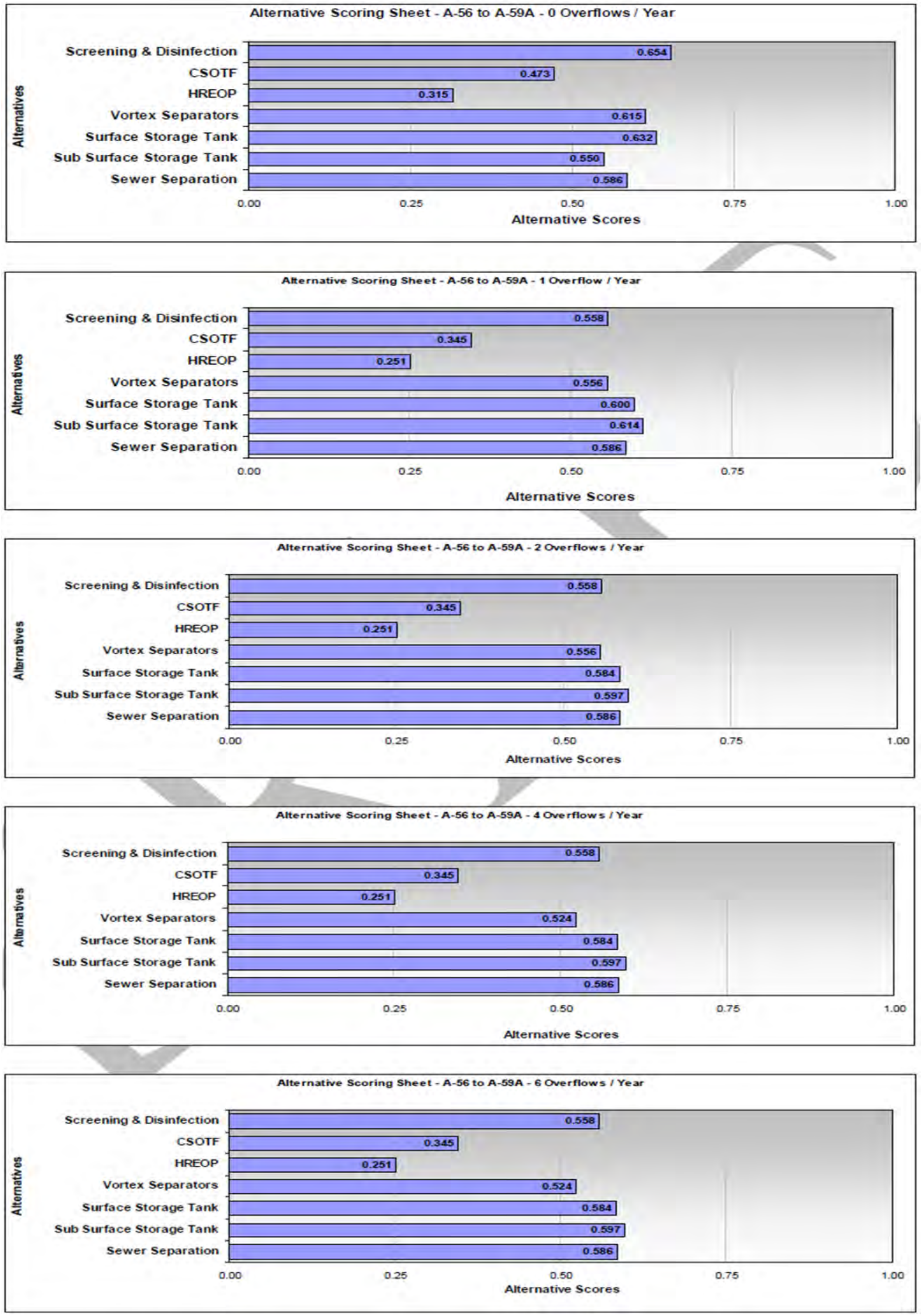
Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Consolidated Outfalls 009EA56, 009EA58, 009BA59, 009BA59A, and 009E001: The results of the control alternative evaluation process are shown in Figure A51-4-4. For control level 0 it is recommended that *Alternative T4-A-56 to A-59A: Screening and Disinfection* be carried forward and re-evaluated with the results of the system-wide alternatives analyses. For control levels 1through 6 it is recommended that *Alternative S2- A-56 to A-59A: Sub-Surface Storage* be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

FIGURE A51-4-4: ALTERNATIVE SCORING –OUTFALLS A-56 to A-59A



4.4.2 Regional Control Alternatives

A-47 to A-59A Region: The results of the regional control alternative evaluation process are shown below in Figure A51-4-5. For control level 0, it is recommended that *Alternative T4- A-47 to A-59A Region: Screening and Disinfection* be carried forward and re-evaluated with the results of the system-wide alternatives analyses. For control levels 1, 2, and 6 it is recommended that *S2- A-47 to A-59A Region: Sub-Surface Storage* be carried forward and re-evaluated with the results of the system-wide alternatives analyses. For control level 4 it is recommended that *S3- A-47 to A-59A Region: Tunnel Storage* be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

4.4.3 Sub-System Control Alternatives

Allegheny North Sub-System. The results of the sub-system control alternative evaluation process are shown below in Figure A51-4-6. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative AN-2: Tunnel Storage* be carried forward as the Allegheny North component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative AN-2: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative AN-2* included only those components required to deliver flows to the A-51 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the A-51 POC would become the responsibility of ALCOSAN.

FIGURE A51-4-5: ALTERNATIVE SCORING – A-47 to A-59A REGION

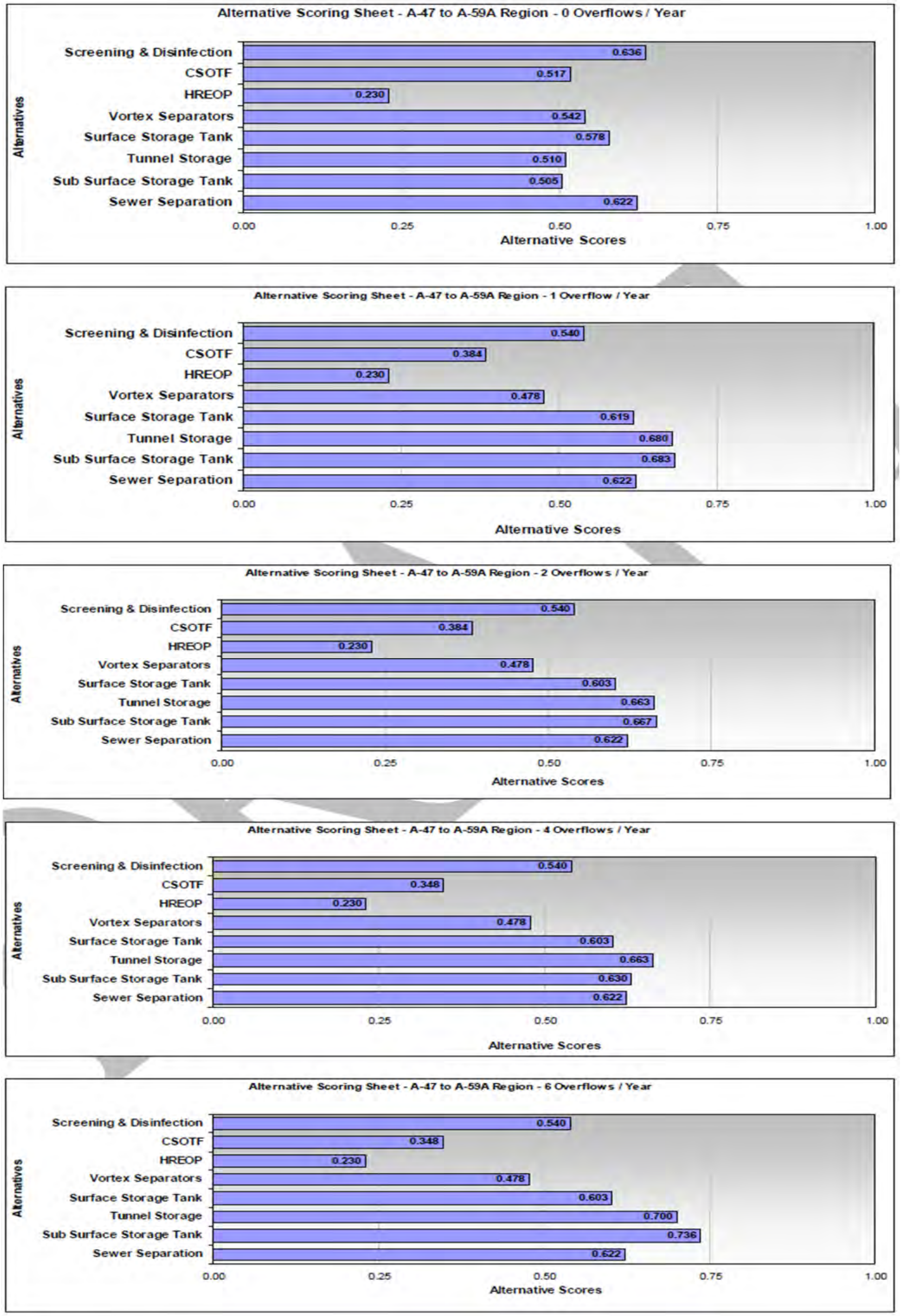
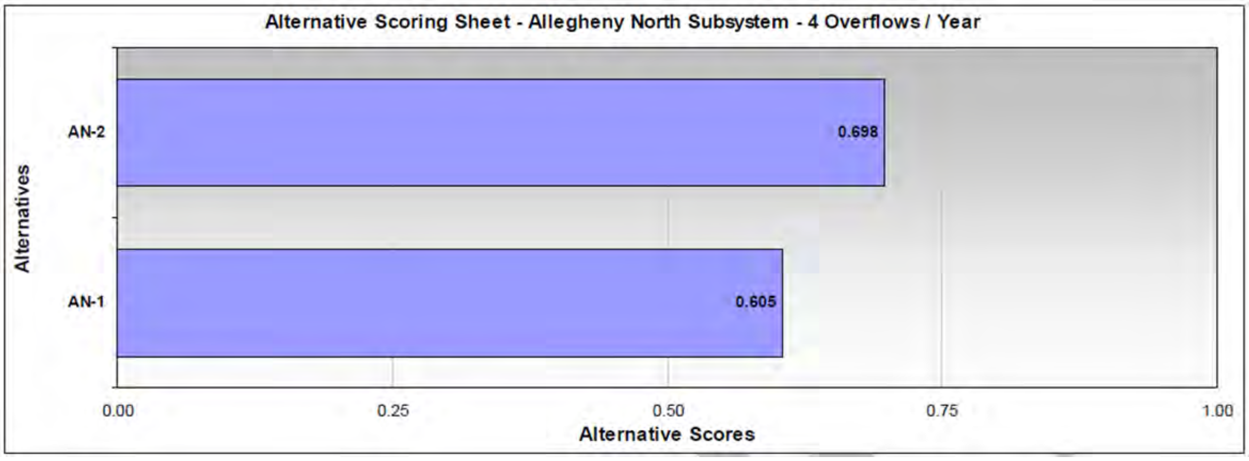


FIGURE A51-4-6: ALTERNATIVE SCORING – ALLEGHENY NORTH SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the East Street Valley sewershed would best be accomplished by implementing *Alternative AN-2: Tunnel Storage*. Within the A-51 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the PWSA permitted CSO to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the S-15 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative AN-2* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-A51-C-0*, *POC-A51-C-4* and *POC-A51-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **A51 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.
- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the A-51 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the A-51 sewershed is four untreated overflows per year. The recommended control alternative for the A-51 East Street sewershed has been designated as POC-A51-C-4. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **A51** The A-51 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **4** The selected level of control is four untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of four (4) untreated overflows per year, the required consolidation / conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-A51-C-4 are summarized in Table A51-5-1.

TABLE A51-5-1: ALTERNATIVE POC-A51-C-4 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
A-51	DC023D001 DC023H001	009E001	C	4
	PADC024A001	009E001	C	4
	DC163L001	163G001	S	0

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, any stream removal projects that may be included, its integration with the ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-A51-C-0 and/or POC-A51-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. Both analyses determined that the optimal method of increasing the level of control of the PWSA and PennDOT overflows in the A-51 / East Street Sewershed is to:

- Separate the sewer system tributary to diversion chamber DC163L001.
- Replace the existing diversion structure in the PennDOT culvert.

Separating the system above DC163L001 would result in the elimination of CSOs from DC163L001. Replacing the existing diversion structure in the 10-foot by 12-foot PennDOT culvert would control CSO discharges from the culvert to the desired level of control by diverting flows from the culvert to the Madison Avenue sewer above the ALCOSAN A-58 POC. To accomplish these goals, the PWSA and/or their tributary municipalities must:

- Replace the existing PennDOT diversion structure to achieve desired level(s) of control.
- Construct additional consolidation piping to convey diverted flows to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

The Madison Avenue trunk sewer between the point of this connection and the ALCOSAN facilities is 102-inches in diameter. Modeling determined that this section of trunk sewer is adequately sized to convey the flow diversions required at achieve the 4- and 10-overflows per typical year CSO levels of control.

5.1.1 Diversion Structure Modifications

For the PennDOT diversion structure in the A-51 sewershed, the H&H model was employed to identify the type and extent of modifications required to achieve four overflows during the typical year.

The required modifications to the flow diversion settings were determined by the current typical year overflow statistics. Table A51-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control. The upstream municipalities of Ross Township and Reserve Township are tributary to the PennDOT diversion structure, but their tributary flows do not have an impact on the planned diversion structure modifications. They are not tributary to DC163L001.

TABLE A51-5-2: ALTERNATIVE POC-A51-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC023D001	None	No Change	No Change	No Change
DC023H001	None	No Change	No Change	No Change
PADC024A001	Diversion structure relocation*	119	92	40
DC163L001	N/A	Closed	Closed	Closed

*The installation of screening is planned for all PWSA diversion structures.

As can be seen from the table, new consolidation piping to convey flows at the four OF/yr level of control must be designed to carry flows up to 92 mgd.

5.1.2 Consolidation Piping

The H&H model was employed to identify the capacity improvements necessary to consolidate and convey increased flows from the PennDOT diversion structure to the A-58 POC. The modeling was accomplished by modifying the model representation of the relocated diversion structure to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, under the maximum typical year peak flow condition. The model also incorporated the proposed 10-ft by 12-ft culvert between the relocated diversion structure and the Madison Avenue sewer.

Assessments of the performance of the existing system, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the conditions. Under this range of operating conditions, it was found that the existing Madison Avenue trunk sewer system has sufficient capacity to convey the increased flows diverted from the A-51 sewershed without significant manhole surcharging and flooding. These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008).*

The general arrangement of the consolidation piping, including required culvert sizes, is presented in Table A51-5-3 and in Figure A51-5-1.

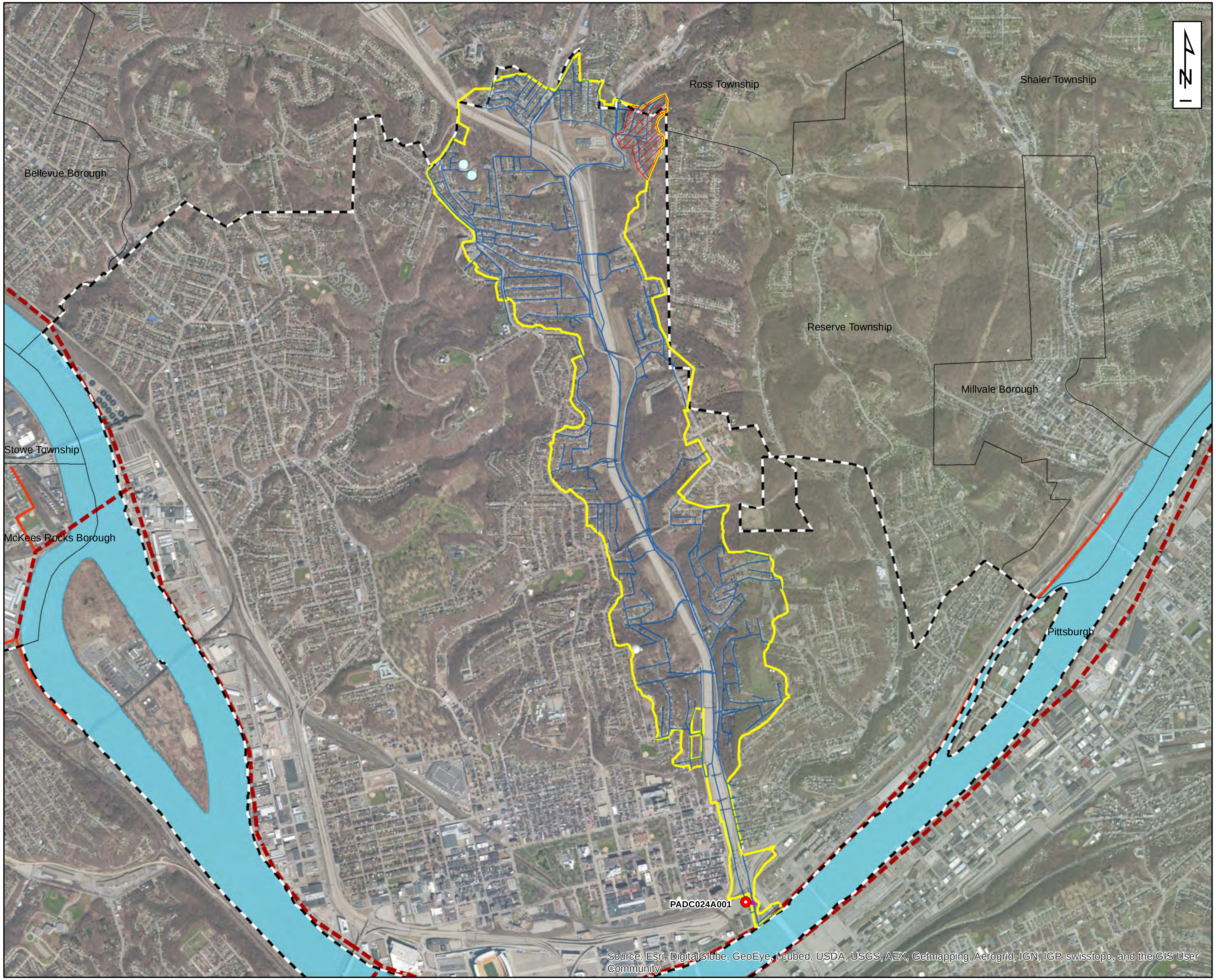
TABLE A51-5-3: POC-A51-C-4 CONSOLIDATION PIPING

Diameter (in)	Length (ft)
8	3,127
12-ft x 4-ft box culvert	140

*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

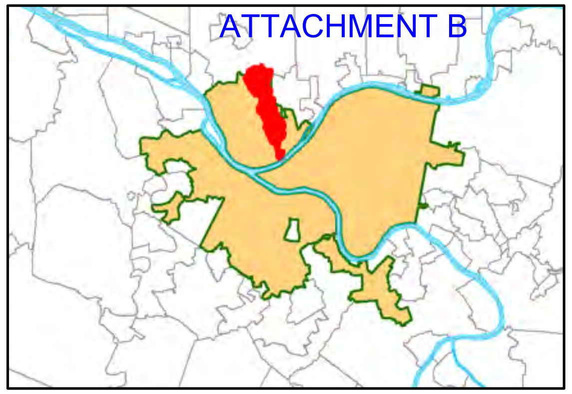
5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes are provided in Table A51-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 111.4 MG in the typical year.



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

- ⦿ PWSA Diversion Structure Modification
- ━ Relief/Consolidation Sewer
- ─ Collector Sewer
- ▨ Drainage Area to be Separated
- ☐ A-51 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ╍ Deep Tunnel
- ─ Shallow Cut

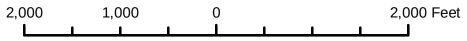


Figure A51-5-1: POC-A51-C-4 Consolidation Piping and Sewer Separation

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\EAST STREET VALLEY (A-51)\FIGURE 5-1_A_51_.mxd

TABLE A51-5-4: A-51 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Outfall	Control Alternative Name					
		POC-A51-C-0		POC-A51-C-4		POC-A51-C-10	
		No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)
Relocated PADC024A001	009E001	29	0	5	0.4	9	5.2
DC023H001							
*DC116F001							
*DC116F002							
*DC116F003							
*DC116F004							
*DC116F005							
*DC116K001							
*DC116K002							
*DC116R001							
*DC116R002							
*DC077C001							
*DC077G001							
*DC077K001							
*DC077L001							
*DC077L002							
*DC077R001							
*DC046C001							
*DC046H001							
*DC046S001							
*DC047J001							
*DC024A002							
*DC024A001							
DC023D001							
DC163L001	163G001	0	0	0	0	0	0
Total Volume			**0**		**0.4**		**5.2**

*PWSA Flow dividers; not diversion structures/chambers

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The combination of diversion structure relocation / modification and additional consolidation piping will result in increased flow rates and volumes to the Madison Avenue sewer and the A-58 POC. Computed flows to the A-58 POC under the 0-, 4- and 10-overflows per typical year levels of CSO control are illustrated in Figure A51-5-2a.

Peak flow rates from the A-51 / East Street sewershed to the A-51 POC were computed during the typical year. Typical year peak flow rates associated with alternatives POC-A51-C-0, POC-A51-C-4 and POC-A51-C-10 are presented in Figure A51-5-2b. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the A-51 POC during the 2-yr, 5-yr and 10-yr design storm conditions were not calculated; this is reflected in the "N/A" designations seen in Table A51-5-5.

FIGURE A51-5-2A: TYPICAL YEAR PEAK FLOW RATES TO THE A-58 POC

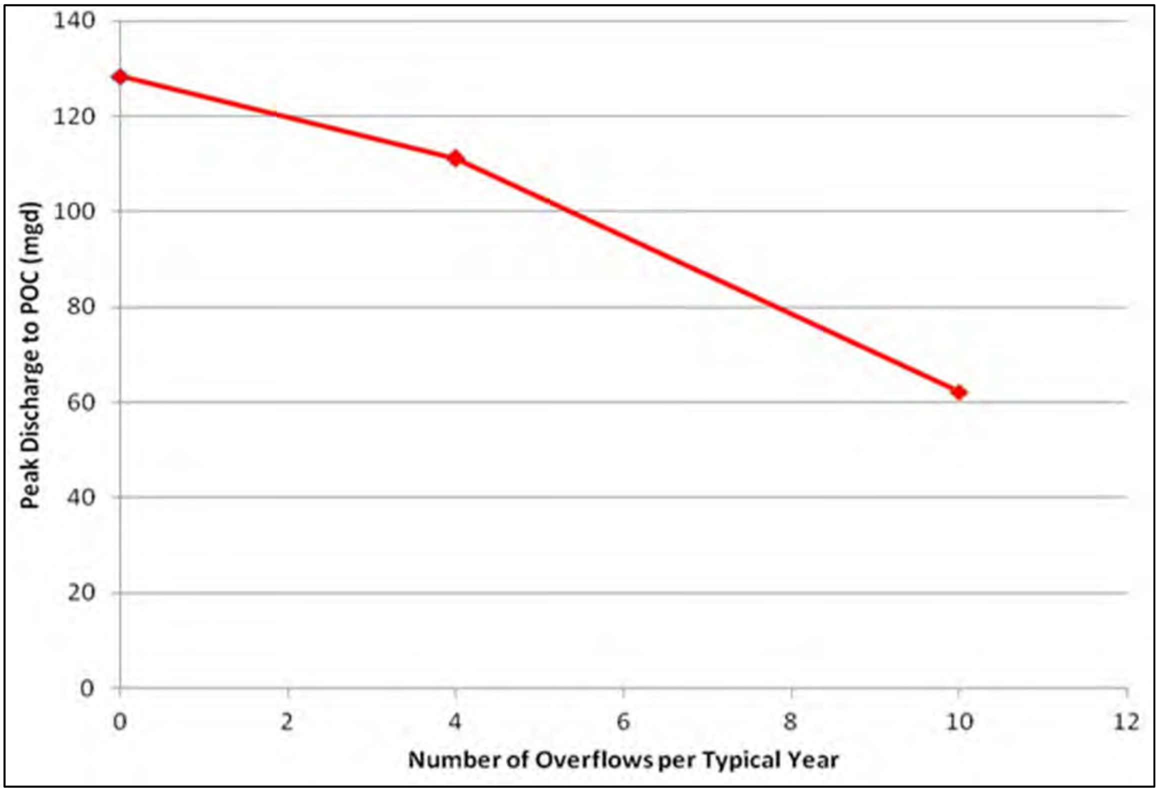


FIGURE A51-5-2B: TYPICAL YEAR PEAK FLOW RATES TO THE A-51 POC

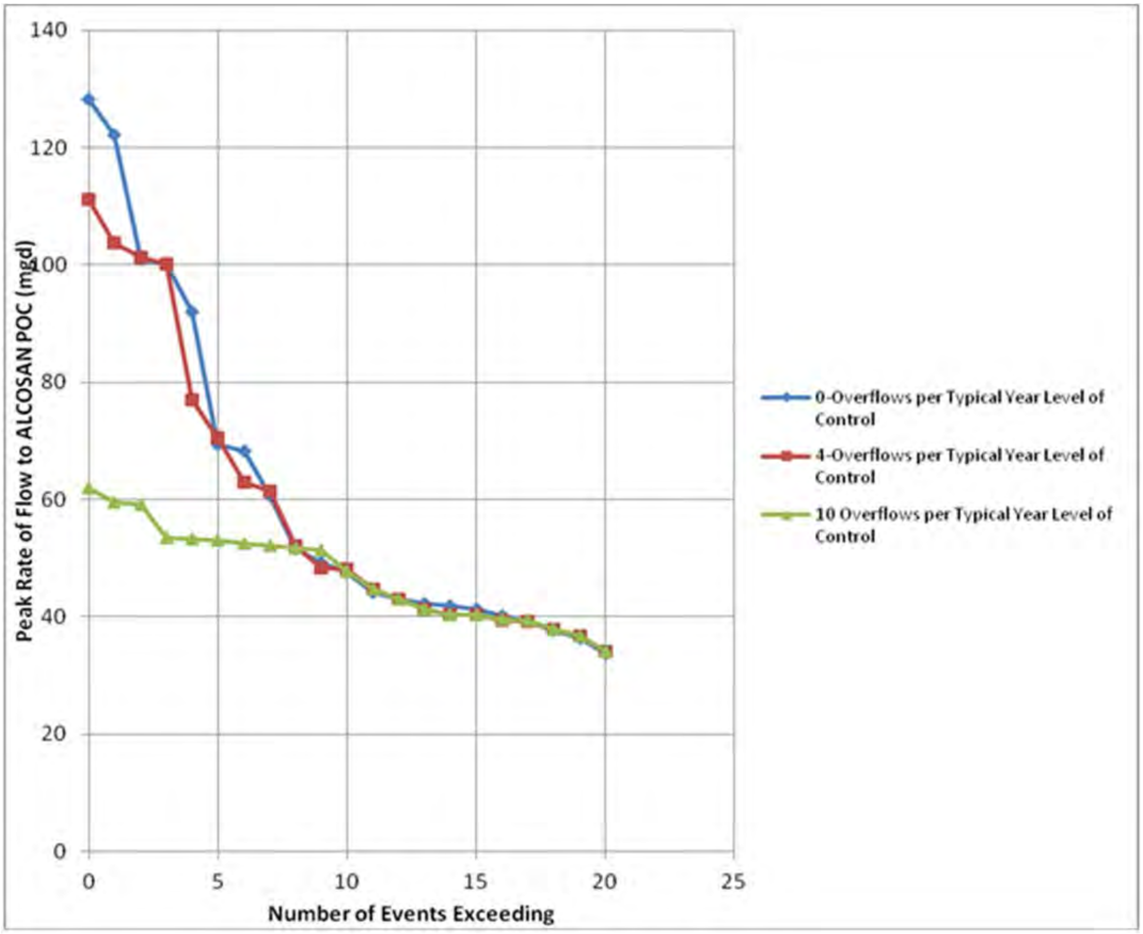


TABLE 5-5: A-51 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-A51-C-0	N/A	N/A	N/A	N/A	N/A	N/A
POC-A51-C-4	N/A	N/A	N/A	N/A	N/A	N/A
POC-A51-C-10	N/A	N/A	N/A	N/A	N/A	N/A

5.1.5 Recommended Control Alternative Integration

For the purpose of submitting this Feasibility Study, the PWSA recognizes that the flows generated by the tributary municipalities of Ross Township and Reserve Township are minor. Due to their minor flow contributions, the PWSA has not approached Ross Township and Reserve Township in regards to cost sharing of capital and O&M costs.

However, it is possible that, in the future, the affected municipalities will agree to enter into an Inter-Municipal Agreement to provide for the allocation and payment of capital costs related to each applicable component or components of the recommended alternative.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing Madison Avenue trunk sewer system has sufficient capacity to convey the increased flows resulting from implementation of alternative POC-A51-C-4 without significant manhole surcharging and flooding. However, flows from the relocated diversion structure must be conveyed from the existing 10-ft x 12-ft culvert to the Madison Avenue trunk sewer via a new conveyance facility. The PWSA addressed this issue by proposing to make the connection using a new, 10-ft x 12-ft culvert designed to convey flows associated with four overflows per typical year, under 2-year design storm conditions (4 OF/yr; 2-yr storm), without manhole surcharging.

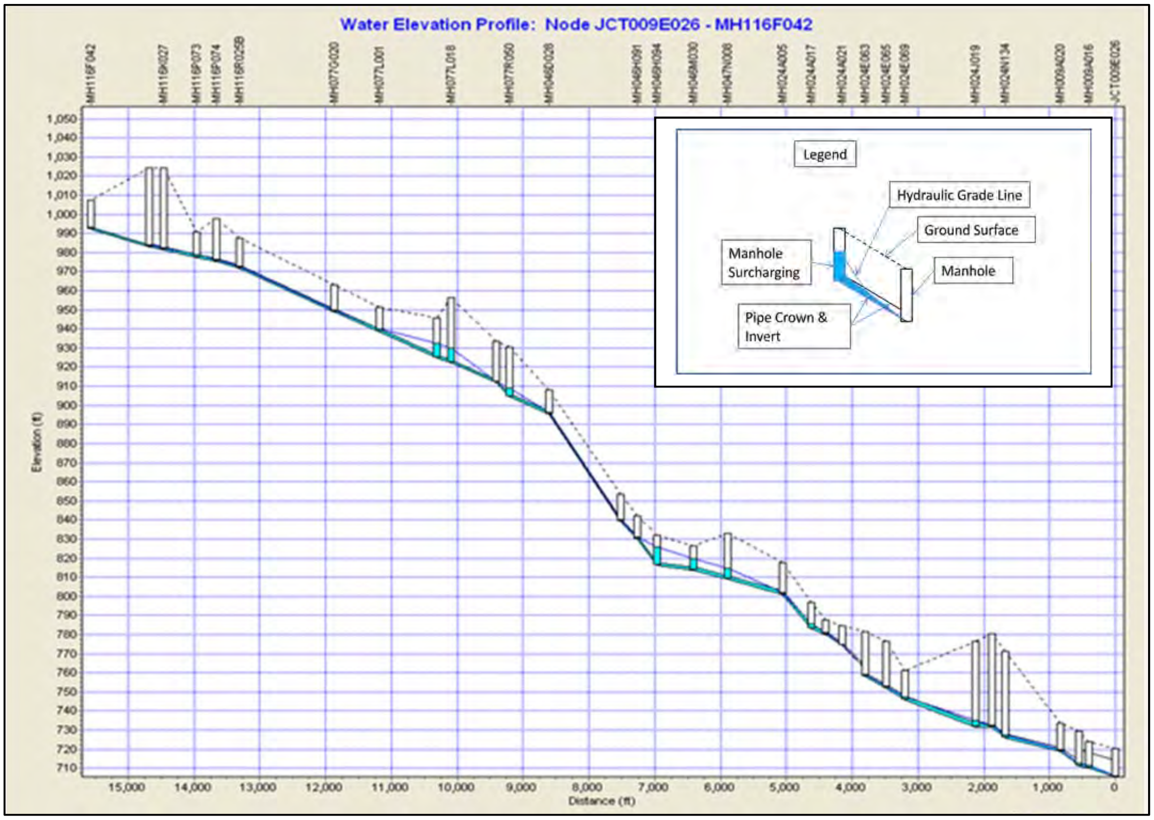
The following paragraphs discuss the hydraulic capacity characteristics of the A-51 sewershed, both before and after implementation of the recommended alternative:

- Peak flow hydraulic grade line (HGL) of the trunk sewer
- 2046 peak flows and volumes to the A-51 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated under maximum typical year peak flow conditions. Figures illustrating these HGLs were included in the July 2012 report; Figure 3 from that report presented profiles of the main trunk sewer under existing conditions / mode of operation and maximum typical year peak flow conditions. This figure is reproduced below as Figure A51-5-3. Under the current system configuration, including existing CSO diversion chamber settings, minimal manhole surcharging occurs along the length of the trunk sewer.

FIGURE A51-5-3: A-51 MADISON AVENUE COMBINED TRUNK SEWER HGL (EXISTING CONDITIONS)



Given that minimal manhole surcharging occurs within the existing system under maximum typical year peak flow conditions, no interceptor modifications were required. The HGL along the main trunk sewer following implementation of alternative POC-A51-C-4 has not been plotted.

5.2.2 2046 Peak Flows and Volumes to A-51 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the PWSA system. ALCOSAN made similar assumptions[1], and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves a relatively small area of sewer separation and the relocation of an existing diversion structure to achieve four overflows per typical year. Also included is a small section of 10-ft x 12-ft culvert to convey increased flows to the A-58 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the A-51 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances from ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This compares well with the PWSA's water quality based decision to recommend a four OF/yr level of control within the A-51 / East Street sewershed.

The control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

intends to retain, store, convey and/or treat all flows delivered to the A-51 and A-58 POCs.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from Ross Township and Reserve Township indicate that each of them plan to convey all their flows to the A-51 trunk sewer for the duration of the planning period. They have no plans to implement controls that would alter the modeled flows upon which the recommended alternative was based. This information is summarized in Table A51-5-6.

TABLE A51-5-6: A-51 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

Tributary Municipality	Volume*		
	Captured	Treated	Conveyed
Ross Township	N/A	N/A	All modeled flows
Reserve Township	N/A	N/A	All modeled flows

*Following implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves the relocation of an existing diversion structure, as well as a box culvert to convey overflows to the A-58 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes the relocation of an existing diversion structure, as well as a box culvert to convey overflows to the A-58 POC. It is designed to control CSOs from the PWSA diversion structures to four overflows per year. Implementation will also result in the conveyance of varying flows and volumes to the A-51 POC and increased flows and volumes to the A-58 POC. At each POC, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-A51-C-4 are a 12-ft x 4-ft culvert, CSO screening facilities, the relocation/replacement of a diversion structure and sewer separation. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment A51-5-1.

5.4.1 Consolidation Piping

In the A-51 sewershed, additional conveyance capacity was not required, with the exception of a box culvert to divert flows from the existing culvert to the Madison Avenue sewer above the A-58 POC.

Significant parameters within the ACT used to calculate box culvert costs were determined as follows:

- Length – Measured from the improvements in the model
- Size – Determined from the model runs to eliminate surcharging
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street

5.4.2 CSO Screening Facilities

It was assumed that the relocated diversion structure would be equipped with screening prior to discharging flows. The unit cost associated with the installation of the screening facility was assumed to be $500,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for the structure was approximately $900,000.

5.4.3 Diversion Structure Relocation

It was assumed that the relocation of the existing regulator would also include more effective and improved methods of flow control and monitoring, improved access, etc. The unit cost associated with the relocation of the existing diversion structure was assumed to be $750,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $1,350,000.

5.4.4 Sewer Separation

It was assumed that the separation of the sanitary and storm sewers would entail the installation of new, 8-in diameter sanitary sewers throughout the area. Significant parameters within the ACT used to calculate collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – assumed to be 8-in
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street

5.4.5 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure A51-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative. A "knee of the curve" is evident at the control level of four untreated overflows per typical year. These costs are also presented in a tabular format in Table A51-5-7.

The selected level of CSO control - 4 OF/yr - was determined based upon water quality considerations.

The capital improvements to be included in alternative POC-A51-C-4 are summarized in Table A51-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE A51-5-4: A-51 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

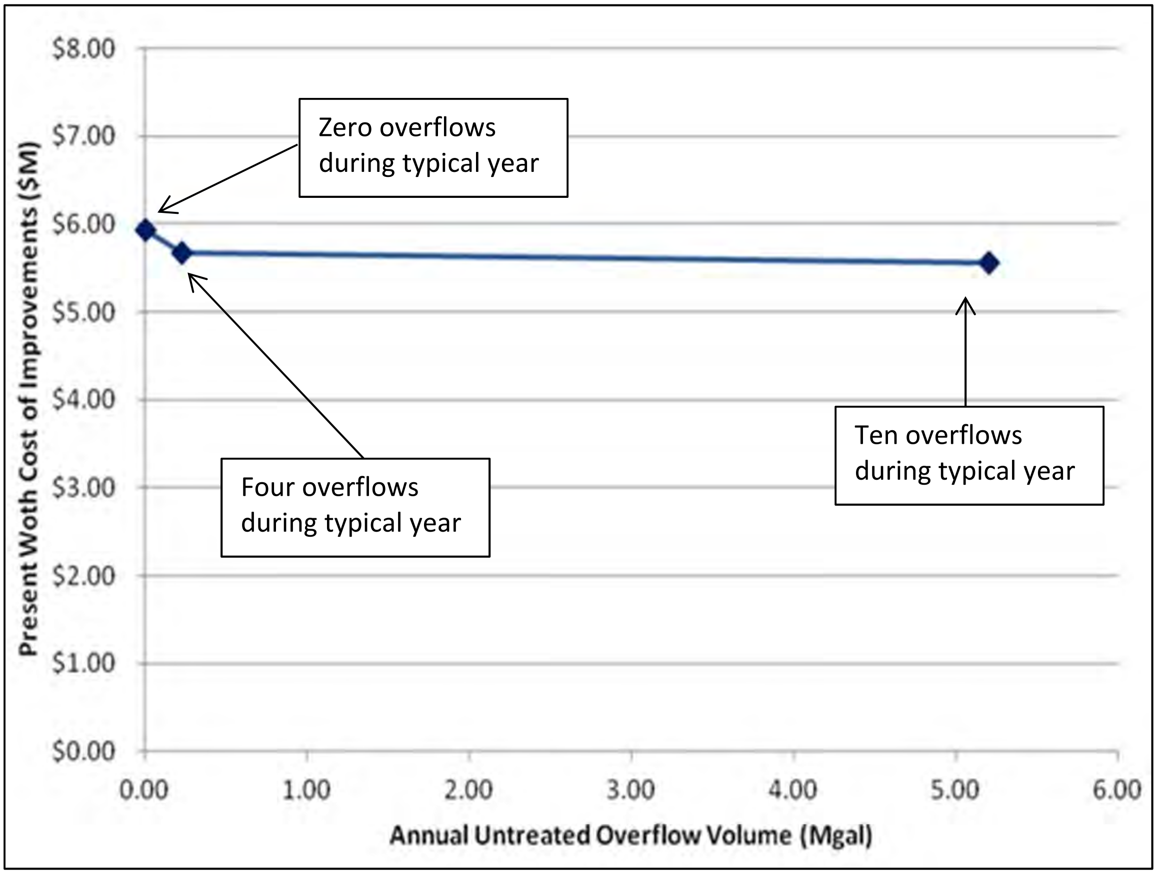


TABLE A51-5-7: A-51 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control				
	Untreated CSO Volume (MG)	**CSO Control Level (OF/yr)**	**PW Capital Cost ($MM)**	**PW O&M Cost* ($MM)**	**TPW CSO Control ($MM)**
POC-A51-C-0	0	0	$5.8	$0.1	$5.9
POC-A51-C-4	0.2	4	$5.6	$0.1	$5.7
POC-A51-C-10	5.2	10	$5.5	$0.1	$5.6
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-A51-C-0	0	2-year	$0	$0	$0
POC-A51-C-4	0	2-year	$0	$0	$0
POC-A51-C-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE A51-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-A51-C-4

Capital Improvements	Size/ Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Relocate diversion structure: PADC024A001	4 OF/yr	$1.35	$1.35	$1.36
Add screening to diversion structures: PADC024A001	92 mgd overflow rate	$0.90	$0.90	$0.90
Conveyance piping	12-ft x 4-ft box culvert	$0.46	$0.46	$0.46
Sewer separation	8-in pipe	$2.88	$2.88	$2.96

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA recognizes that the flows generated by the tributary municipalities of Ross Township and Reserve Township are minor. Due to their minor flow contributions, the PWSA has not approached Ross Township and Reserve Township in regards to cost sharing of capital and O&M costs.

However, it is possible that, in the future, the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the A-51 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant improvements (WWTP), a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, Storage Tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC A-51 overflow is not intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the “Selected Plan” to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the “Recommended Plan”. This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the “Selected Plan” is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

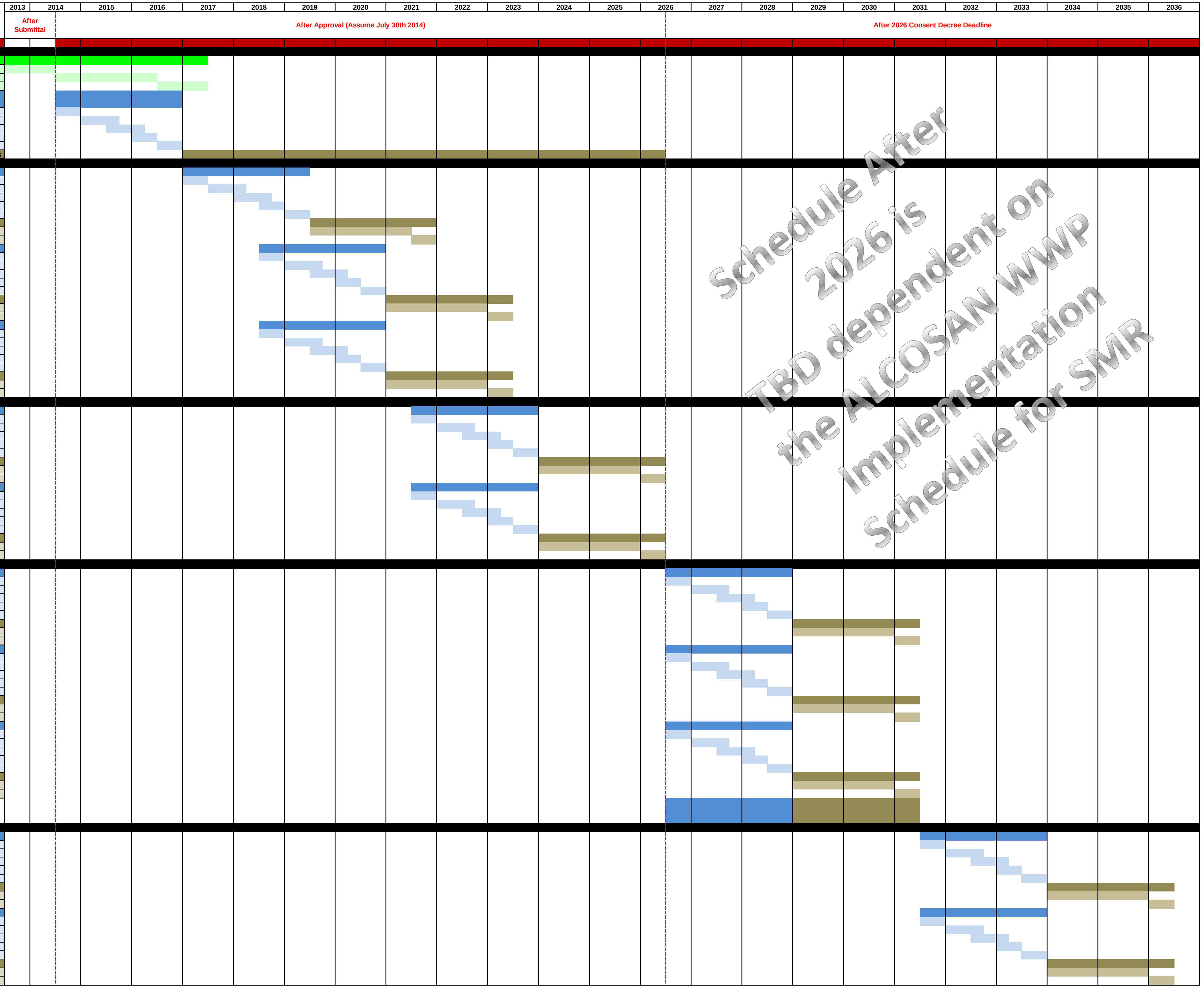
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it’s important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements be up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the Allegheny River tunnel segment extending toward A-51 portion of the regional plan is being implemented by the end of 2024. Per PWSA's implementation schedule, A-51 is included in Phase 2 (2017 to mid-2023) due to the preference to follow the design /construction of the ALCOSAN Allegheny River tunnel segment as well as to apply considerations for balanced distribution of costs and resources throughout the duration of the implementation schedule.

ATTACHMENT B

FIGURE A51-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the East Street sewershed. At this point, there are no multi-municipal improvements being proposed for this sewershed. Therefore, Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Ross Township, Reserve Township, and the Pittsburgh Water and Sewer Authority are not being considered. Other considerations regarding the A-51 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the “2-year design storm” for the municipal separate sanitary system portions and “4 OF/ typical year” for the PWSA’s combined system outside of Saw Mill Run where “0 OF/ typical year” is proposed.

At this point, since the recommended improvements involve a small contribution from Ross and Reserve Townships, cost allocations and inter-municipal cost sharing agreements have not been pursued at this point.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

If cost sharing agreements becomes a necessary option, a DRAFT Memorandum of Understanding (MOU) would be used in developing cost allocation procedures and move towards arriving at inter-municipal agreements. The MOU development would be guided by and be based on the following set of principles:

- The major goal is to develop a fair and equitable cost allocation process.
- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.
- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.
- Cost allocations should be simple and easy to calculate in the future.
- The final cost allocation methodology should encourage efficiencies between municipalities.
- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.
- Unless agreed to by all parties, existing contracts should not form the only basis for cost allocations.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended A-51 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after A-51 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination

- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

Phase I	2013 through 2017
Phase II	2017 through 2023
Phase III	2021 through 2026
Phase IV	TBD
Phase V	TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure A51-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the East Street shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

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[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

6.3.2 Joint Municipal Planning and Implementation

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. As previously stated in Section 6.2, a draft MOU has not been pursued at this time. If a draft MOU was deemed a necessary option, then it would contain provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

At this time, there are no known flow management strategy conflicts / concerns or institutional / administrative obstacles that could delay or impede the signing of the MOU.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$5,590,000.

- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance

- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of

annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following the implementation of the recommended alternative are shown in Table A51-6-1. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE A51-6-1: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638
Ross Township	Not Available	Not Available	Not Available
Reserve Township	Not Available	Not Available	Not Available

---

[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.

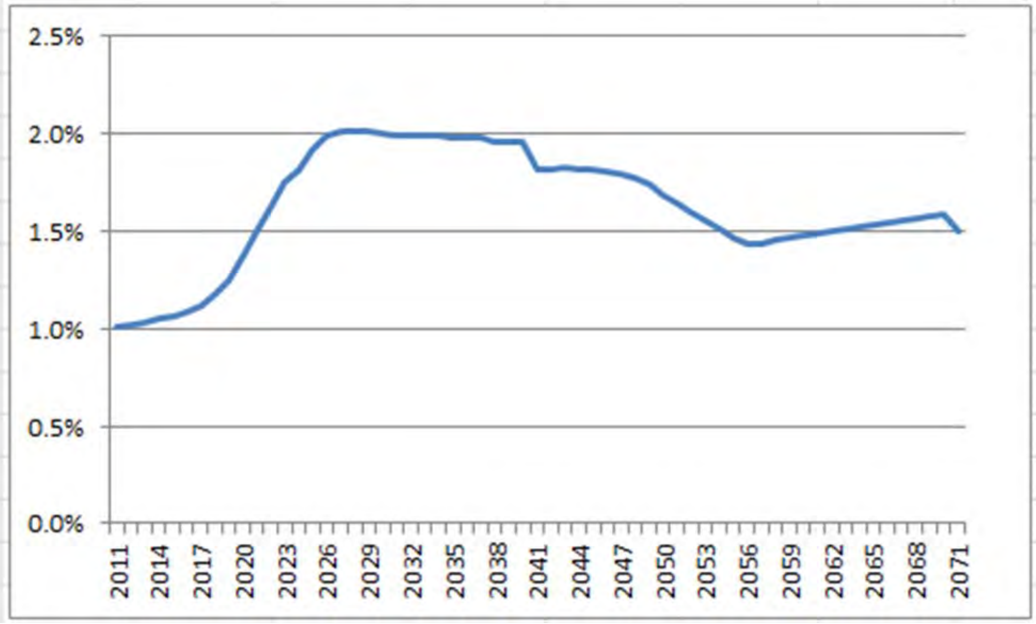
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure A51-6-1.

FIGURE A51-6-1 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.

7.0 STAKEHOLDER INVOLVEMENT

For the purpose of developing the PWSA Feasibility Study and this POC-based feasibility study, the PWSA recognized that the flows tributary to the East Street sewershed generated by the municipalities of Ross Township and Reserve Township are minor. Due to their minor flow contributions, stakeholder meetings facilitated by 3RWW, titled POC Sewershed Coordination Meetings, were not held for POC A-51. However, the PWSA led a Wet Weather Feasibility Study Coordination Meeting to facilitate stakeholder participation between the PWSA and Ross Township and Reserve Township communities tributary to the East Street watershed. The purpose of this meeting was to coordinate the development of planning information specific to the multi-municipal sewershed, reach a consensus agreement on the recommended improvements and receive authorization to submit the results. Other stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

TABLE 7-1: A-51: EAST STREET POC MEETINGS

Title/Purpose	Date	Time	Location
WW Feasibility Study Coordination	4/24/12	1:30 PM	PWSA Office

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
M-34: BECKS RUN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA <u>and</u> tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh, Mount Oliver Borough, and Baldwin Borough. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.

- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.

- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.

- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.

- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.

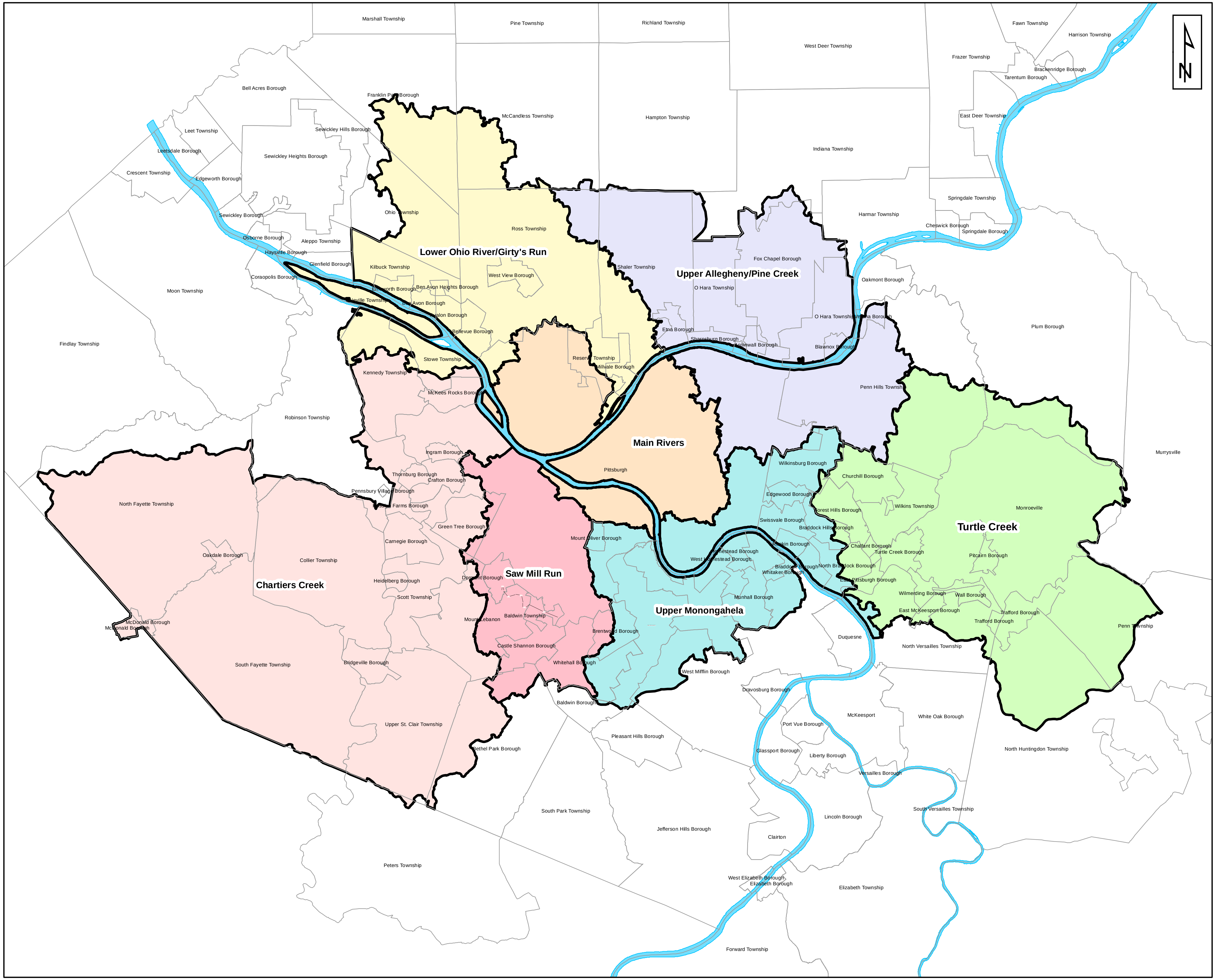
- Section 7.0 describes how stakeholders were included in the plan development.

1.2 EXISTING SYSTEM DESCRIPTION

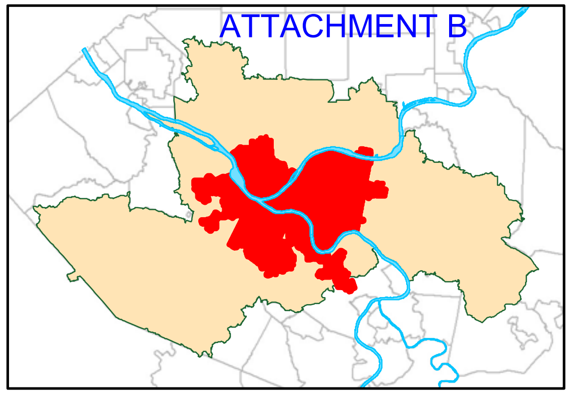
This POC FS Report addresses POC M-34, also known as Becks Run. The M-34 sewershed is located in the Upper Monongahela Planning Basin. The Upper Monongahela basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: M-34 Becks Run Existing Facilities Map*. The M-34 sewershed is served by one main trunk sewer that starts at the ALCOSAN diversion chamber ADC 031GM34 at the Monongahela River and extends west along Becks Run Road. The line diverges from Becks Run Road to follow Bajo Street until Bajo Street and Becks Run Road merge again. Here, the line resumes running parallel to Becks Run Road until it reaches the intersection of Becks Run Road and Agnew Road. This vitrified clay and brick lines range in size from 20-inches in the upper sewershed to 39-inches at the diversion chamber. Two lines branch off of this main line. One branch extends northwest from Bajo Street to Syrian Street and then follows Devlin Street west. This line varies from 8-inches to 18-inches. A line (15-inch to 20-inch) runs parallel to this pipe along Devlin and Syrian Streets to a PWSA diversion structure and combined sewer overflow on Syrian Street. The second branch diverges from the main line at the intersection of Becks Run Road and Wagner Street. The 20-inch line runs parallel to Wagner Street to Mountain Avenue where it branches into a 20-inch line that follows Wagner Street and a 21-inch line that follows Mountain Avenue. This branch contains two PWSA diversion structures and combined sewer overflows that divert flow to a tributary to Becks Run.

There are three PWSA CSO diversion chambers in the sewershed that overflow to Becks Run and the Monongahela River at four permitted CSOs. The M-34 sewershed encompasses approximately 1,635 acres. The sewershed is made up of 1,190 acres of the City of Pittsburgh, 254 acres of Baldwin Borough, and 191 acres of Mount Oliver Borough. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to M-34* for specific information on this POC.



ATTACHMENT B



ALCOSAN Service Area Overview

Legend

☐	Municipal Boundary
🟥	Chartiers Creek
🟨	Lower Ohio River / Girty's Run
🟧	Main Rivers
🟥	Saw Mill Run
🟩	Turtle Creek
🟪	Upper Allegheny / Pine Creek
🟦	Upper Monongahela
🟦	River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

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Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd

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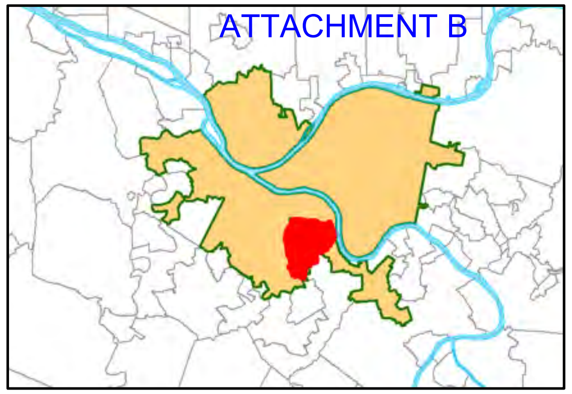
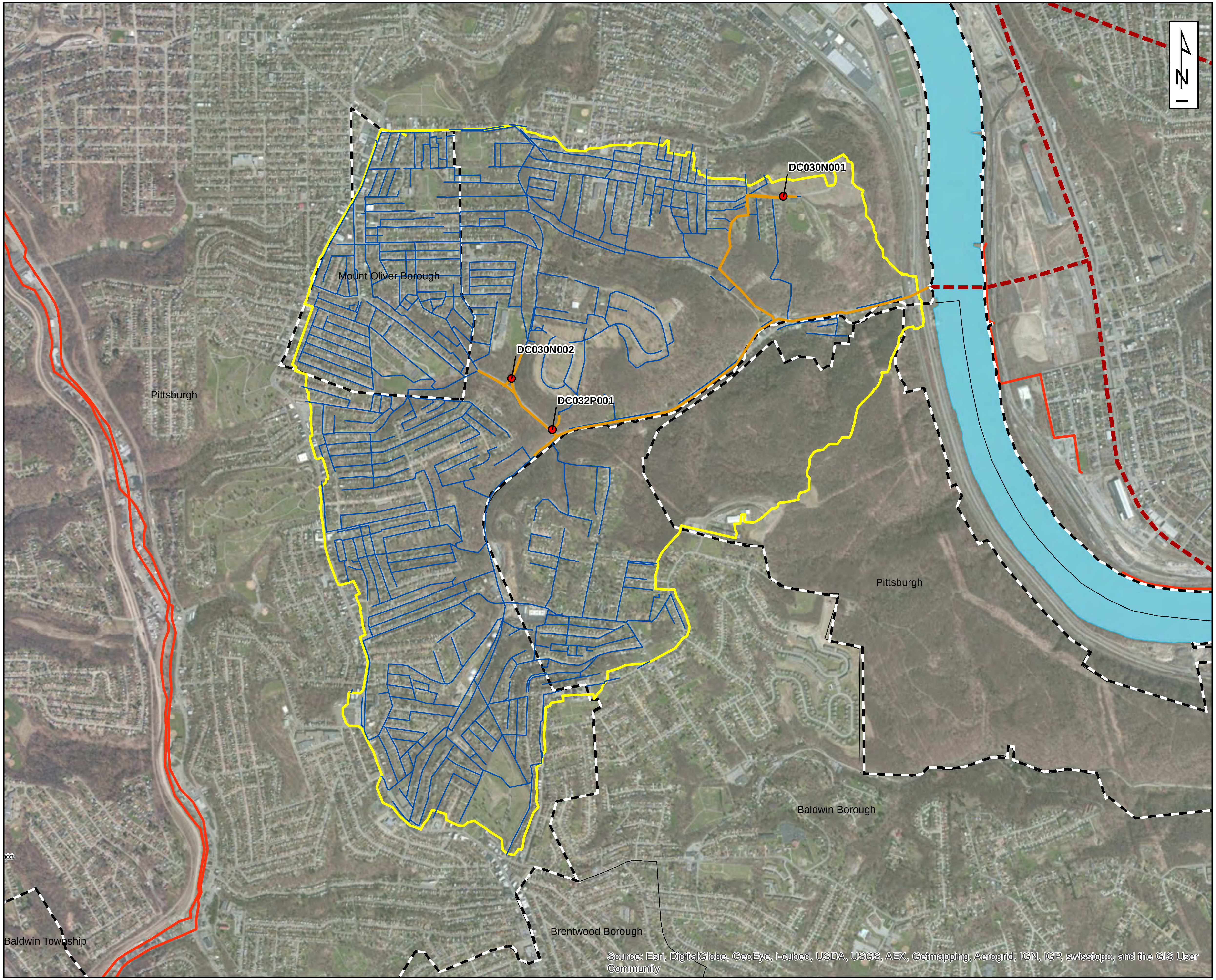


PWSA Service Area Overview



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- ● PWSA CSO Diversion Structure
- ━ Trunk Sewer
- ━ Collector Sewers
- ▭ M-34 Sewershed Boundary
- ▭ PWSA Service Area Boundary
- ▭ Municipal Boundary
- ■ River

Existing ALCOSAN Interceptor

- ╍ Deep Tunnel
- ━ Shallow Cut

1,500 750 0 1,500 Feet

Figure 1 - 2: M-34 Becks Run Existing Facilities Map

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Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\LITTLE SAW MILL RUN (MH-18)\FIGURE 1-2_M_34Existing Overflows_2.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR MUNICIPALITIES TRIBUTARY TO M-34

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY		
	City of Pittsburgh	**Baldwin Borough**	**Mount Oliver Borough**
Tributary Area (Acres)	1,190	254	191
Population	7,416	1,093	3,200
Combined			
Inch-Miles	49	0	0
Linear Feet	13,100	0	0
Inch-Miles/Acre	0.04	0	0
Separate			
Inch-Miles	349	50	98
Linear Feet	186,300	30,900	58,500
Inch-Miles/Acre	0.29	0.20	0.51

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows that are not released to the environment by the upstream PWSA diversion structures are regulated by the M-34 ALCOSAN CSO diversion structure located along the Monongahela River near the intersection of Becks Run Road and East Carson Street.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to M-34*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO M-34

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
030N001	DC030N001	CSO030N001	Syrian Street	Tributary to Becks Run
032N001	DC030N002	CSO032N001	Wagner Street	Tributary to Becks Run
032P001	DC032P001	CSO032P001	Wagner Street	Tributary to Becks Run

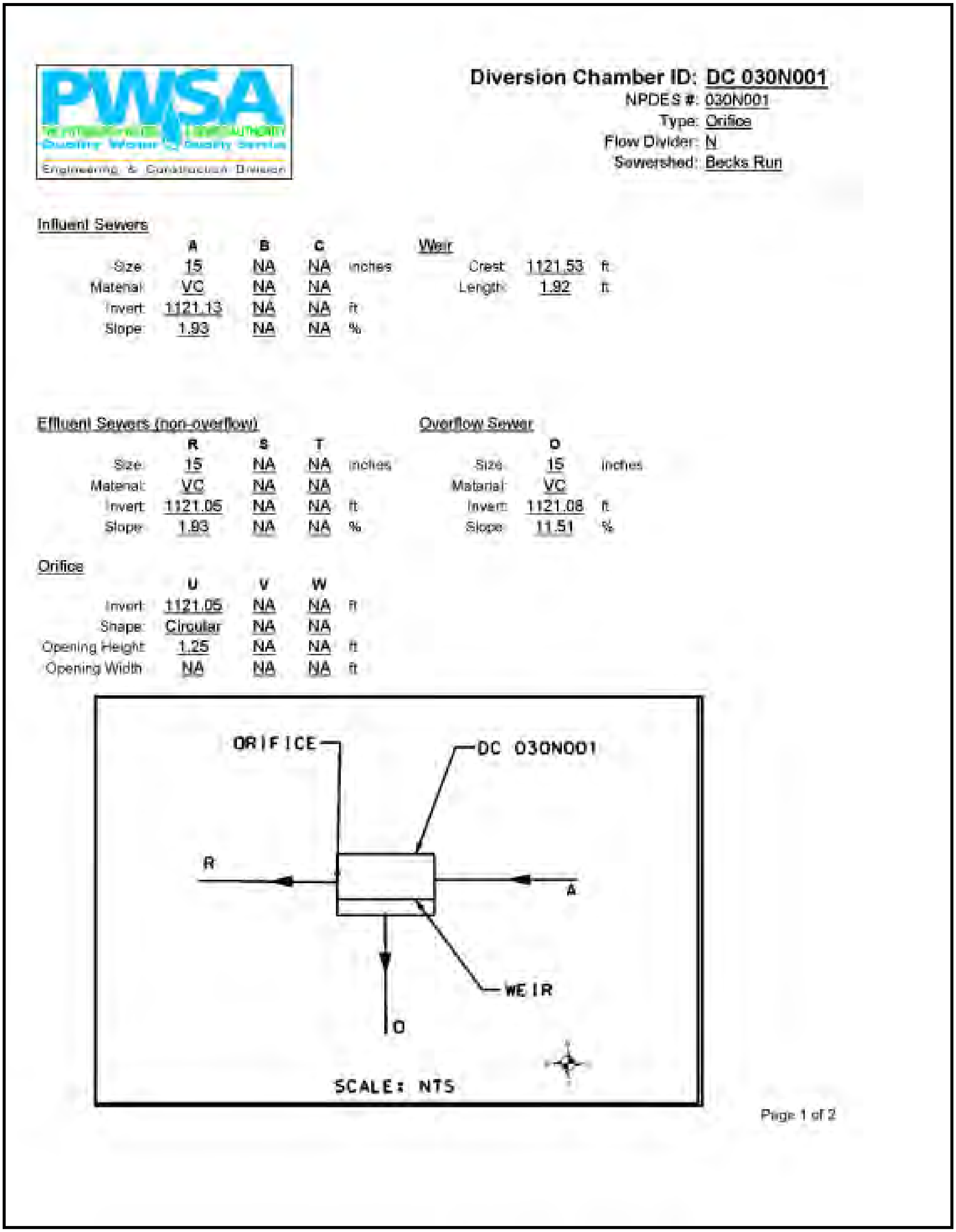
As shown in *Table 1-3: M-34 Sewershed Typical Year Overflow Statistics*, during the typical year these three structures overflow between one and 24 times. Overflow volumes range from 10,000 gallons to 90,000 gallons per event, and from 10,000 gallons to 210,000 gallons annually, on a structure by structure basis. Annual overflow flow volume for this sewershed is 0.28 million gallons.

TABLE 1-3: M-34 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC030N001	1	0.05	N/A	N/A	0.01	N/A	N/A	0.01
DC030N002	24	4.34	0.52	0.21	0.09	0.01	0.01	0.21
DC032P001	1	0.22	N/A	N/A	0.06	N/A	N/A	0.06
Total Annual Volume								**0.28**

1.2.1 Diversion Structure Sketches

The following sketches of the M-34 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.



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Diversion Chamber ID: DC 030N001
NPDES #: 030N001
Type: Orifice
Flow Divider: N
Sewershed: Becks Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	VC	NA	NA	
Invert:	1121.13	NA	NA	ft
Slope:	1.93	NA	NA	%

Weir

Crest:	1121.53	ft
Length:	1.92	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	15	NA	NA	inches
Material:	VC	NA	NA	
Invert:	1121.05	NA	NA	ft
Slope:	1.93	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	VC	
Invert:	1121.08	ft
Slope:	11.51	%

Orifice

	U	V	W	
Invert:	1121.05	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	1.25	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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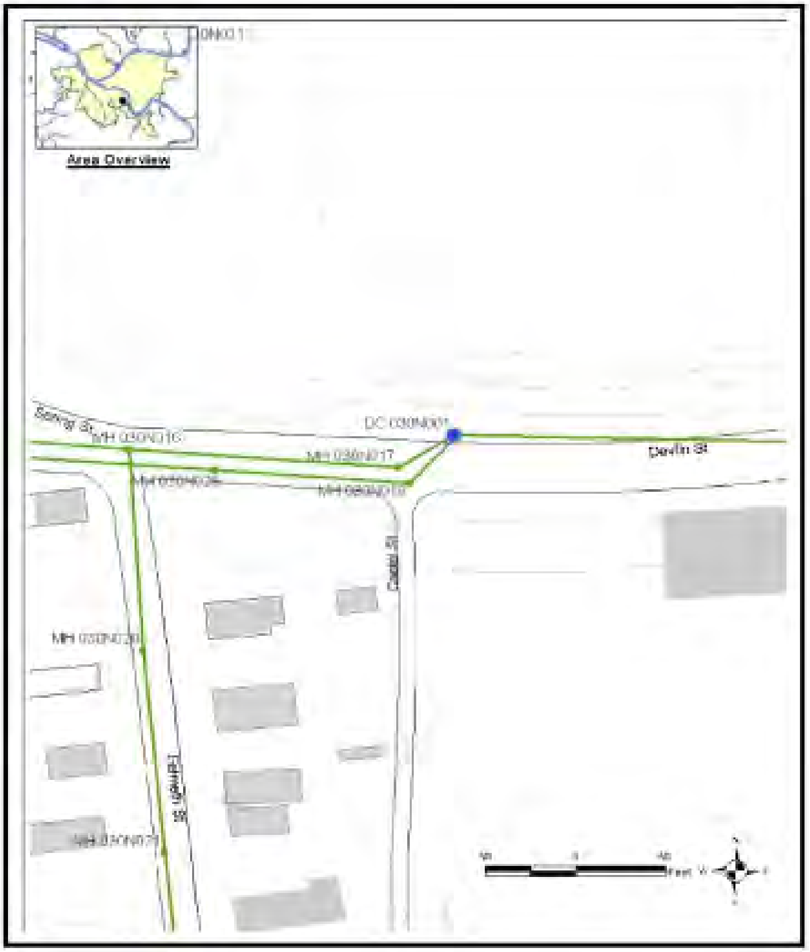
Engineering & Construction Division

Diversion Chamber ID: DC 030N001



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PWSA
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 032K001
NPDES #: 032N001
Type: Sluice
Flow Divider: N
Sewershed: Becks Run

Influent Sewers

	A	B	C	
Size:	21	NA	NA	inches
Material:	TC	NA	NA	
Invert:	953.7	NA	NA	ft
Slope:	12.43	NA	NA	%

Weir

Crest:	954.32	ft
Length:	2.67	ft

Effluent Sewers (non-overflow)

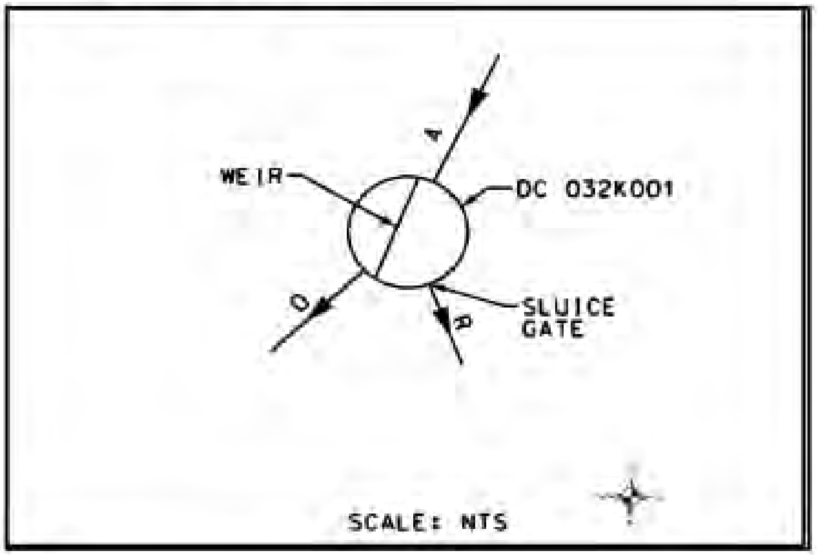
	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	953.6	NA	NA	ft
Slope:	18.38	NA	NA	%

Overflow Sewer

	O	
Size:	21	inches
Material:	TC	
Invert:	953.4	ft
Slope:	15.24	%

Orifice

	U	V	W	
Invert:	953.6	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.42	NA	NA	ft
Opening Width:	NA	NA	NA	ft



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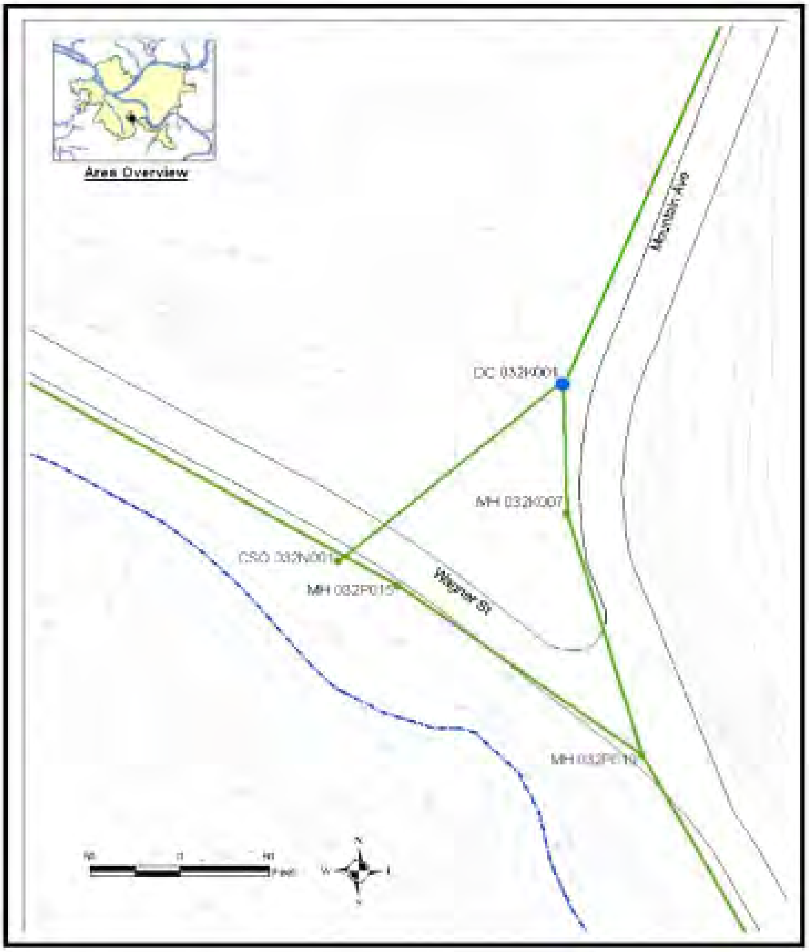
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 032K001



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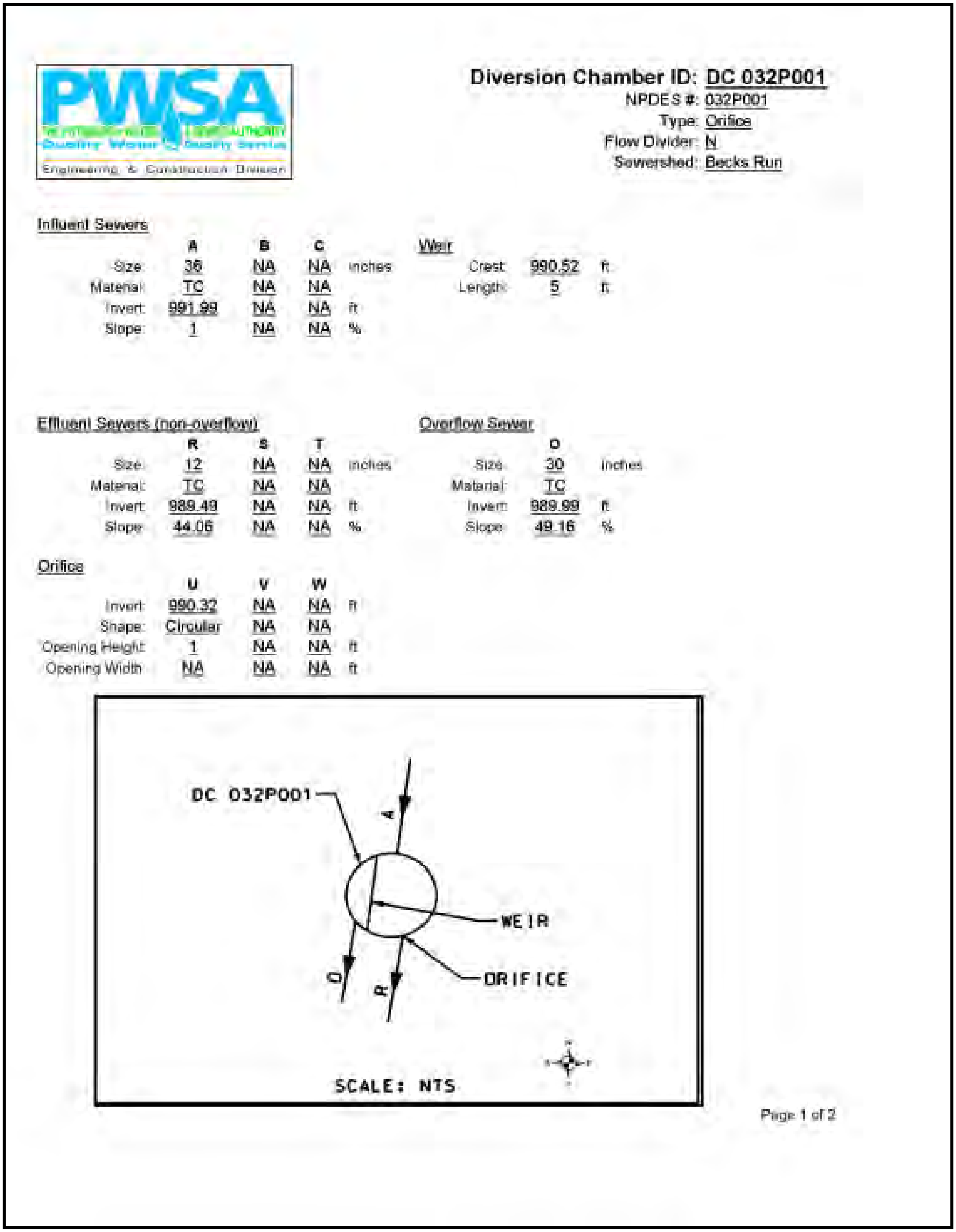

PWSA
The Pittsburgh Water & Sewer Authority
Quality Water ♦ Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 032P001
NPDES #: 032P001
Type: Orifice
Flow Divider: N
Sewershed: Becks Run

Influent Sewers

	A	B	C	
Size:	36	NA	NA	inches
Material:	TC	NA	NA	
Invert:	991.99	NA	NA	ft
Slope:	1	NA	NA	%

Weir

Crest:	990.52	ft
Length:	5	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	989.49	NA	NA	ft
Slope:	44.06	NA	NA	%

Overflow Sewer

	O	
Size:	30	inches
Material:	TC	
Invert:	989.99	ft
Slope:	49.16	%

Orifice

	U	V	W	
Invert:	990.32	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	1	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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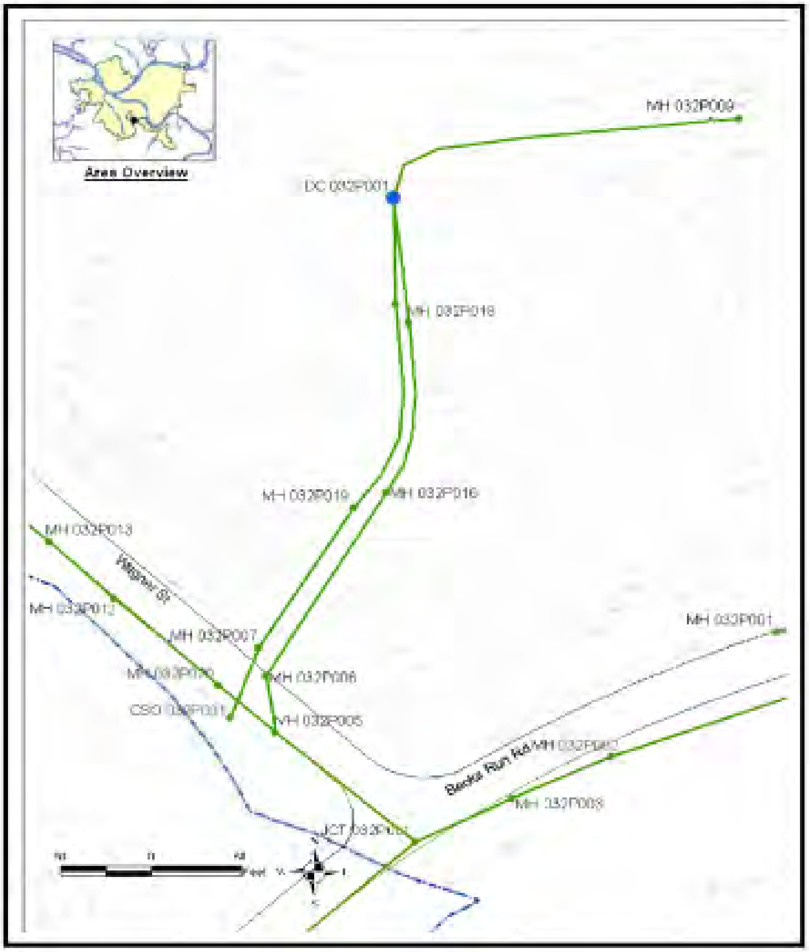
PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 032P001



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2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC M-34: Becks Run through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Upper Monongahela Basin Planners (UM_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for M-34.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The

flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. Four (4) flow meters located within the M-34 sewershed were used in the RCS-FMP. Details on the four (4) RCS-FMP flow monitors installed within the Becks Run sewershed are found in Table M34-2-1.

TABLE M34-2-1: M-34 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Type	Monitor Term[1]
M3400__-MB_-L-02_	City of Pittsburgh	MB	L
M3400__-MB_-L-04_	Baldwin Borough	MB	L
M3400__-MM_-L-03_	City of Pittsburgh	MM	L
M3400__-POC-L-01_	City of Pittsburgh	POC	L

[1]L=Long Term: 1-year minimum to 21-month maximum.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).
- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.
- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.
- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

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[1] The flow monitor information in this table is from a file titled "Summary of Program Monitors by Name, Type and Dates.xls". This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled "Summary and Report of Flow Monitoring June 2009".

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the M-34 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the M-34 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.
- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The maximum, minimum, and average DWF and the GWI ratio for the, and GWI per inch-mile of sewer for each flow monitor within the M-34 sewershed are listed in Table M34-2-2. The GWI ratio is an estimated amount of the DWF that can be associated with GWI compared to the DWF peaking factor (i.e. Average Daily Maximum Flow vs. Average Daily Minimum Flow).

TABLE M34-2-2: M-34 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

POC	Average Daily Flow (mgd)			GWI Ratio (min/avg)
	Maximum	Minimum	Average	
M-34	3.0	1.5	2.2	75.2%

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table M34-2-3.

TABLE M34-2-3: M-34 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
M-34	2.05	2.07	1.0%

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event.

RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

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[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Upper Monongahela Planning Basin – Table 4-3.

[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Upper Monongahela Planning Basin – Table 2-3.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for M-34 are presented in Table M34-2-4.

TABLE M34-2-4: M-34 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
M-34	26.3	26.3	0.0%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

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[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Upper Monongahela Planning Basin – Table 2-4

Figures M34-2-1a, M34-2-1b, and M34-2-1c present the computed hydraulic profiles of the existing Becks Run trunk sewer, Parkwood Road trunk sewer and Wagner Street trunk sewers, respectively, under projected 2-year design storm peak flow conditions. As is indicated in the figures, under the current system configuration, including existing CSO diversion chamber settings, operate acceptably.

Figures M34-2-2a, M34-2-2b, and M34-2-2c present the computed hydraulic profiles of the existing Becks Run trunk sewer, Parkwood Road trunk sewer and Wagner Street trunk sewers, respectively, under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, operate acceptably.

Figures M34-2-3a, M34-2-3b, and M34-2-3c present the computed hydraulic profiles of the existing Becks Run trunk sewer, Parkwood Road trunk sewer and Wagner Street trunk sewers, respectively, under projected 10-year design storm peak flow conditions. These figures illustrate how the trunk sewers operate under the current system configuration, including existing CSO diversion chamber settings. The Becks Run sewer generally functions acceptably; however, some surcharging does occur at two locations in the upper and lower extremities of the sewer. The Parkwood Road trunk sewer generally functions acceptably; however, some surcharging does occur at one location at the upper end of the sewer. The existing Wagner Street trunk sewer operates acceptably.

Computed flow hydrographs for each of the design storms at the M-34 POC are presented in Figure M34-2-4.

FIGURE M34-2-1A: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-BECKS RUN

Existing System Configuration and Mode of Operation under Peak 2-Year Design Storm and Future Baseline Conditions

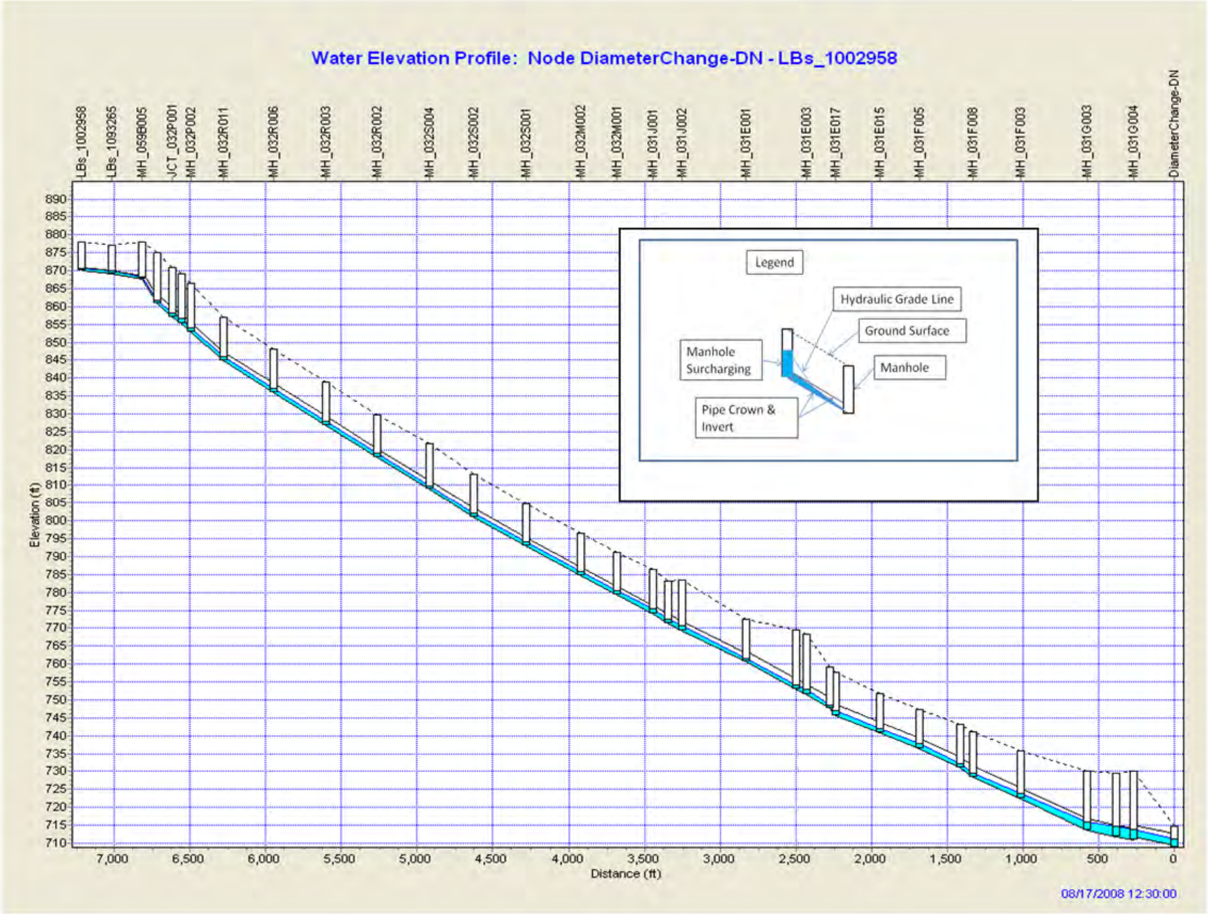


FIGURE M34-2-1B: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-PARKWOOD ROAD

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

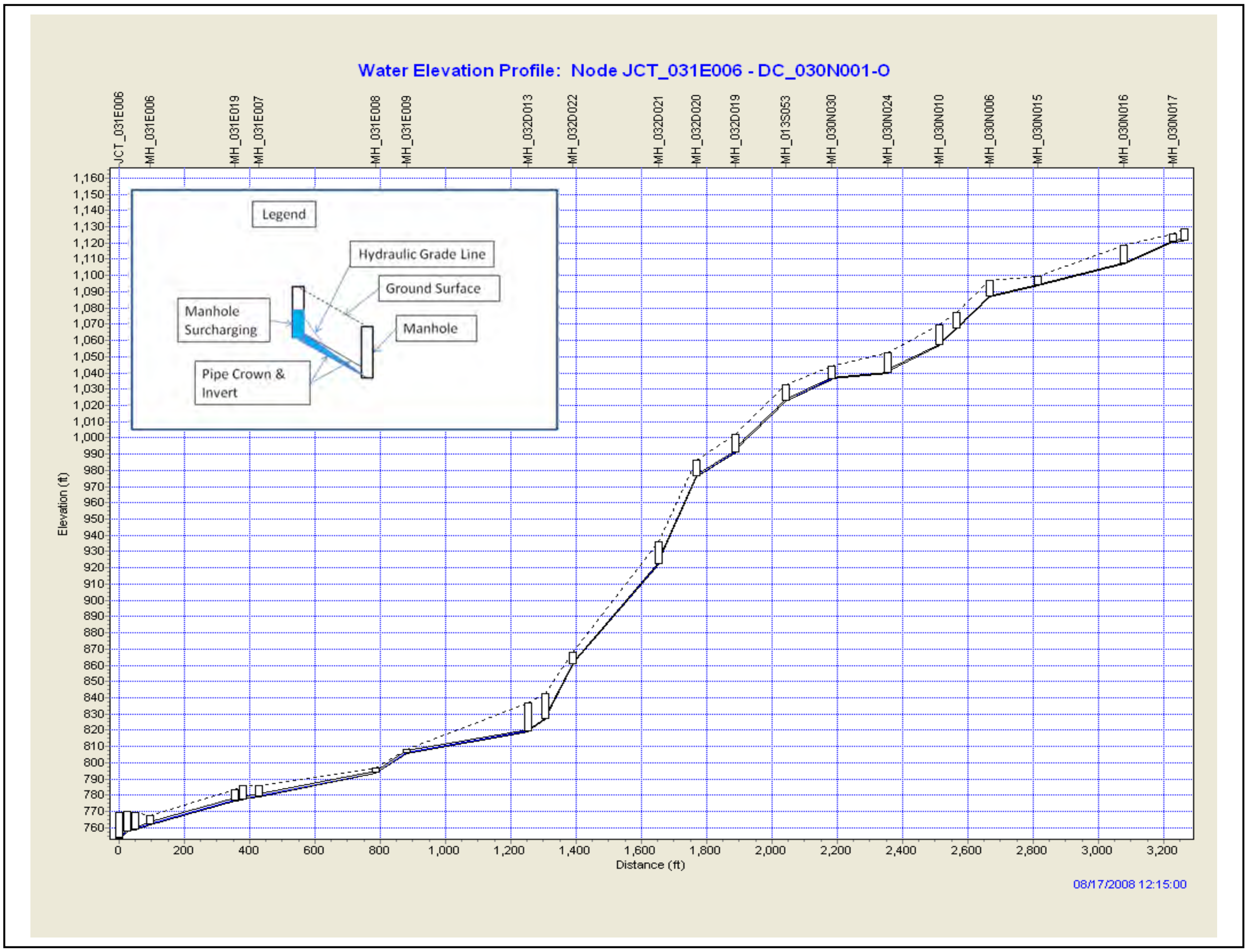


FIGURE M34-2-1C: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-WAGNER STREET

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

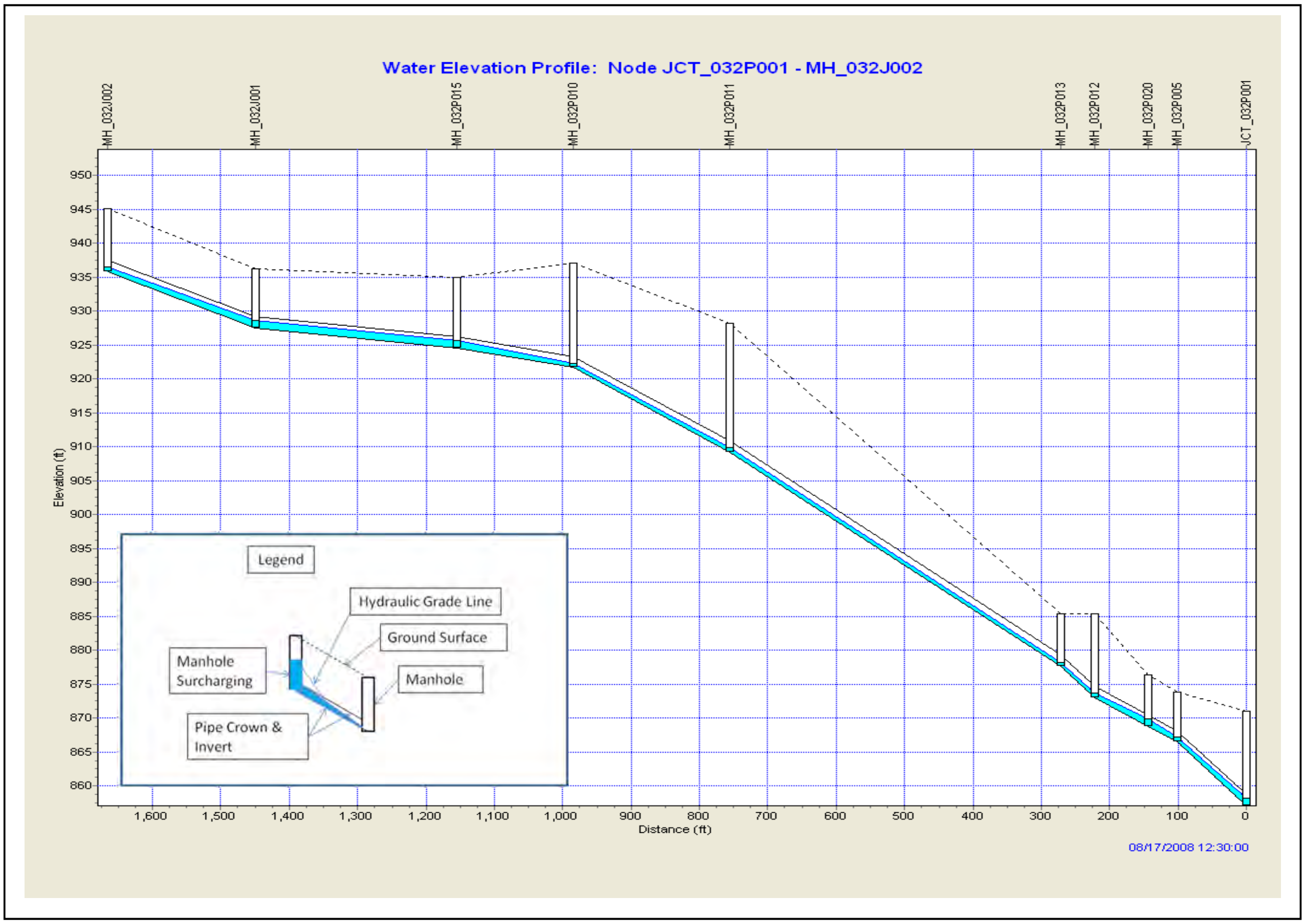


FIGURE M34-2-2A: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-BECKS RUN

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

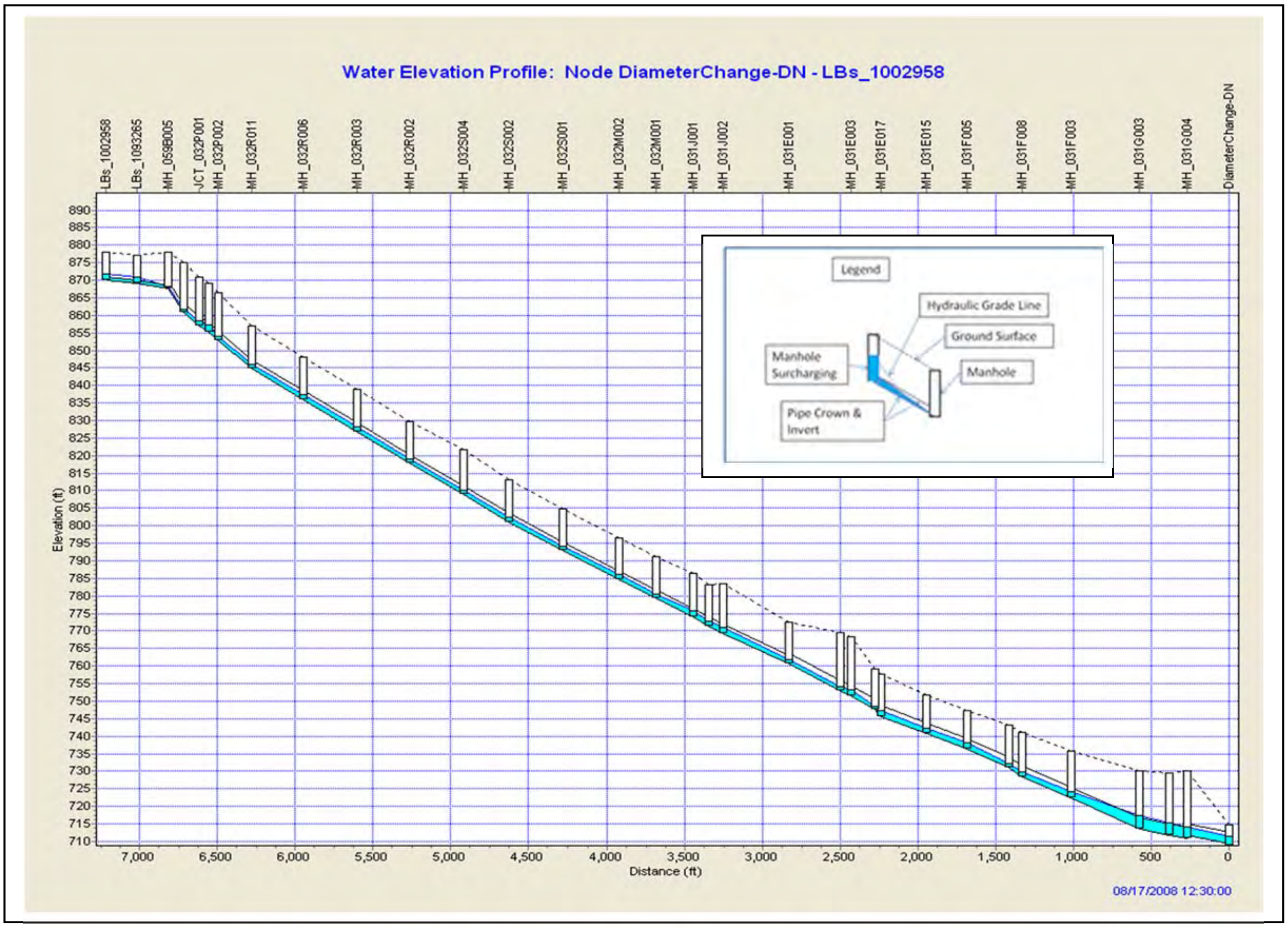


FIGURE M34-2-2B: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-PARKWOOD ROAD

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

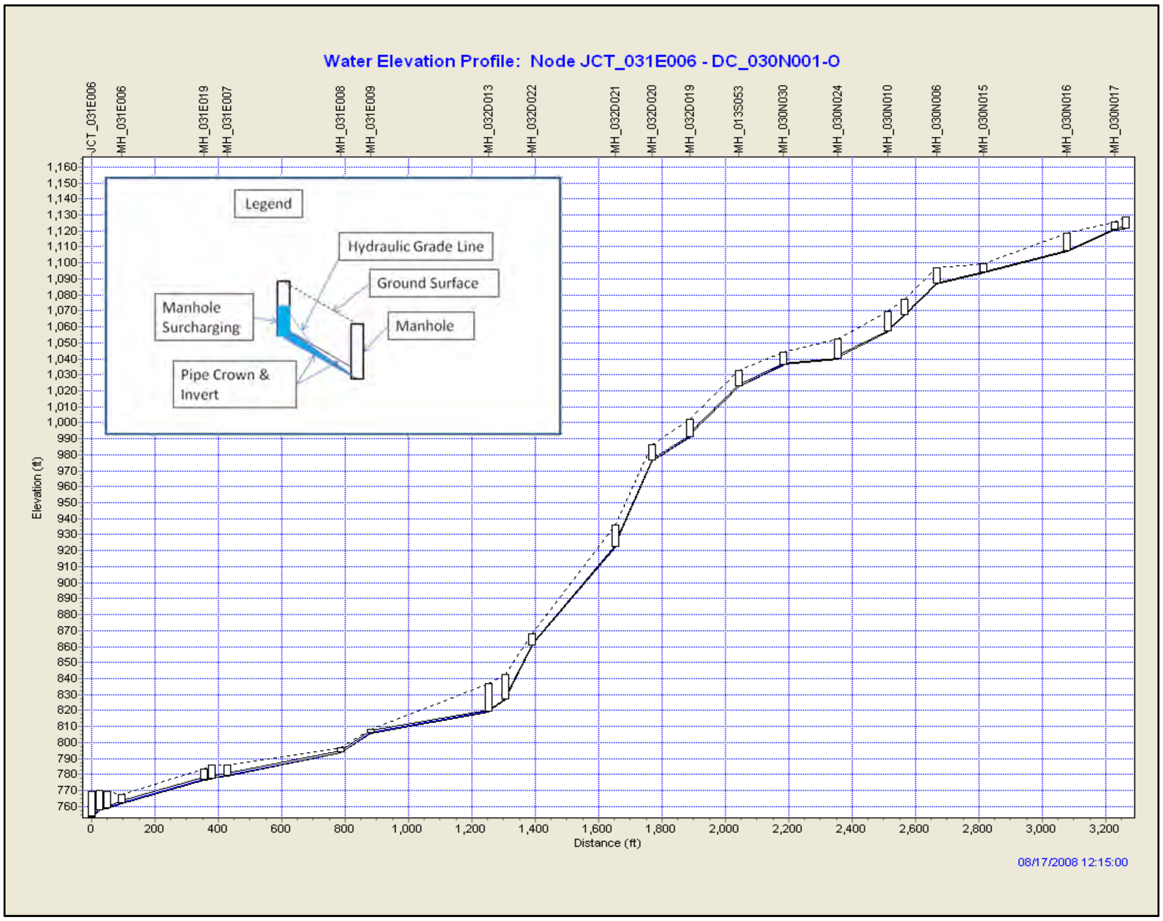


FIGURE M34-2-2C: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-WAGNER STREET

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

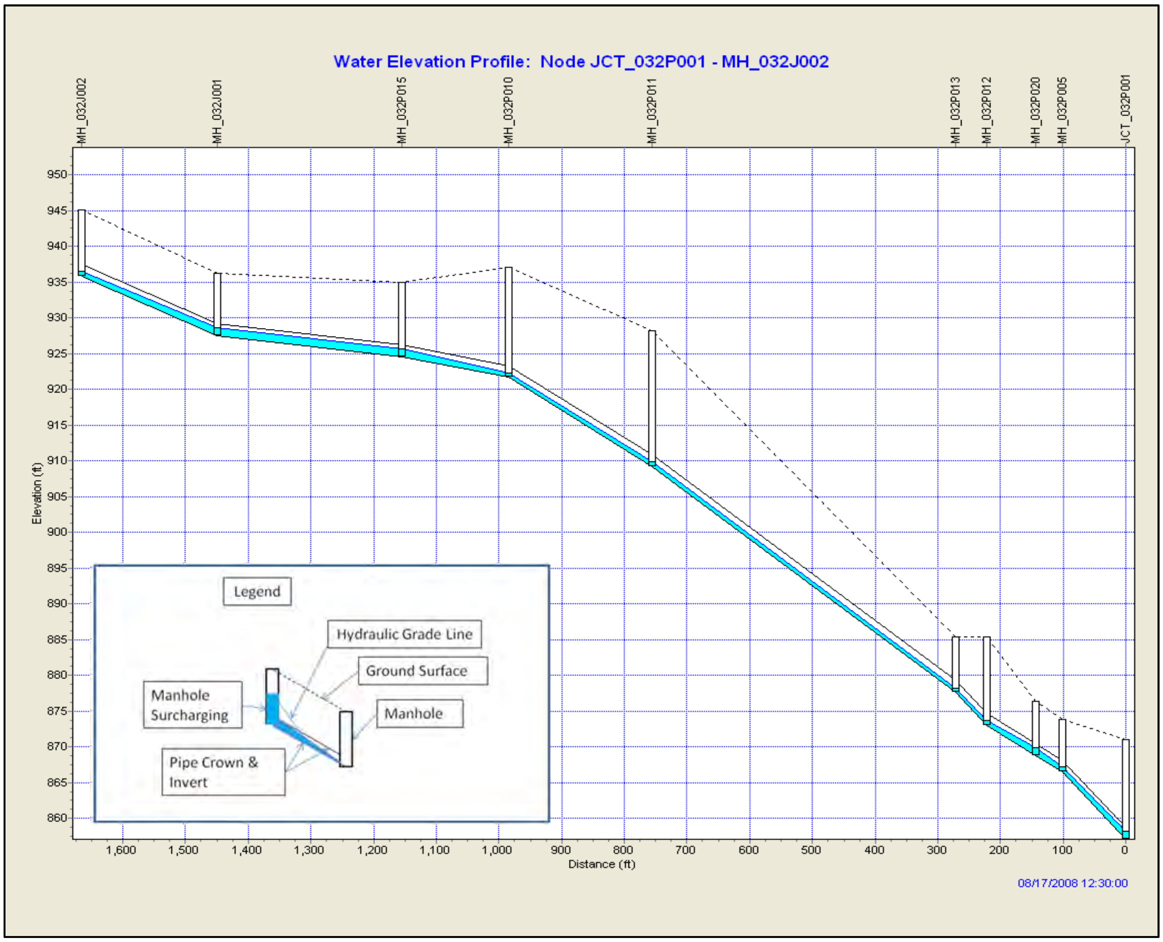


FIGURE M34-2-3A: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-BECKS RUN

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

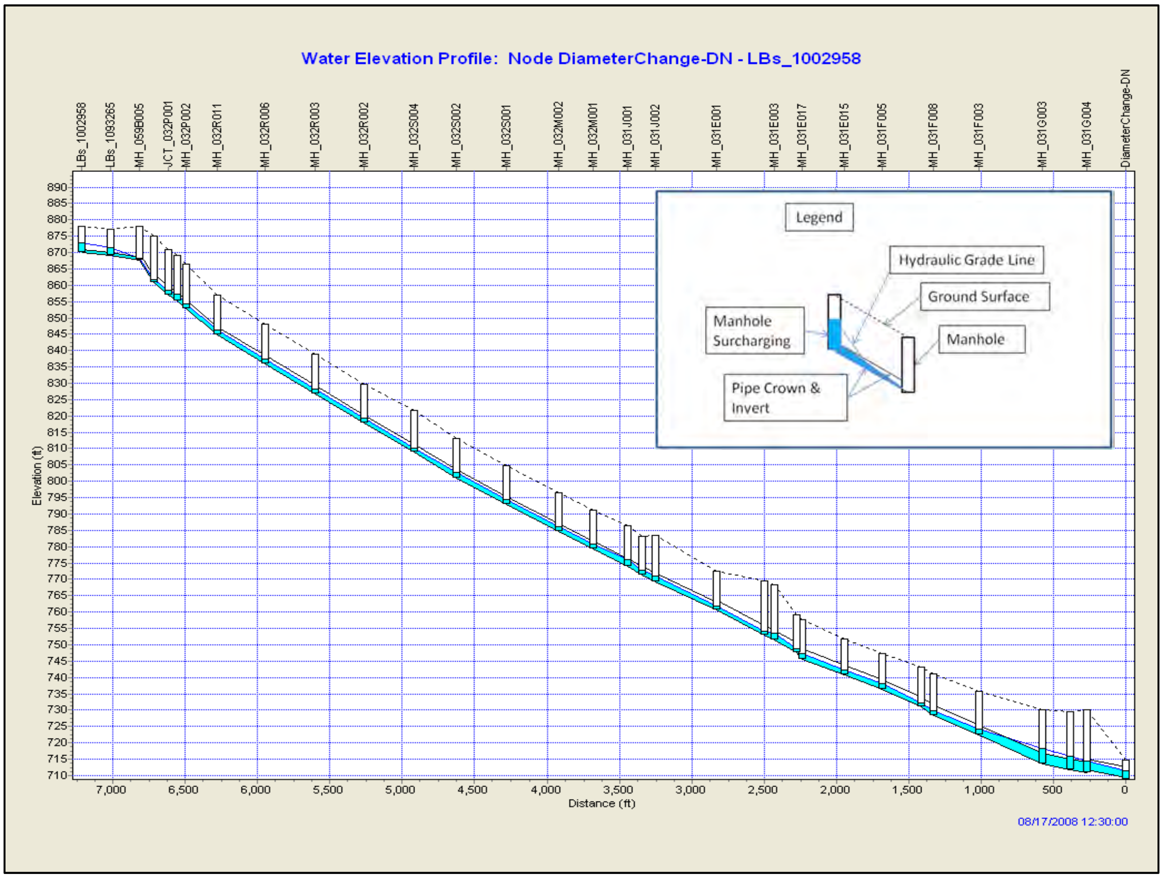


FIGURE M34-2-3B: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-PARKWOOD ROAD

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

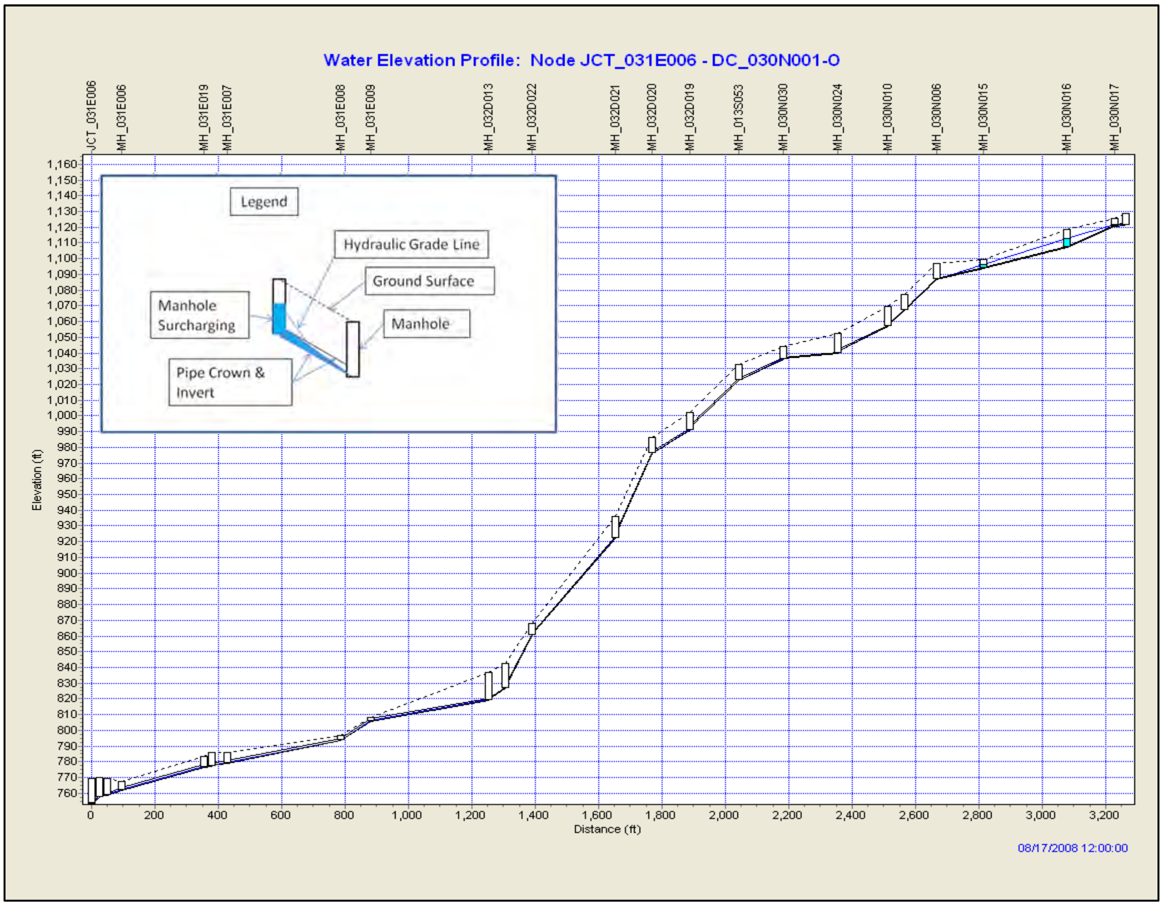


FIGURE M34-2-3C: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-WAGNER STREET

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

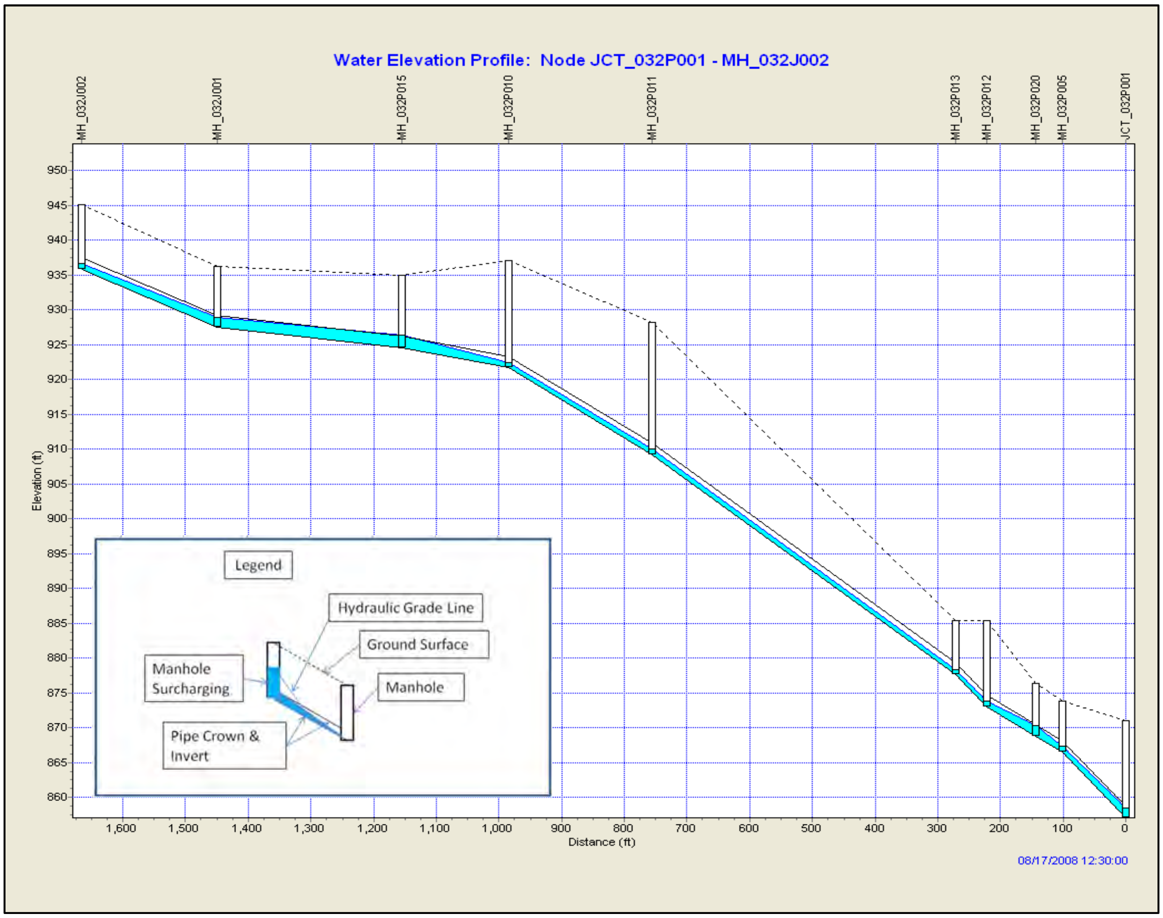
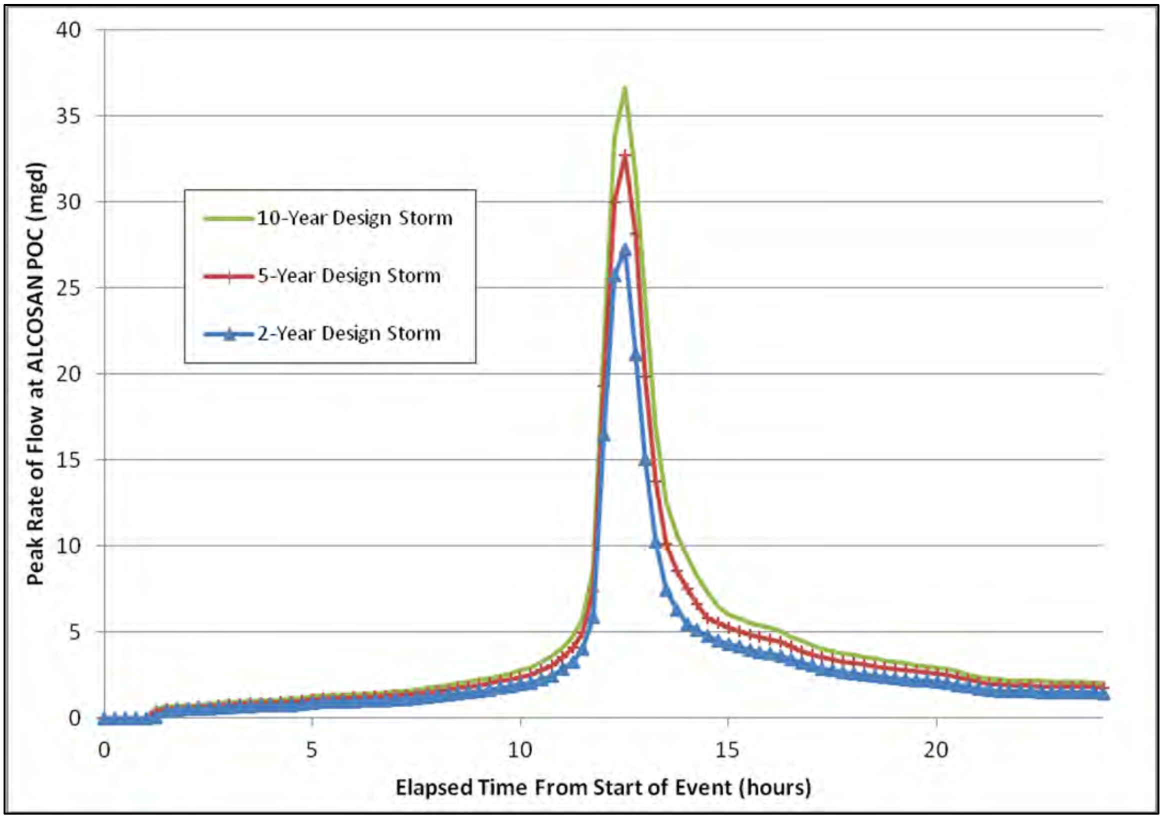


FIGURE M34-2-4: M-34 SEWERSHED PEAK FLOW RATES TO POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

Table M34-2-5 presents a summary of the identified chronic basement flooding locations within the PWSA portion of Becks Run. The neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. The data presented in Table M34-2-5 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE M34-2-5: M-34 CHRONIC BASEMENT BACKUP LOCATIONS (PWSA SYSTEM)[5]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
2019 Dowling Street	2	2005
328 E. Agnew Street	2	2009
341 E Agnew Street	3	2008
1421 Triana Street	2	2006
520 Kohne Street	2	2004
2221 Jonquile Way	2	2007
231 Fernleaf Street	2	2008

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the M-34 ALCOSAN POC at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the

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[5] Information from analysis of PWSA SAP system

flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures M34-2-5a, M34-2-5b, M34-2-5c, M34-2-6a, M-34-2-6b and M-34-2-6c. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figures show that under this range of operating conditions, the existing sewer system generally has sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding.

FIGURE M34-2-5A: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-BECKS RUN

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

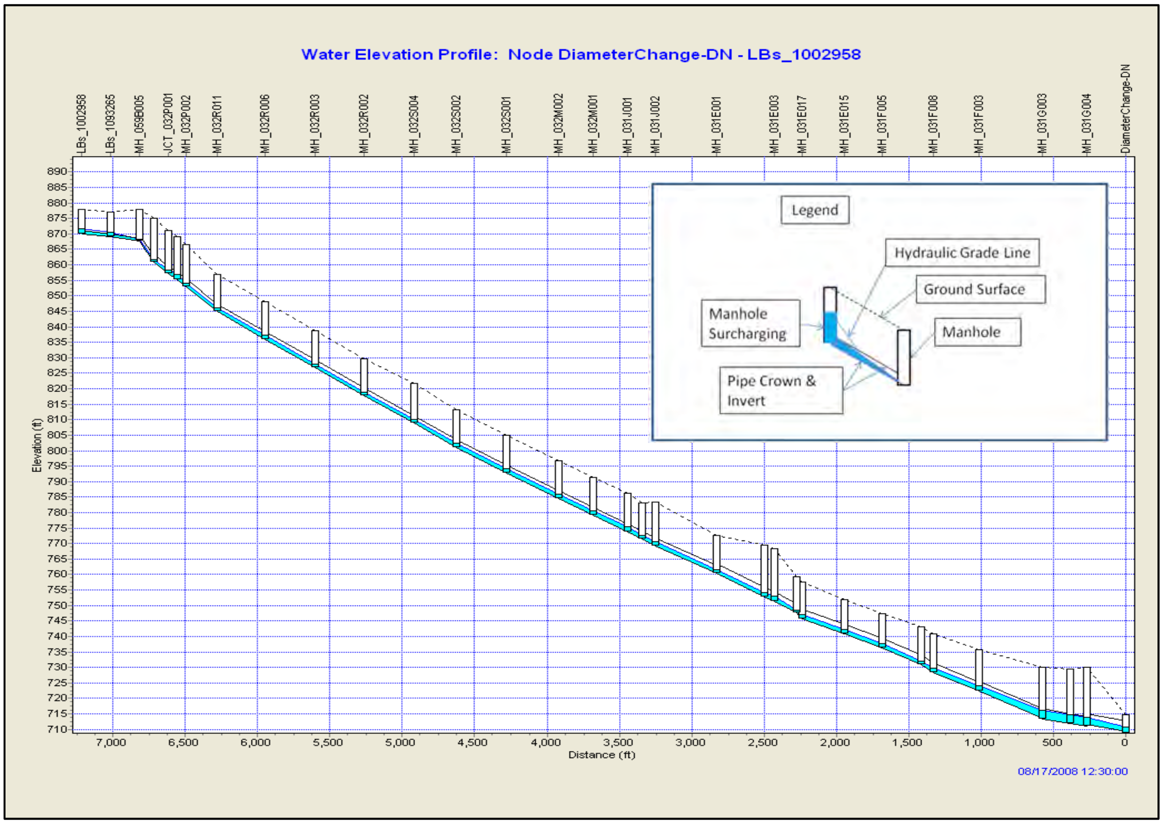


FIGURE M34-2-5B: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-PARKWOOD ROAD

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

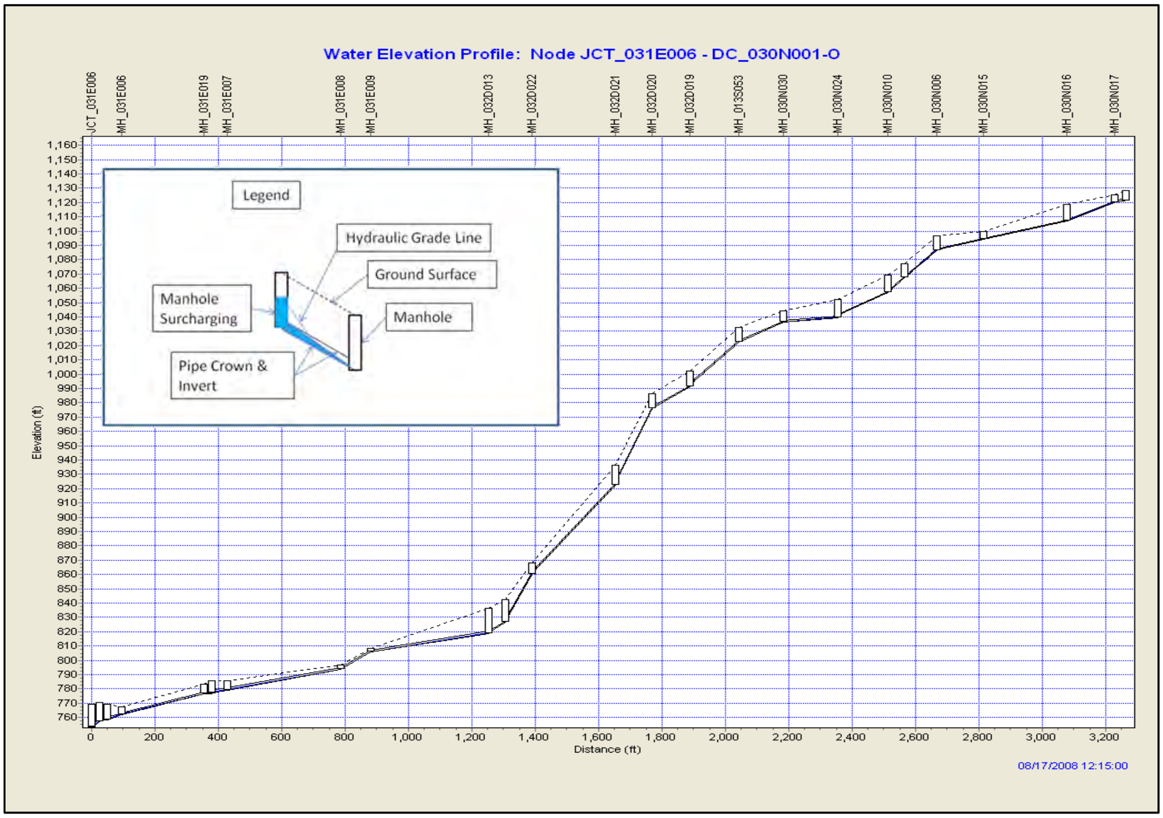


FIGURE M34-2-5C: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-WAGNER STREET

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

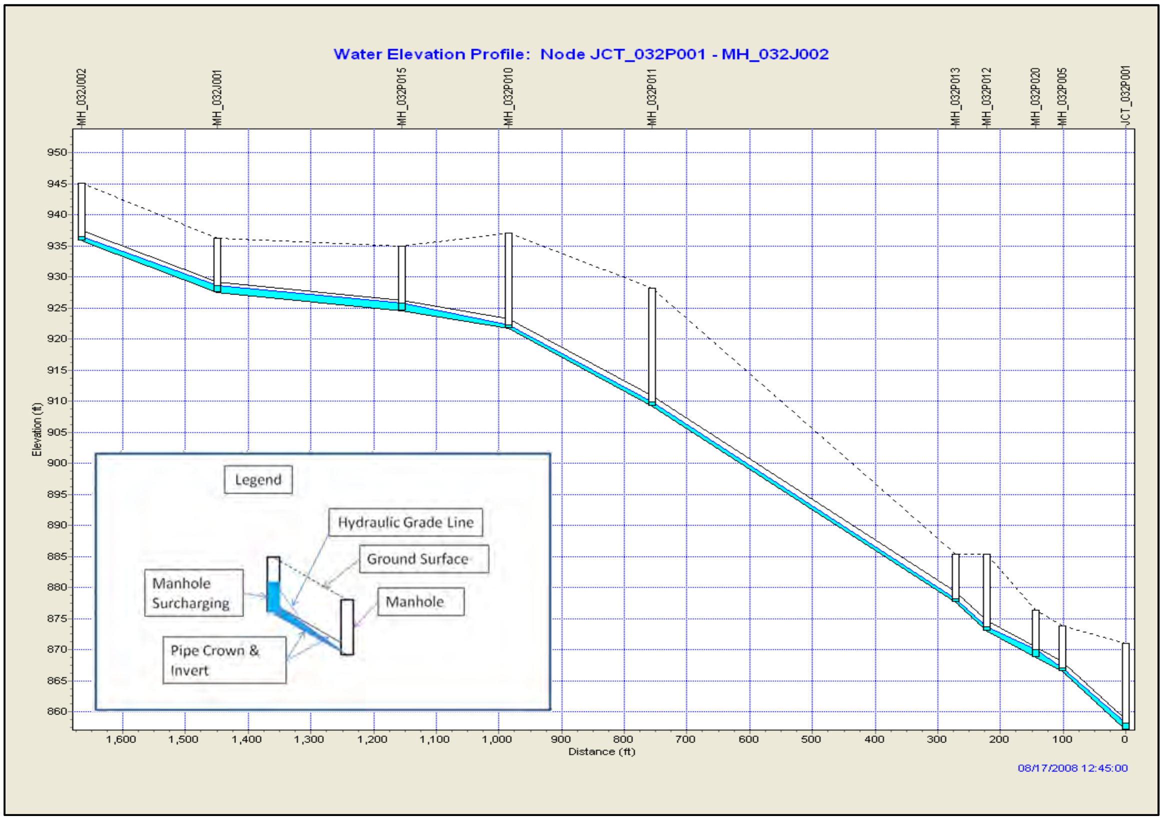


FIGURE M34-2-6A: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-BECK RUN

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

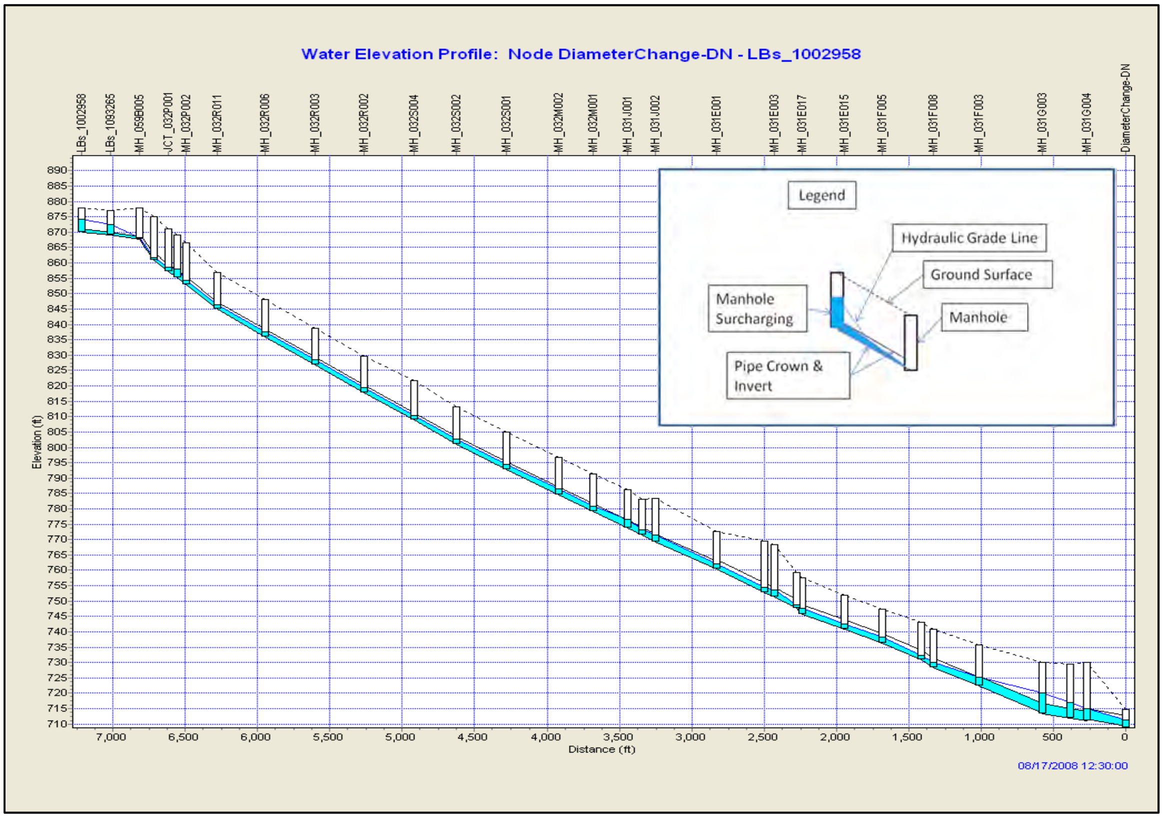


FIGURE M34-2-6B: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE- PARKWOOD ROAD

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

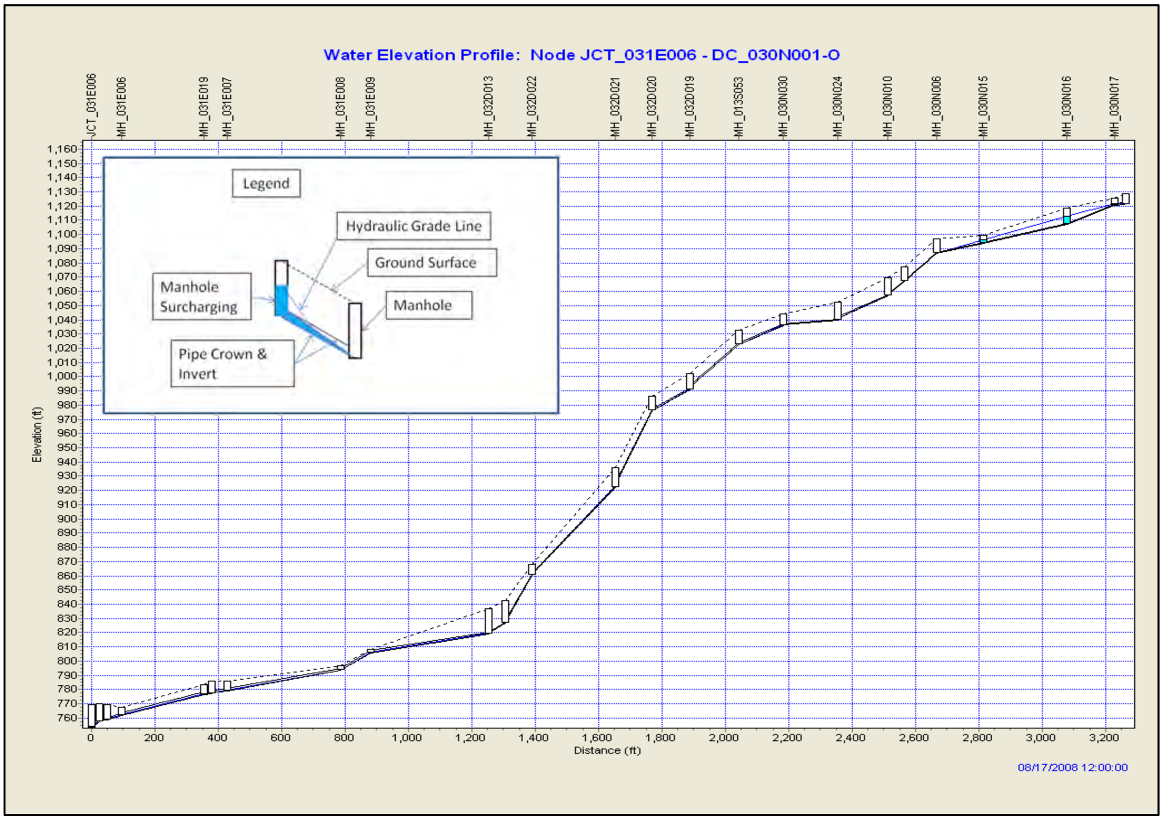
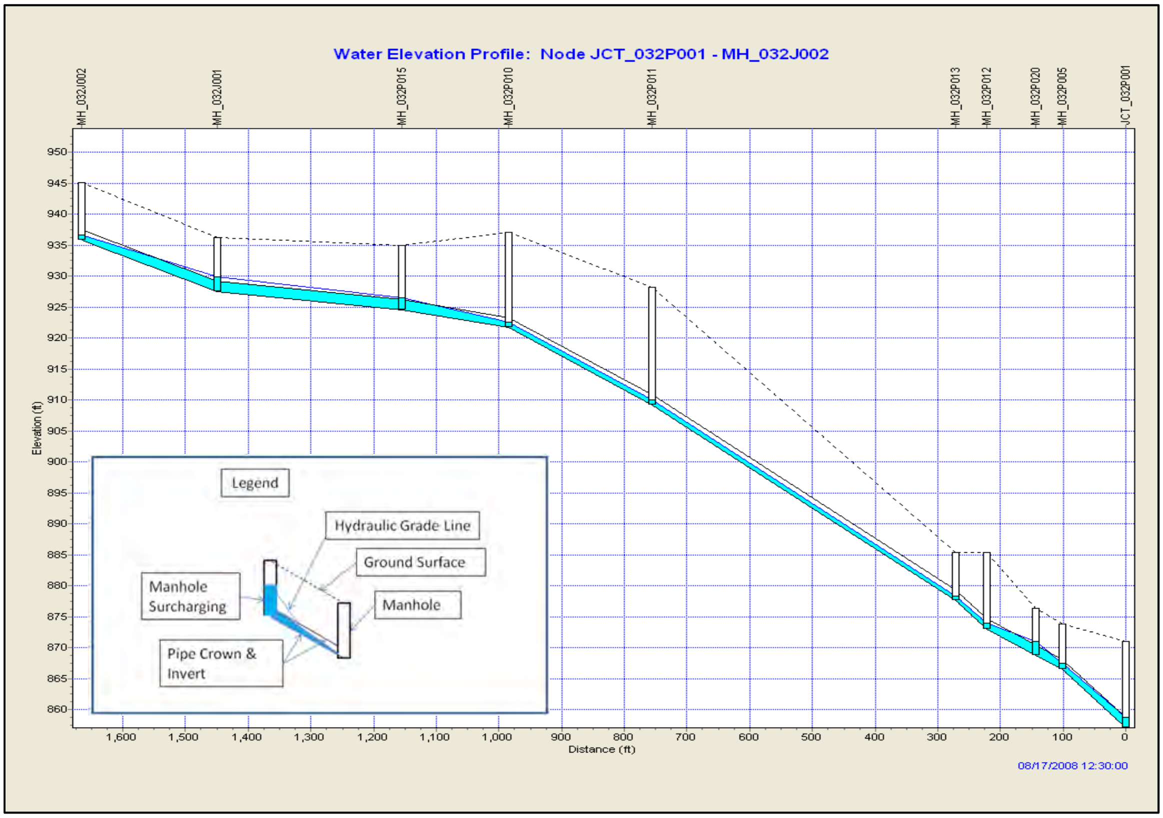


FIGURE M34-2-6C: M-34 SEWERSHED MAIN TRUNK SEWER PROFILE-WAGNER STREET

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the M-34 sewer system performed by PWSA produced computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table M34-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the M-34: Becks Run sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.

- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."

- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."

- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. Three (3) of these outfalls are found within the M-34 or Becks Run Sewershed, as shown in Table M34-3-1.

TABLE M34-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE M-34: BECKS RUN SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF032N001	UM	M-34	Becks Run	WWF[1]	N	N
OF032P001	UM	M-34	Becks Run	WWF	N	N
OF030N001	UM	M-34	Becks Run	WWF	N	N

As shown in the table, the three (3) PWSA owned outfalls discharges into Becks Run. This receiving water is classified as warm water fishery (WWF) and currently does not meet its assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is

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[1] Warm Water Fishery

calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.

- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical

characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the M-34 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO

controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the M-34 sewershed, Table M34-3-2 lists the untreated CSO statistics that were computed for each control level.

TABLE M34-3-2: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE M-34: BECKS RUN SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC030N001	Closed	0	Closed	0	Closed	0
DC032K001	0	0	3	0.08	8	0.09
DC032P002	0	0	1	0.01	1	0.01
Total Volume		**0**		**0.09**		**0.10**

As will be described later in this report, the M-34 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events) under of the typical year condition.

A range of control levels for the typical year were evaluated for transport of flows. PWSA plans to use the 4 overflows per year which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

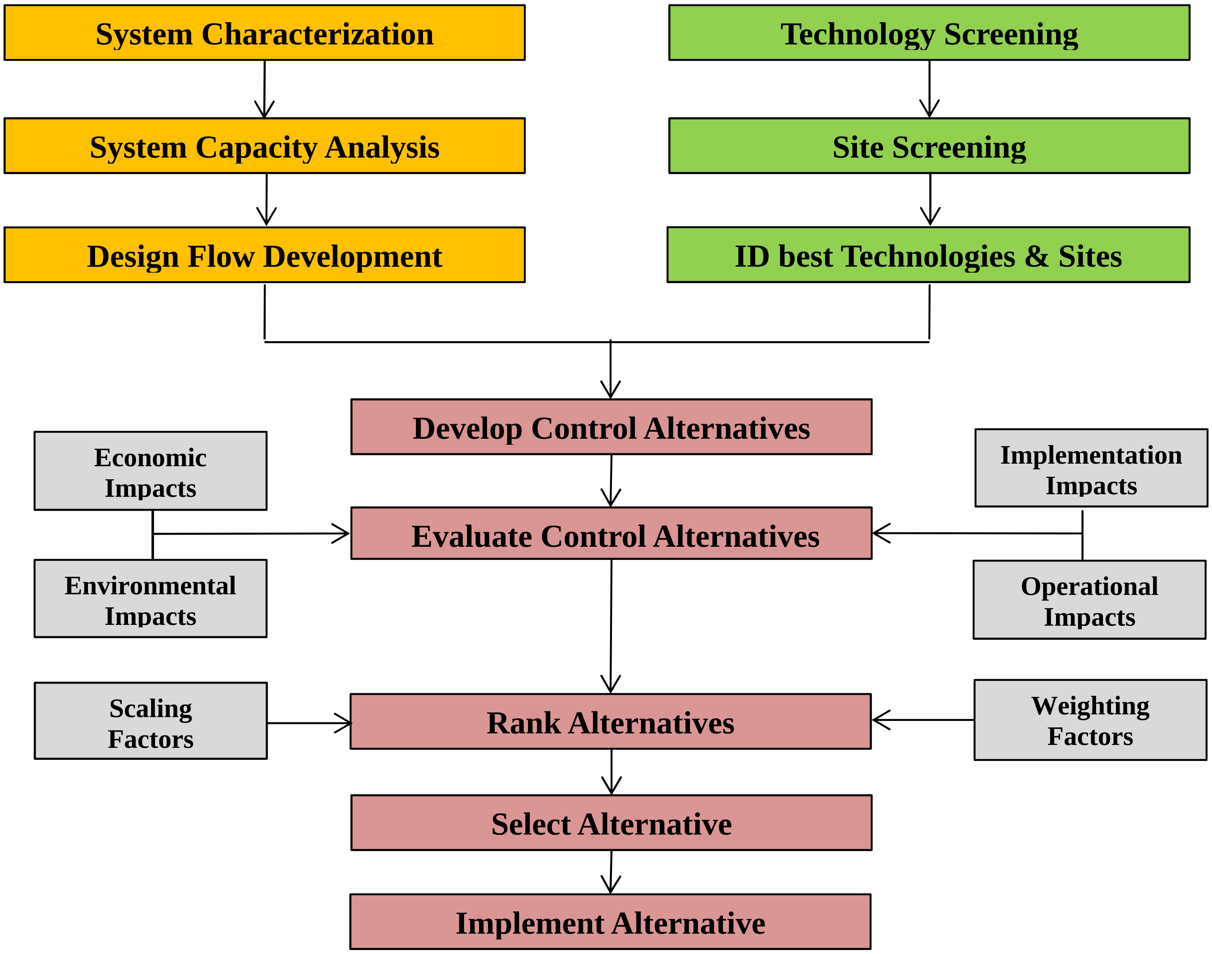
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure 4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE 4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered “feasible” for use in the M-34 sewershed are shown below in Table 4-1.

TABLE 4-1: M-34 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house

the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies was identified for the M-34 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table 4-2.

Contributing flows from the municipalities that are tributary to the M-34 sewershed, which include Baldwin Borough and Mt. Oliver Borough, were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as waterways.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning “Objective Scores” to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

TABLE 4-2: M-34 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 031GM34	CS4 031GM34: Sewer separation	Complete sewer separation of tributary area.
	S2-031GM34: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-031GM34: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-031GM34: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-031GM34: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-031GM34: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-031GM34: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 032N001	CS4-032N001: Sewer Separation	Complete sewer separation of tributary area.
	S2-032N001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-032N001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-032N001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-032N001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-032N001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-032N001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 030N001	No activations during the typical year.	No control required.
Outfall 032P001	No activations during the typical year.	No control required.
Regional Controls – M-34: Becks Run Controls		
None	NA	NA
Sub-system Controls – Monongahela - Ohio Controls		
Outfalls 031GM34, 032N001, 030N001,	MO-1: Tunnel Storage[2]	A 2.4 mile long tunnel collecting flow from M-28 to O-25 The Becks Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • M-34 - Surface Storage • 030N001 – Sewer Separation

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

CSO(s)	Control Alternative(s)	Description
and 032P001		• 032N001 – Sub-Surface Storage
	MO-2: Tunnel Storage[2]	A 2.9 mile long tunnel collecting flow from M-29 to O-25 The Becks Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • M-34 - Surface Storage • 030N001 – Sewer Separation • 032N001 – Sub-Surface Storage
	MO-3: Tunnel Storage[2]	A 5.4 mile long tunnel collecting flow from M-40 to O-25. The 030N001 and 032N001 outfalls will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 030N001 – Sewer Separation • 032N001 – Sub-Surface Storage
	MO-4: Tunnel Storage[2]	A 6.1 mile long tunnel collecting flow from M-42 to O-25 The 030N001 and 032N001 outfalls will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 030N001 – Sewer Separation • 032N001 – Sub-Surface Storage
	MO-5: Tunnel Storage[2]	A 7.5 mile long tunnel collecting flow from M-47 to O-25 The 030N001 and 032N001 outfalls will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 030N001 – Sewer Separation • 032N001 – Sub-Surface Storage
	MO-6: Tunnel Storage[2]	A 5.0 mile long tunnel collecting flow from M-29 to O-25 and M-47. The Becks Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • M-34 - Surface Storage • 030N001 – Sewer Separation • 032N001 – Sub-Surface Storage

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

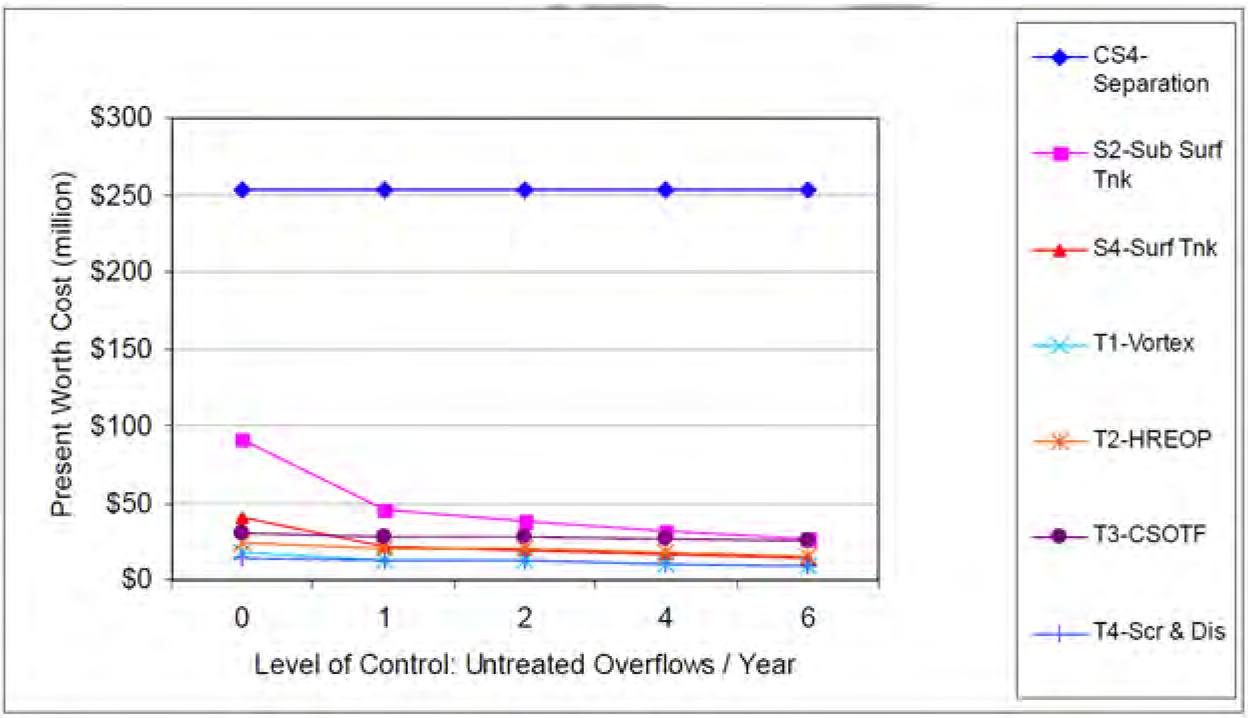
PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

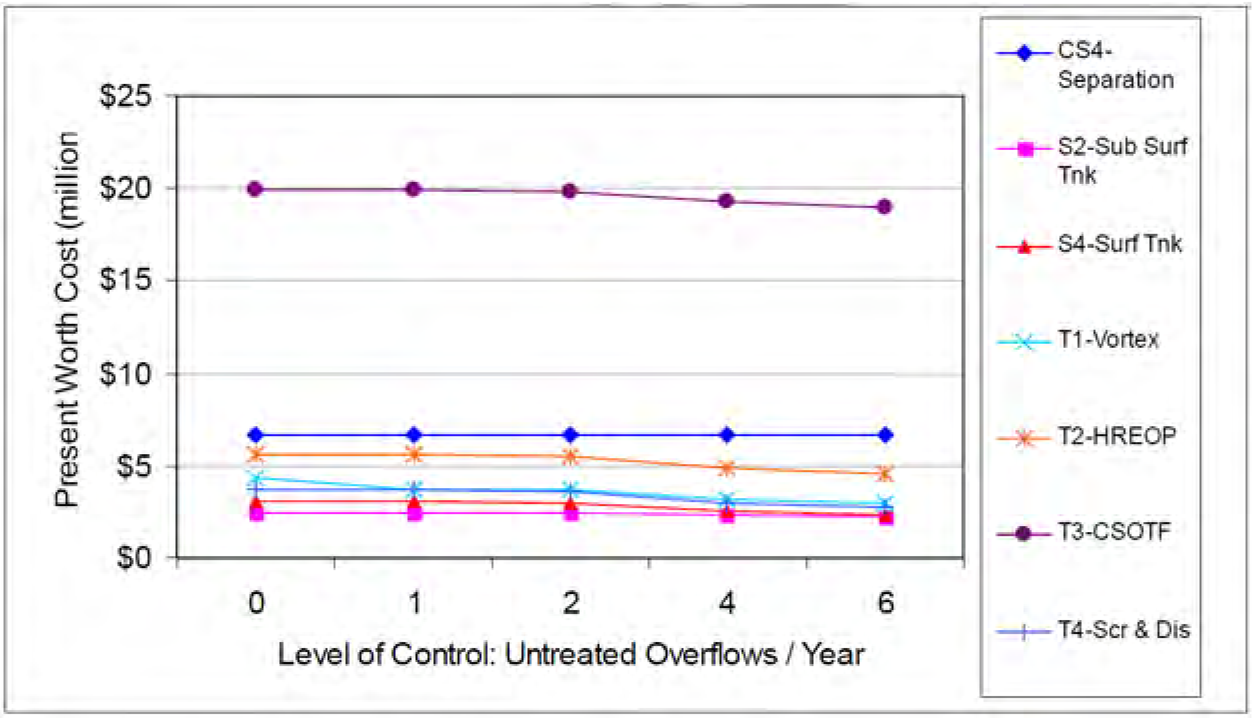
Outfall 031GM34: Cost estimates were produced for outfall-specific control alternatives CS4 031GM34: Sewer separation, S2-031GM34: Sub-Surface Storage, S4-031GM34: Surface Storage, T1-031GM34: Suspended Solids Control, T2-031GM34: High Rate End of Pipe Treatment, T3-031GM34: CSO Treatment Facility, and T4-031GM34: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2 illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2: OUTFALL 031GM34 ALTERNATIVE COSTS



Outfalls 032N001: Cost estimates were produced for outfall-specific control alternatives CS4-032N001: Sewer separation, S2-032N001: Sub-Surface Storage, S4-032N001: Surface Storage, T1-032N001: Suspended Solids Control, T2-032N001: High Rate End of Pipe Treatment, T3-032N001: CSO Treatment Facility, and T4-032N001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-3 illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-3: OUTFALLS 032N001 ALTERNATIVE COSTS



Outfall 130N001: Outfall 130N001 did not activate the typical year, and no control alternatives were required.

Outfall 132P001: Outfall 132P001 did not activate the typical year, and no control alternatives were required.

4.2.2 Regional Control Alternatives

No regional control alternative includes M-34 Becks Run.

4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Monongahela- Ohio sub-system. Table 4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Monongahela- Ohio subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between “complete” sub-system alternatives. It remains PWSA’s assumption that ALCOSAN will assume

responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE 4-3: MONONGAHELA- OHIO SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
MO-1	478.2	4.4	529.3
MO-2	441.4	4.2	489.2
MO-3	420.7	3.9	464.9
MO-4	435.0	4.0	479.8
MO-5	458.5	4.2	505.8
MO-6	438.4	4.2	486.9

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the “highest ranked alternative” for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining “Objective Scores” relative to each evaluation criteria.
- Applying “scaling” and “weighting” factors.
- Determining “Weighted Objective Scores” relative to each evaluation criteria.
- Ranking each alternative based on the sum of its “Weighted Objective Scores”.

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a

score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table 4-4.

TABLE 4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

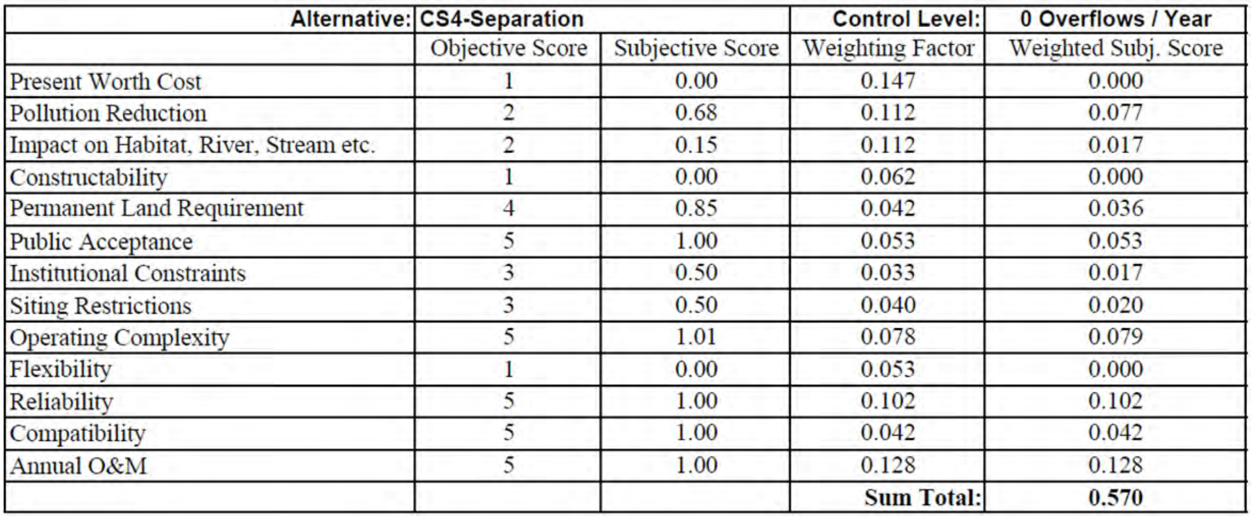
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in Table 4-5.

TABLE 4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 032N001: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in Table 4-6.

TABLE 4-6: WEIGHTED SUBJECTIVE SCORING - CS4 032N001: SEWER SEPARATION



Alternative:	CS4-Separation		Control Level:	0 Overflows / Year
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	1	0.00	0.147	0.000
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.112	0.017
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	3	0.50	0.033	0.017
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.570**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 031GM34: The results of the control alternative evaluation process are shown in Figure 4-4. For control level 0, it is recommended that Alternative T4-031GM34: Screening and Disinfection be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses. For control levels 1 through 6, it is recommended that Alternative S4-031GM34: Surface Storage be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses.

Outfalls 032N001: The results of the control alternative evaluation process are shown in Figure 4-5. For control levels 0 through 6, it is recommended that Alternative S2-032N001: Sub-Surface Storage be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses.

Outfall 030N001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This “no activation” outfall was not considered further in the alternatives analysis process.

Outfall 032P001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This “no activation” outfall was not considered further in the alternatives analysis process.

FIGURE 4-4: ALTERNATIVE SCORING - OUTFALL 031GM34

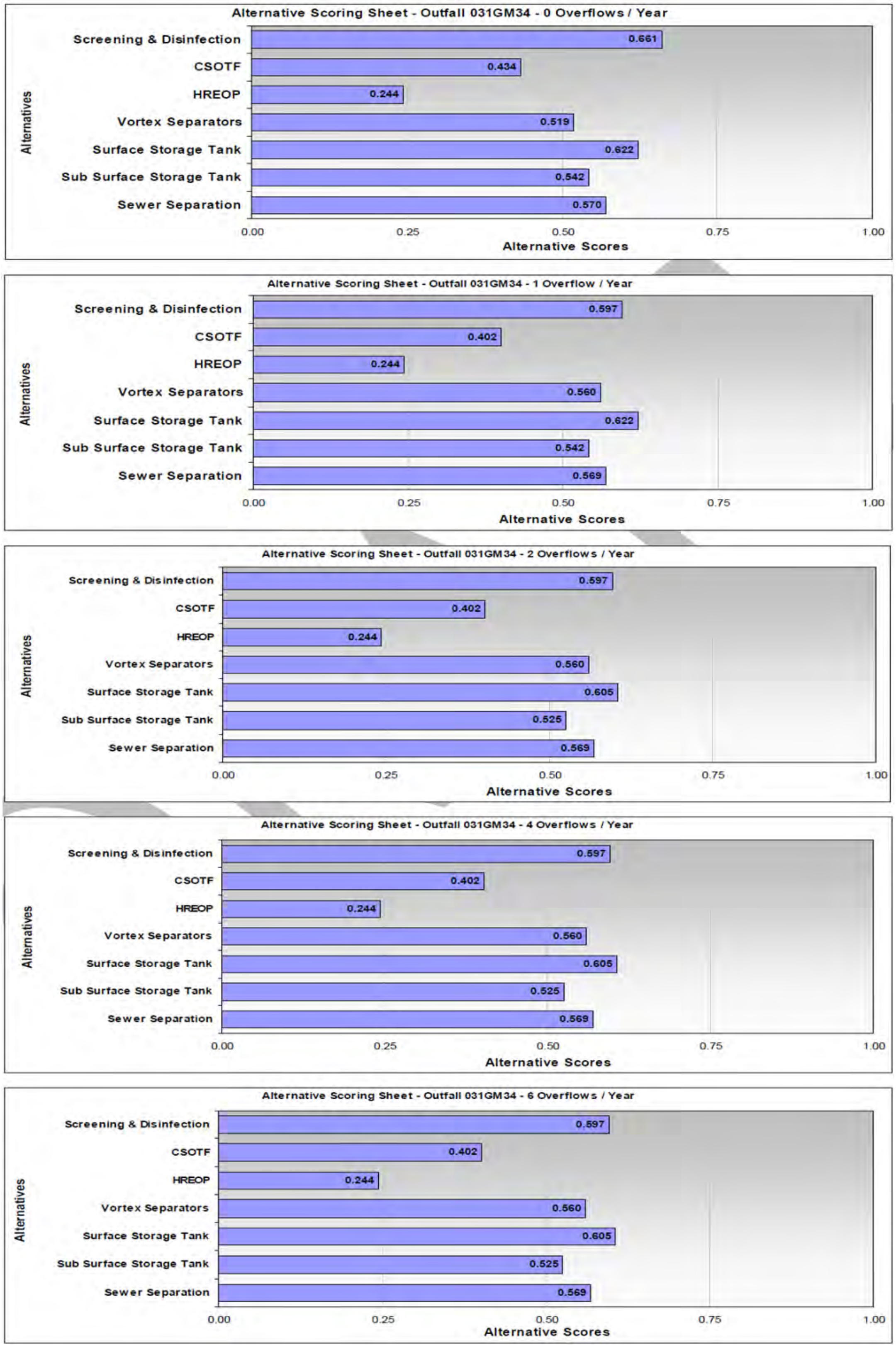
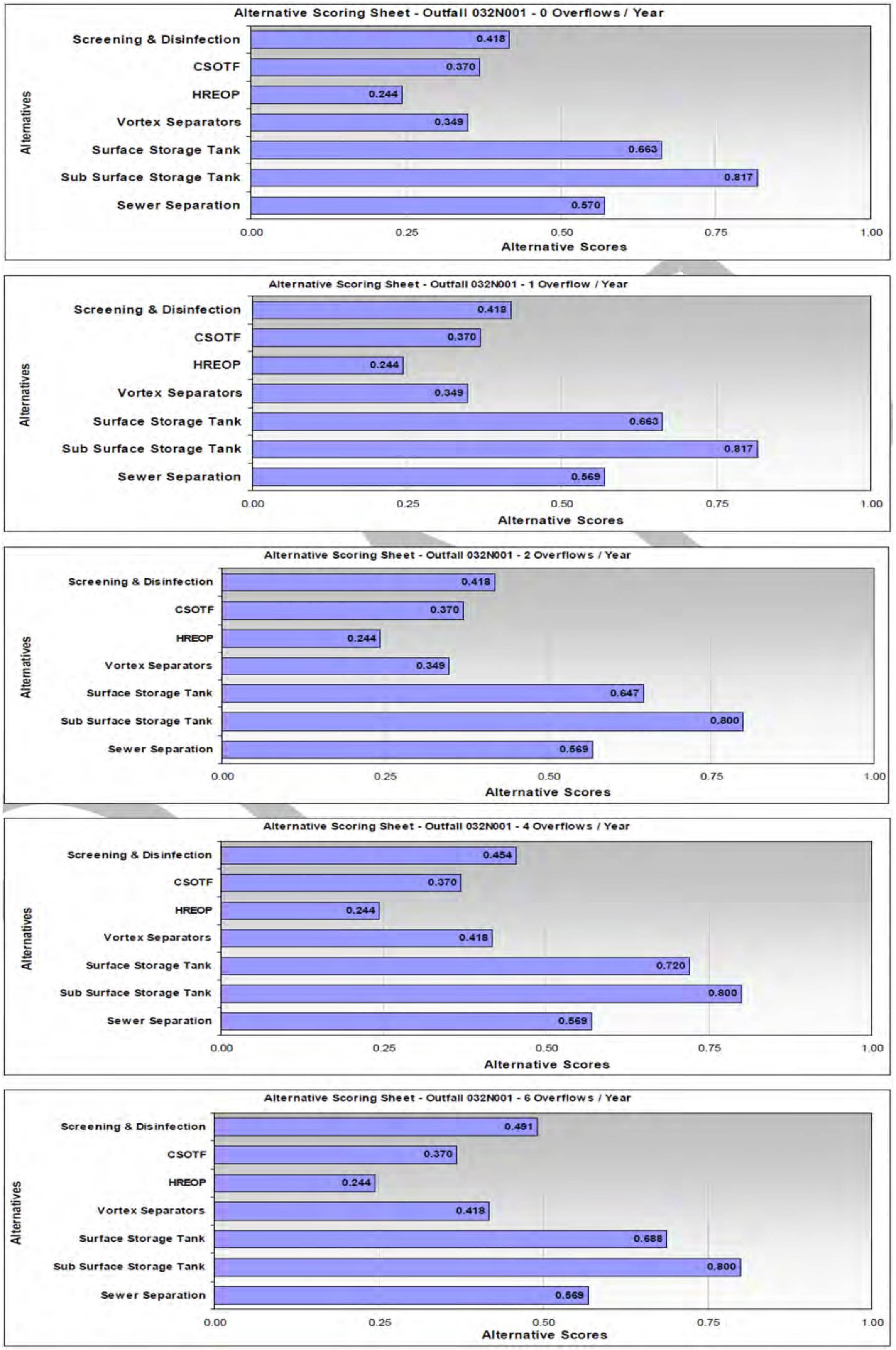


FIGURE 4-5: ALTERNATIVE SCORING - OUTFALLS 032N001



4.4.2 Regional Control Alternatives

No regional control alternative includes M-34 Becks Run.

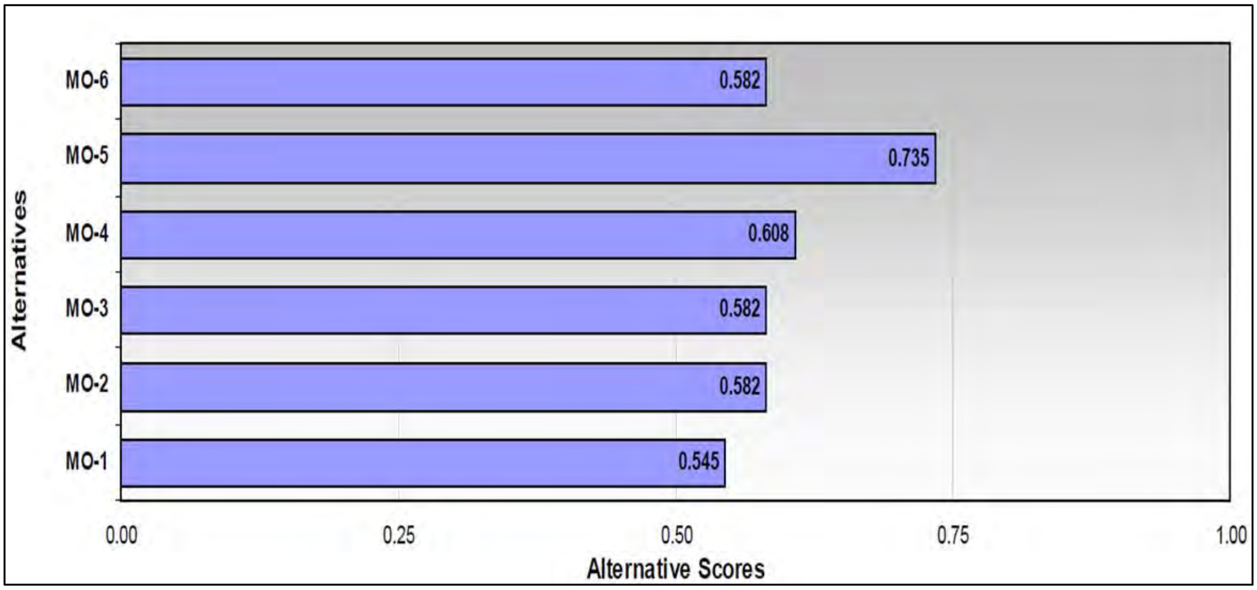
4.4.3 Sub-System Control Alternatives

Monongahela - Ohio. The results of the sub-system control alternative evaluation process are shown below in Figure 4-6. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative MO-5: Tunnel Storage* be carried forward as the Monongahela - Ohio component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative MO-5: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative MO-5* included only those components required to deliver flows to the M-34 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the M-34 POC would become the responsibility of ALCOSAN.

FIGURE 4-6: ALTERNATIVE SCORING – MONONGAHELA OHIO SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Becks Run sewershed would best be accomplished by implementing *Alternative MO-5: Tunnel Storage*. Within the M-34 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the three PWSA permitted CSOs to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the M-34 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative MO-5* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-M34-C-0*, *POC-M34-C-4* and *POC-M34-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **M34 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.

- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the M-34 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results partially validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional wet weather storage to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the M-34 sewershed is four untreated overflows per year. The recommended control alternative for the M-34 Becks Run sewershed has been designated as POC-M34-C-4. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **M34** The M-34 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **4** The selected level of control is four untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of four (4) untreated overflows per year, it is anticipated that any required increases in conveyance capacity will be accomplished by constructing relief sewers, only as necessary, to eliminate hydraulic overloading and avoid sewer surcharging. The components of alternative POC-M34-C-4 are summarized in Table M34-5-1.

TABLE M34-5-1: ALTERNATIVE POC-M34-C-4 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
M-34	DC030N001	030N001	C*	4
	DC030N002	032N001		
	DC032P001	032P001		

*To be achieved via regulator modifications and screening.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, any stream removal projects that may be included, its integration with the ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-M34-C-0 and/or POC-M34-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were partially validated by the results of the analyses undertaken in support of the July, 2012 report. The Draft Feasibility Study initially determined that a method of increasing the level of control of CSO overflows in the Becks Run Sewershed was to provide wet weather storage to control discharges from PWSA diversion chamber DC030N002 and to modify the other two diversion chambers as necessary to achieve the desired level of control. Additional analysis of flows at DC030N002 determined that the interceptor sewer system provides significant capacity to accept additional flows from this chamber as necessary to attain the target control levels without the need for local storage. Therefore, local storage at DC030N002 was eliminated and CSO controls at this location will be achieved by directing increased flows to the interceptor. To accomplish this, the PWSA and/or their tributary municipalities must:

- Modify existing diversion structures to achieve desired level(s) of control.
- Construct additional consolidation/relief piping (as needed) to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

It has been determined that the optimal method of increasing the level of control of CSO overflows in the Becks Run Sewershed is to reduce the number of overflows and convey the additional wastewater to the ALCOSAN point of connection. This would be accomplished by modifying the existing diversion chambers (by replacing DC030N002) to increase peak rate of flow to the conveyance system to the extent necessary to reduce the number of typical year overflows to the desired level. The required modifications to the flow diversion settings are determined by the current typical year overflow statistics. Due to recent demolition work, there are no customers upstream of DC030N001 and DC030N001 has been eliminated. Wastewater not diverted from the system at the remaining diversion chambers will be conveyed to the ALCOSAN point of connection. The upstream municipalities, the Borough of Mt. Oliver and the Borough of Baldwin, do not report that they anticipate any actions to their tributary sewer systems that will affect the projected flow rates.

Table M34-5-2 presents the required changes to each tributary area and CSO diversion chamber that are required to achieve the 0, 4, and 10-overflows per typical year levels of control. As is indicated in Table M34-5-2, some of the diversion structures currently produce fewer than the control level number of overflows during the typical year. In those cases, sewer separation would not be required and changes to the diversion chamber settings would not be made so as not to increase the current frequency of CSO discharges. Those diversion structures requiring modifications (replacement and/or screening) are presented in Figure M34-5-1.

TABLE M34-5-2: POC-M34-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	**Modification Required**	**Maximum Flow Rate (mgd)**		
		0 OF/yr	**4 OF/yr**	**10 OF/yr**
DC030N001	Closed	Closed	Closed	Closed
DC030N002	Diversion structure replacement*	6.0	1.2	0.4
DC032P001	No change*	9.1	No change	No change

*The installation of screening is planned for all PWSA diversion structures.

5.1.2 Consolidation Piping

The H&H model was employed to assess the ability of the existing trunk sewer system to convey the flows that will result from the system modifications. The modeling was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

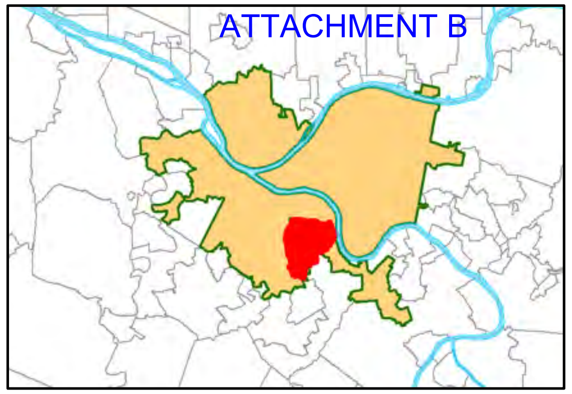
Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer system, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the M-34 POC without significant manhole surcharging and flooding.

It was anticipated that the required increase in conveyance capacity would be achieved by constructing parallel relief sewers as necessary to eliminate hydraulic overloading and avoid sewer surcharging. Note that the upstream municipalities the Borough of Mt. Oliver and the Borough of Baldwin have not reported any plans to modify their systems to reduce their tributary flows.

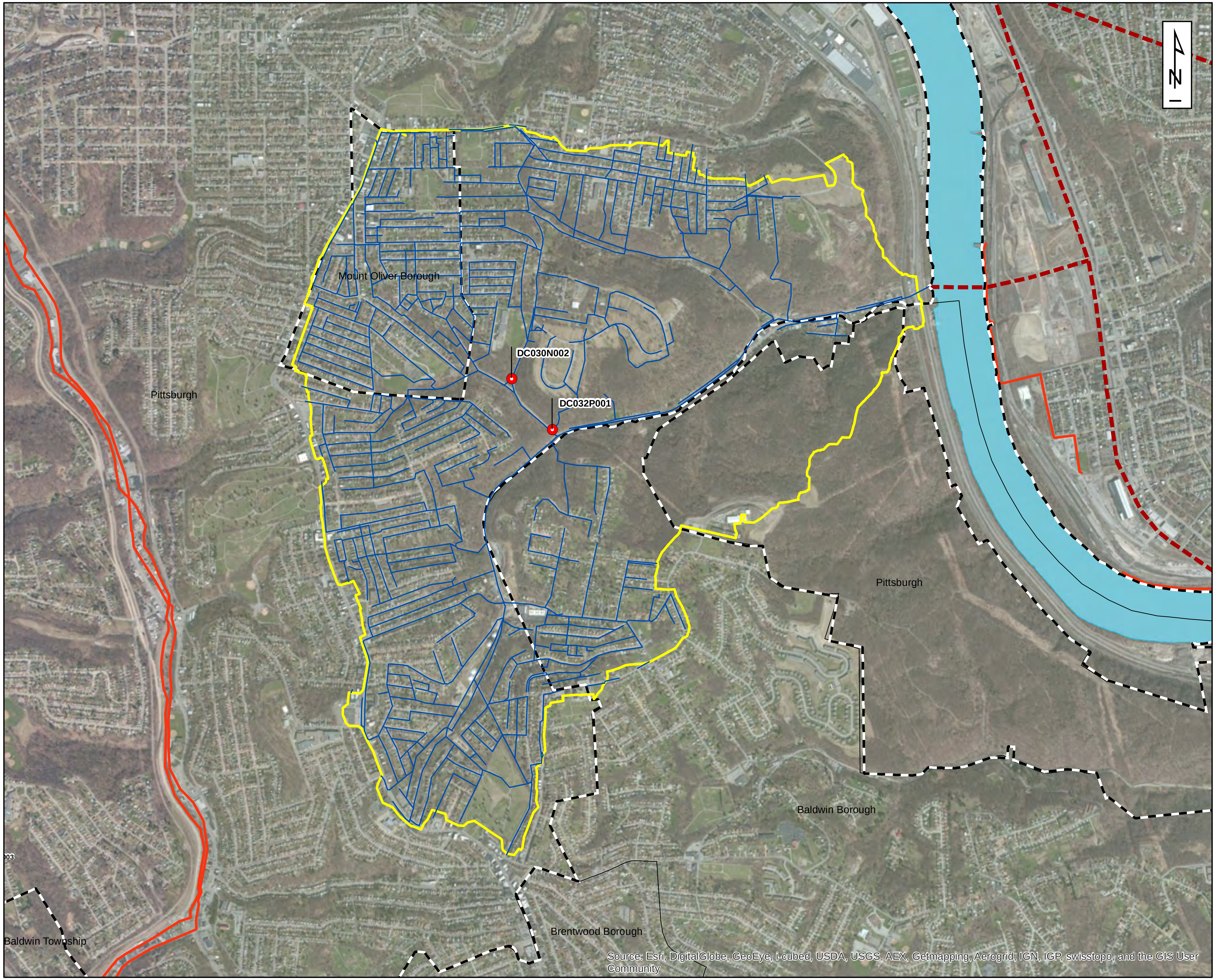
5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA’s diversion structures are provided in Table M34-5-3. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 0.28 MG in the typical year.

ATTACHMENT B



PWSA Service Area Overview



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure M34-5-1: POC-M34-C-4 Diversion Structure Modification

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\BECKS RUN (M-34)\FIGURE 5-1_M_34.mxd

TABLE M34-5-3: M-34 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name					
	POC-M34-C-0		POC-M34-C-4		POC-M34-C-10	
	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)
DC030N001	Closed	0	Closed	0	Closed	0
DC030N002	0	0	3	0.1	8	0.1
DC032P001	0	0	1	0.01	1	0.01
Total Volume		**0**		**0.1**		**0.1**

5.1.4 Anticipated Flow Rates To The ALCOSAN POC

The proposed regulator modifications will result in increased flow rates and volumes to the M-34 POC. Peak flow rates to the M-34 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-M34-C-0, POC-M34-C-4 and POC-M34-C-10 are presented in Figure M34-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the M-34 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table M34-5-4.

FIGURE M34-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE M-34 POC

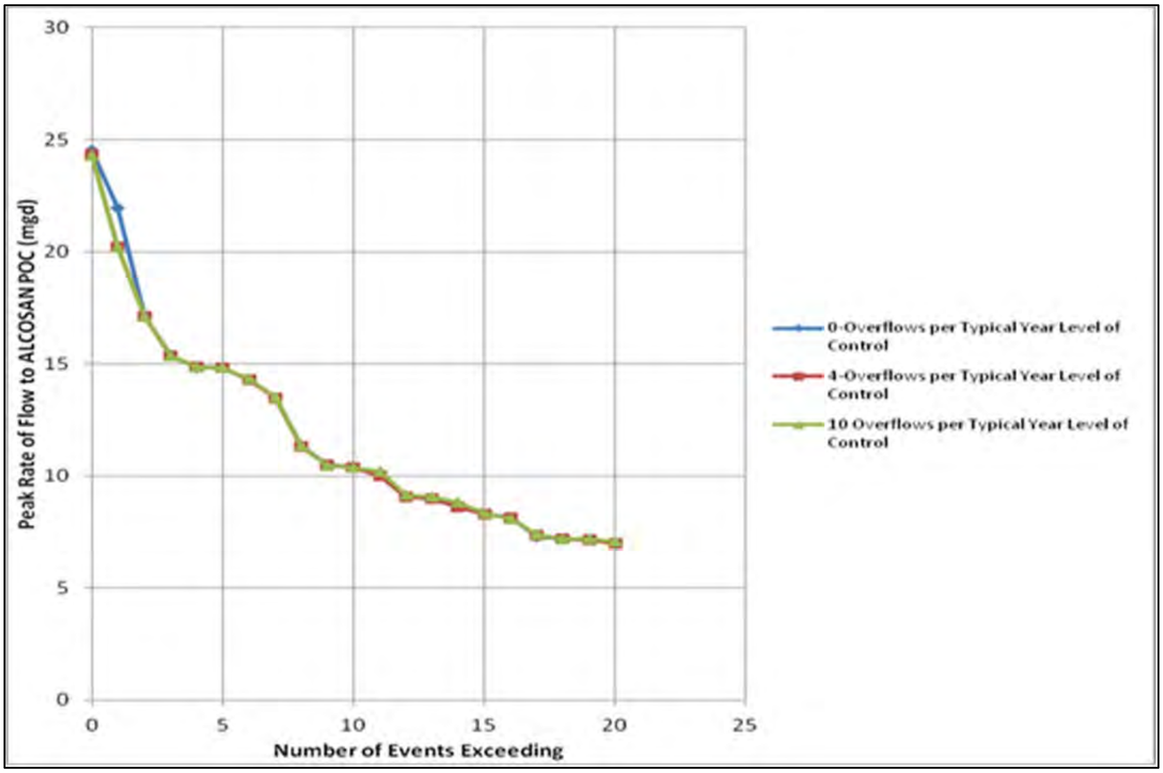


TABLE 5-4: M-34 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-M34-C-0	29.7	35.1	43.2	5.7	6.5	7.4
POC-M34-C-4	29.7	35.1	39.7	5.7	6.5	7.1
POC-M34-C-10	29.7	34.9	39.7	5.7	6.5	7.1

5.1.5 Recommended Control Alternative Integration

For the purpose of submitting this Feasibility Study, the PWSA recognizes that the flows generated by the tributary Baldwin Borough and Mt. Oliver Borough are minor. Specifically, Baldwin Borough does not contribute flow to the diversion structures with proposed modifications and the locations of the improvements are in the City of Pittsburgh. As a result, the PWSA has not approached Baldwin Borough and Mt. Oliver Borough in regards to cost sharing of capital and O&M costs.

However, it is possible that, in the future, the affected municipalities will agree to enter into an Inter-Municipal Agreement to provide for the allocation and payment of capital costs related to each applicable component or components of the recommended alternative.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-M34C-4 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through diversion structure modifications and the construction of parallel relief sewers, as needed, designed to convey flows associated with four overflows per typical year, under 2-year design storm conditions (4 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the M-34 sewershed, both before and after implementation of the recommended alternative:

- Peak flow hydraulic grade line (HGL) of the trunk sewer system
- 2046 peak flows and volumes to the M-34 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

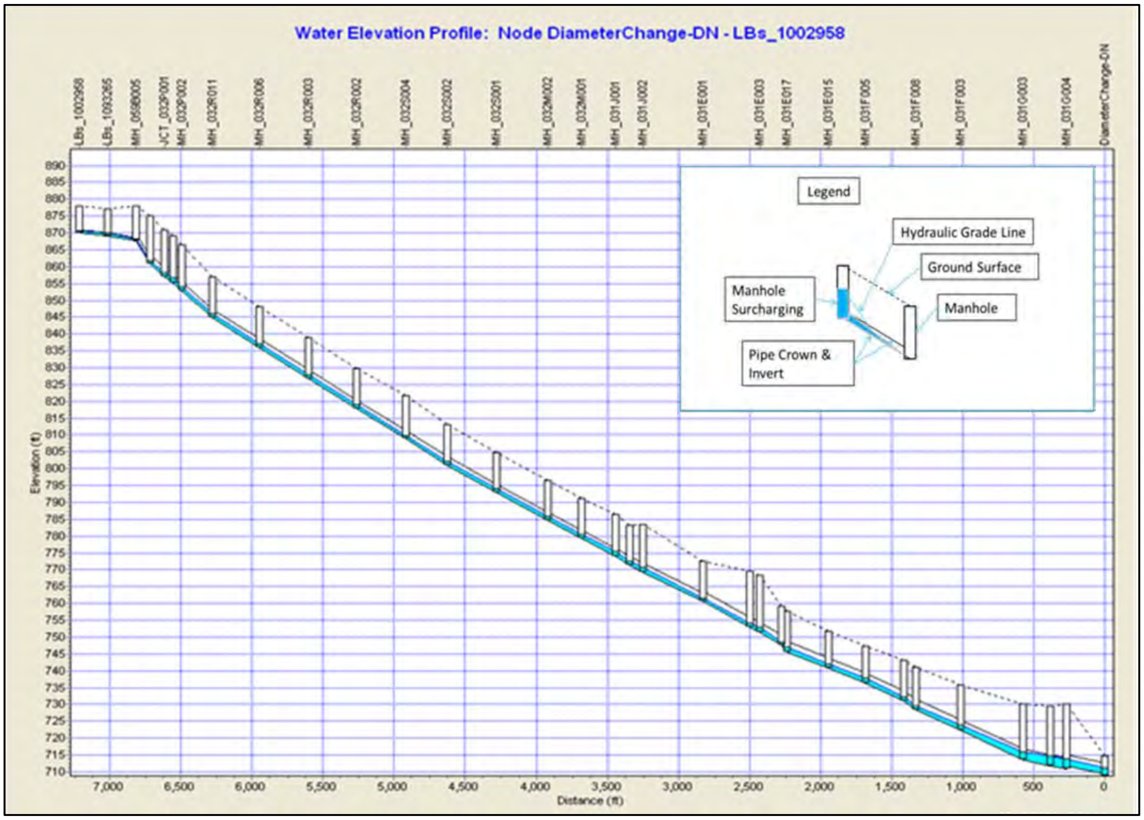
5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events.

Figures illustrating these HGLs were included in the July 2012 report; Figures 3a, 3b, and 3c from that report presented profiles of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. These figures are reproduced below as Figure M34-5-3a, M34-5-3b, and Figure M34-5-3c. Under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging and manhole flooding occurs along the length of the trunk sewer.

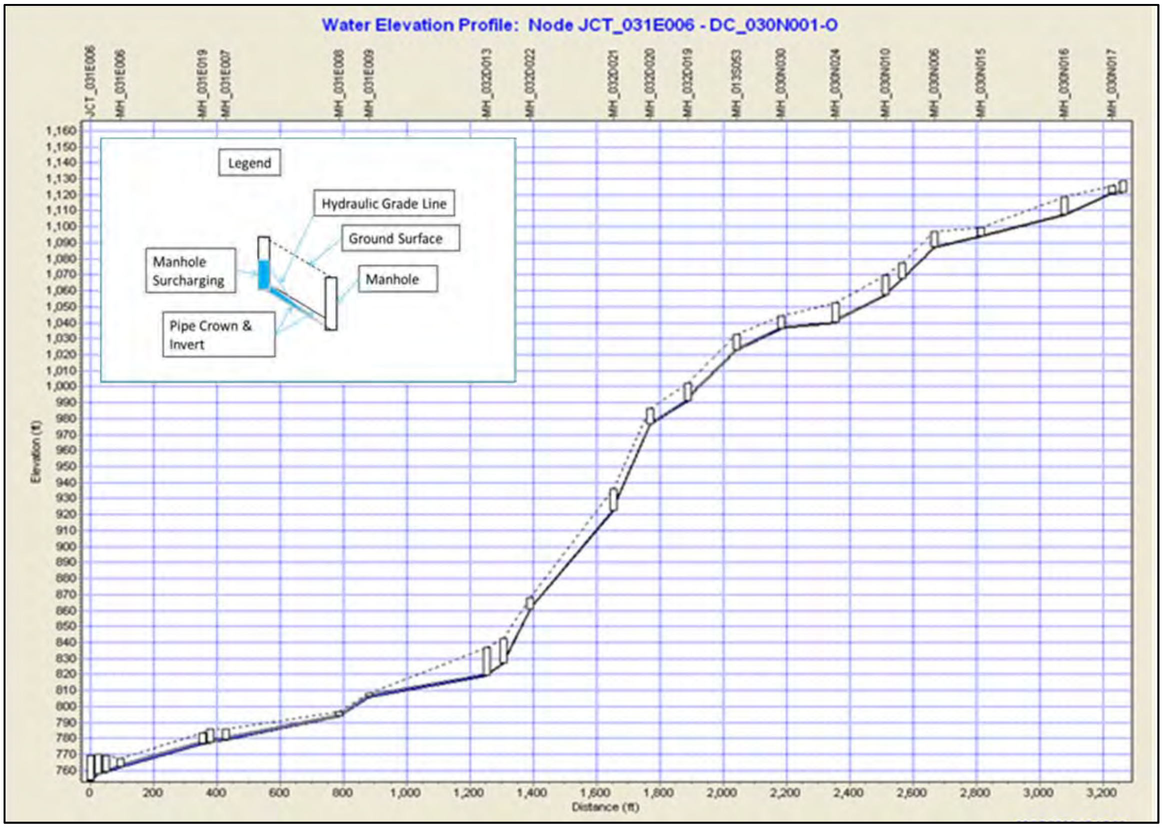
The HGL along the main trunk sewer following implementation of alternative POC-M34-C-4 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with four overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, modification of the diversion structures combined with additional conveyance capacity (4 OF/yr; 2-yr storm) will satisfactorily reduce manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE M34-5-3A: M-34 UPPER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



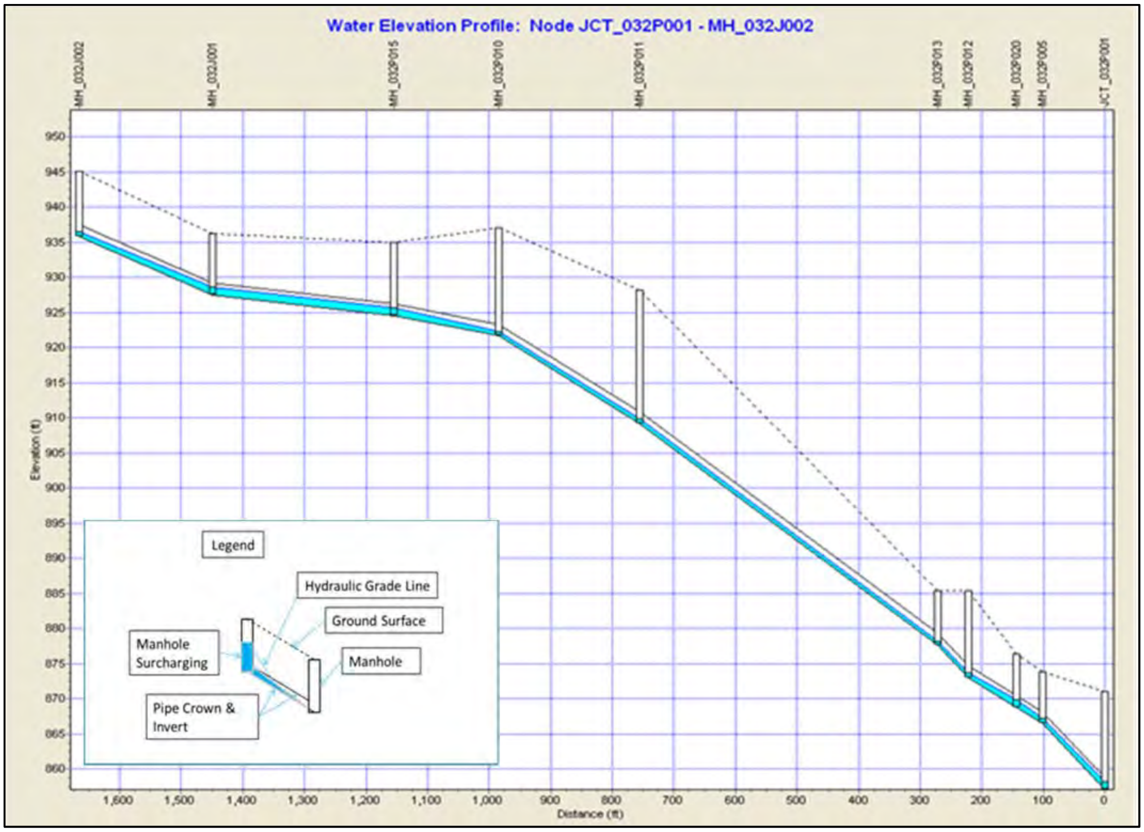
As is indicated in Figure M34-5-3a, the Becks Run interceptor sewer operates acceptably under the current system configuration, including existing CSO diversion chamber settings.

FIGURE M34-5-3B: M-34 LOWER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure M34-5-3b, the Parkwood Road trunk sewer operates acceptably under the current system configuration, including existing CSO diversion chamber settings.

FIGURE M34-5-3C: M-34 WAGNER STREET TRUCK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure M34-5-3c, the Wagner Street trunk sewer operates acceptably under the current system configuration, including existing CSO diversion chamber settings.

5.2.2 2046 Peak Flows and Volumes to M-34 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the

PWSA system. ALCOSAN made similar assumptions[1], and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve four overflows per typical year, as well as additional consolidation/relief piping to convey increased flows to the M-34 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the M-34 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances From ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year.

The control alternatives developed and evaluated by both ALCOSAN and PWSA, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the M-34 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from the Borough of Baldwin and the Borough of Mt. Oliver, indicate that each of them plan to convey all their flows to the M-34 trunk sewer system for the duration of the planning period. They have no plans to implement controls that would alter the modeled flows upon which the recommended alternative was based. This information is summarized in Table M34-5-5.

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

TABLE M34-5-5: M-34 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

Tributary Municipality	Volume*		
	Captured	Treated	Conveyed
Borough of Baldwin	N/A	N/A	All modeled flows
Borough of Mt. Oliver	N/A	N/A	All modeled flows

*Following Implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve four overflows per typical year, as well as increased conveyance piping, as needed, to convey increased flows to the M-34 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of regulator modifications and additional consolidation piping, as needed, designed to control CSOs from the PWSA diversion structures to four overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the M-34 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-M34-C-4 are consolidation/ relief piping (as needed), CSO screening facilities, and diversion structure modifications. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment M34-5-1.

5.4.1 Consolidation Piping

In the M-34 sewershed, additional conveyance capacity was provided through the use of relief sewers (as needed) to convey flows to the M-34 POC. All improvements added to the model were designed to eliminate surcharging.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street
- Other values included in the cost – Trench excavations and backfill, rock excavation, trench wall support, street opening, clearing and grubbing, street restoration, flow maintenance, traffic maintenance

5.4.2 CSO Screening Facilities

It was assumed that each outfall location will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

It was assumed that adjustments to existing regulator settings, including more effective and improved methods of flow control and monitoring, improved access, etc., would be sufficiently extensive as to make it more cost effective to simply replace each structure. The unit cost associated with the installation of each new diversion structure was assumed to be $200,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $360,000.

5.4.4 Knee Of The Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure M34-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible "knee of the curve" is evident from this data.

These costs are also presented in a tabular format in Table M34-5-6.

The selected level of CSO control - 4 OF/yr - was determined based upon the costs anticipated and the expectation of meeting water quality standards. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most municipalities in the region.

The capital improvements to be included in alternative POC-M34-C-4 are summarized in Table M34-5-7. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE M34-5-4: M-34 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

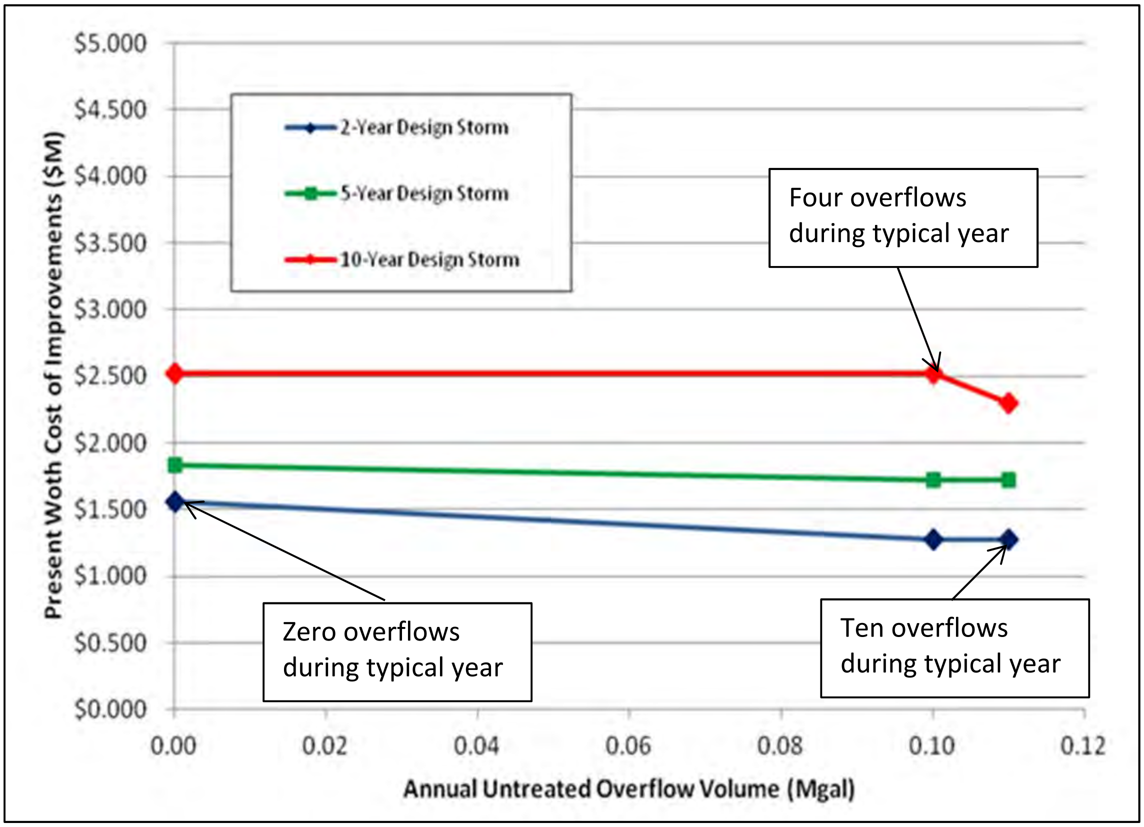


TABLE M34-5-6: M-34 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control				
	Untreated CSO Volume (MG)	CSO Control Level (OF/yr)	PW Capital Cost ($MM)	PW O&M Cost* ($MM)	TPW CSO Control ($MM)
POC-M34-C-0	0	0	$1.5	$0.02	$1.5
POC-M34-C-4	0.1	4	$1.3	$0.02	$1.3
POC-M34-C-10	0.1	10	$1.3	$0.02	$1.3
Alternative Name	SSO Control				
	Untreated SSO Volume (MG)	SSO Control Level	PW Capital Cost ($MM)	PW O&M Cost ($MM)	TPW SSO Control ($MM)
POC-M34-C-0	0	2-year	$0	$0	$0
POC-M34-C-4	0	2-year	$0	$0	$0
POC-M34-C-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE M34-5-7: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-M34-C-4

Capital Improvements	Size/ Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Close diversion structure: DC030N001	N/A	$0	$0	$0
Replace diversion structure: DC030N002	4 OF/yr Each	$0.36	$0.36	$0.36
Add screening to diversion structures: DC030N002 DC032P001	0.2 to 1.2 mgd overflow rates	$0.90	$0.90	$0.91

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA and their tributary municipalities have agreed that the basis of allocation for future operation and maintenance costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the M-34 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all planned the tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new

wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC M-34 overflow is not intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the “Selected Plan” to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the “Recommended Plan”. This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the “Selected Plan” is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

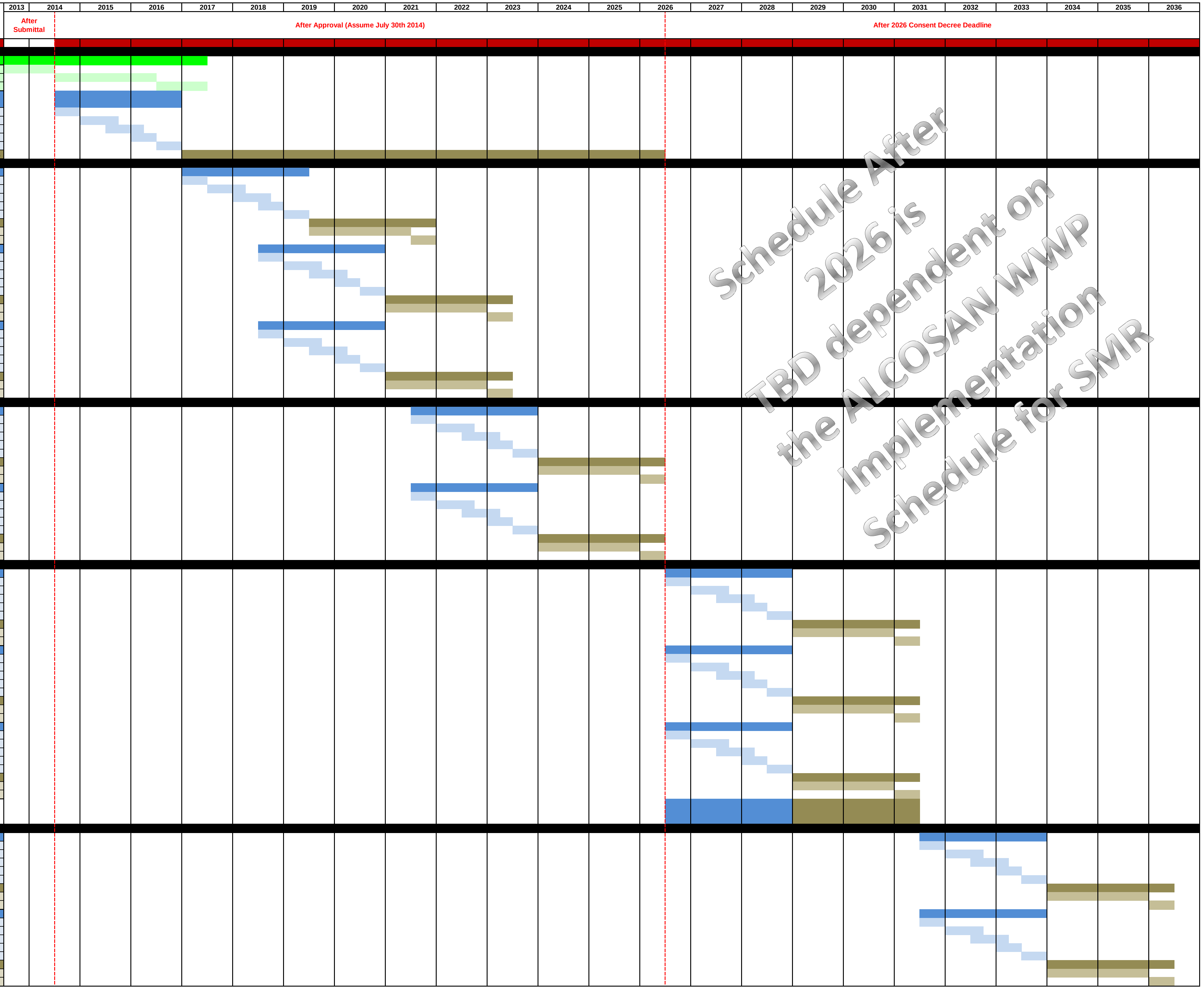
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it’s important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements be up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the Monongahela River tunnel segment, extending toward M-34, of regional plan is being implemented by 2026. Per PWSA's implementation schedule, M-34 is included in Phase 1 (mid 2014 to 2026) since the entire recommended alternative encompasses diversion structure modifications and outfall screen installation and Phase 1 includes all of the diversion structure modifications and outfall screen installations in the entire PWSA improvement program. This is intended to balance the distribution of costs and resources throughout the duration of the implementation schedule as much as practical.

ATTACHMENT B

FIGURE M34-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the M-34 sewershed. At this point, there are no multi-municipal improvements being proposed for this sewershed. Therefore, Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Baldwin Borough, Mt. Oliver Borough, and the Pittsburgh Water and Sewer Authority are not being considered. Other considerations regarding the M-34 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the "2-year design storm" for the municipal separate sanitary system portions and "4 OF/ typical year" for the PWSA's combined system outside of Saw Mill Run where "0 OF/ typical year" is proposed.

At this point, since there are no multi-municipal improvements being proposed for the M-34 POC sewershed, Cost allocation is not required. It is understood that PWSA shall assume the financial responsibility for the proposed improvements.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

At this point, since there are no multi-municipal improvements being proposed for the M-34 POC sewershed, Cost allocation is not required and therefore MOU and Inter-Municipal Agreements is not required. It is understood that PWSA shall assume the financial responsibility for the proposed improvements for the M-34 sewershed.

If the proposed improvements change into multi-municipal improvements a DRAFT Memorandum of Understanding (MOU) by and between Baldwin Borough, Mt. Oliver Borough, and The Pittsburgh Water and Sewer Authority, would be used in developing cost allocation procedures and move towards arriving at inter-municipal agreements. The MOU development would be guided by and be based on the following set of principles:

- The major goal is to develop a fair and equitable cost allocation process.
- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.
- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.
- Cost allocations should be simple and easy to calculate in the future.
- The final cost allocation methodology should encourage efficiencies between municipalities.
- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.
- Unless agreed to by all parties, existing contracts should not form the only basis for cost allocations.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended M-34 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after M-34 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

- Phase I 2013 through 2017
- Phase II 2017 through 2023

- Phase III 2021 through 2026
- Phase IV TBD
- Phase V TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure M34-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the M-34 shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

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[1] Text is derived from "A Guide for Preparing Act 537 Update Revisions, 2003".

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

6.3.2 Joint Municipal Planning and Implementation

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. As previously stated in Section 6.2, a draft MOU is not required. If the recommended improvements were to change to become multi-municipal improvements and a draft MOU was required, then it would contain provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

At this time, there are no known flow management strategy conflicts / concerns or institutional / administrative obstacles that could delay or impede the signing of the MOU.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$1,260,000.
- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance
- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table M34-6-1. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE M34-6-1: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638
Mt. Oliver Borough	$687	$1,580	Not Available
Baldwin Borough	Not Available	Not Available	Not Available

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure M34-6-1.

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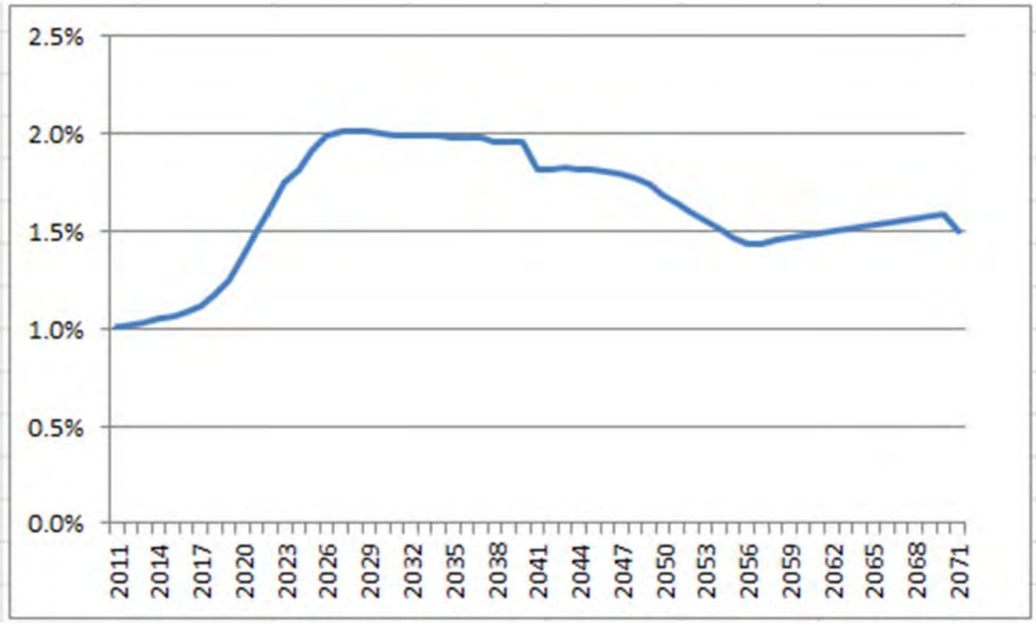
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

FIGURE M34-6-1 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.

7.0 STAKEHOLDER INVOLVEMENT

Stakeholder meetings titled POC Sewershed Coordination Meetings, facilitated by 3RWW, were held during the site and technology selection and alternative development processes. These meetings facilitated cooperation, information exchange and consensus building between the PWSA, its stakeholders and tributary municipalities essential to the development of the PWSA Feasibility Study Report and supporting POC-based feasibility studies. For the meetings listed in Table 7-1, POC M-34 was the focus of the discussion and representatives from municipalities' tributary to the Becks Run sewershed were in attendance. Meeting topics included source reduction and green infrastructure, alternatives analysis, affordability and implementation schedule, and cost allocation. Other stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

The Wet Weather Feasibility Study Coordination Meeting, led by the PWSA, facilitated stakeholder participation between the PWSA and Baldwin Borough and Mt. Oliver Borough communities tributary to the Becks Run watershed. The purpose of this meeting was to coordinate the development of planning information specific to the multi-municipal sewershed, reach a consensus agreement on the recommended improvements and receive authorization to submit the results.

TABLE 7-1: BECKS RUN M-34 POC MEETINGS

Title/Purpose	Date	Time	Location
WW Feasibility Study Coordination	3/20/12	1:30 PM	PWSA Office
POC Sewershed Coordination	2/27/13	1:00 PM	PWSA Office
POC Sewershed Coordination	3/19/13	1:00 PM	Green Tree Municipal Building

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
C-25: BELLS RUN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh, Crafton Borough, and Green Tree Borough. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.
- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.
- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.
- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

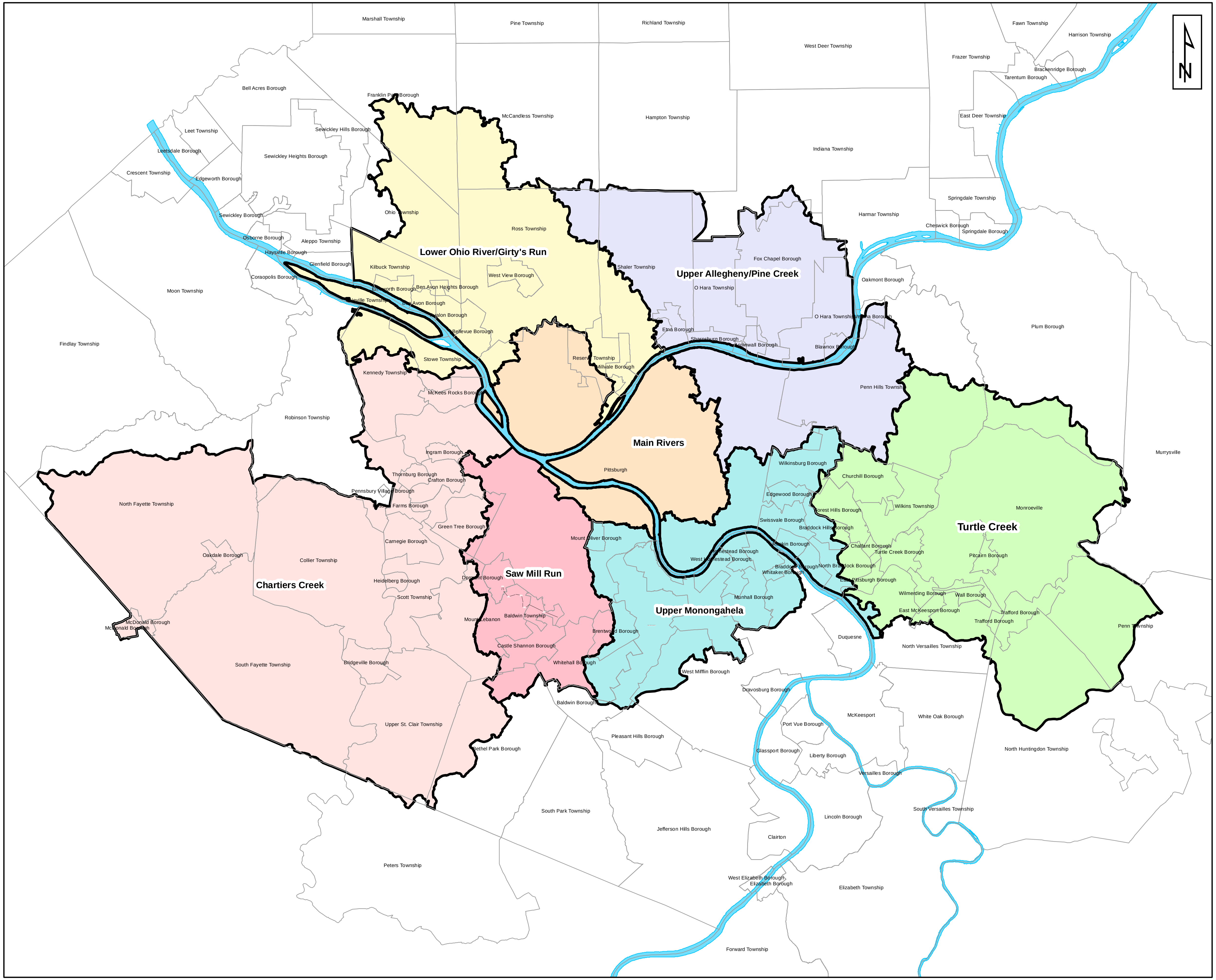
- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.
- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.
- Section 7.0 describes how stakeholders were included in the plan development.

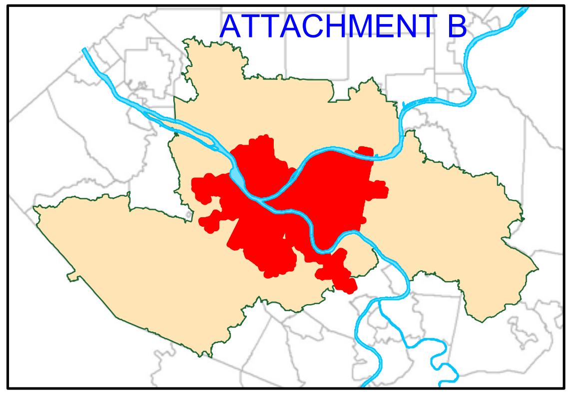
1.2 EXISTING SYSTEM DESCRIPTION

This POC FS Report addresses POC C-25, also known as Bells Run. The C-25 sewershed is located in the Chartiers Creek Planning Basin. The Chartiers Creek basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: C-25 Bells Run Existing Facilities Map*. The C-25 sewershed is served by one main trunk sewer that varies in size from 15 inches to 42 inches in diameter and is comprised mainly of reinforced concrete and vitrified clay pipe. The trunk sewer extends from ALCOSAN diversion chamber C-25 near Chartiers Creek in a northeasterly direction along Bell Road, Chartiers Avenue, Steen Street and Noblestown Road toward the intersection of Brett Street and Keever Avenue in the City of Pittsburgh.

There are nine PWSA CSO diversion chambers in the sewershed that overflow to Bells Run and Chartiers Creek at six permitted CSOs. The C-25 sewershed encompasses approximately 726 acres. The sewershed is made up of 447 acres of the City of Pittsburgh, 20 acres of Crafton Borough, and 260 acres of Green Tree Borough. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to C-25* for specific information on this POC.





ALCOSAN Service Area Overview

Legend

- ☐ Municipal Boundary
- 🟥 Chartiers Creek
- 🟨 Lower Ohio River / Girty's Run
- 🟧 Main Rivers
- 🟥 Saw Mill Run
- 🟩 Turtle Creek
- 🟪 Upper Allegheny / Pine Creek
- 🟦 Upper Monongahela
- 🟦 River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

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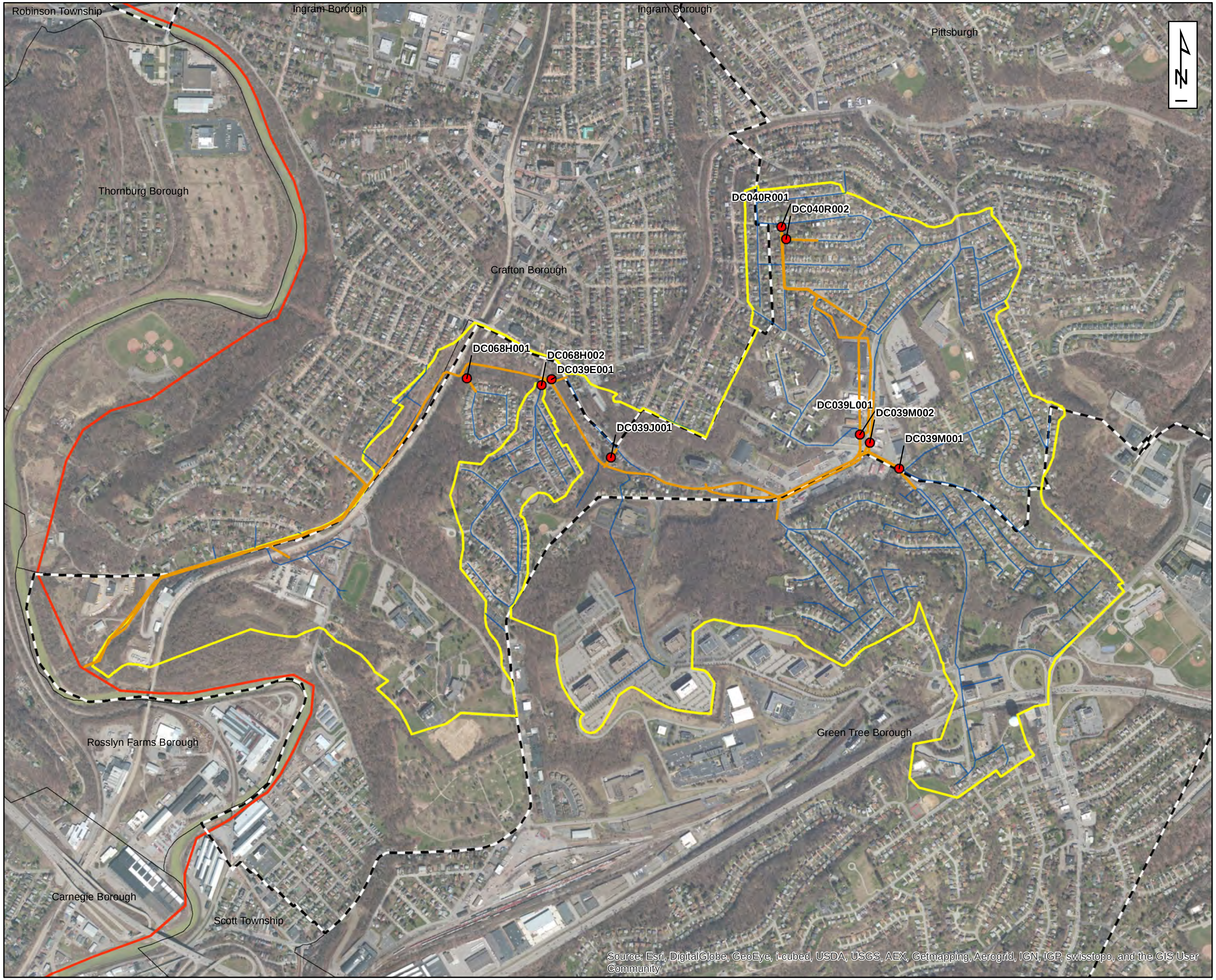
Quality Water Quality Service

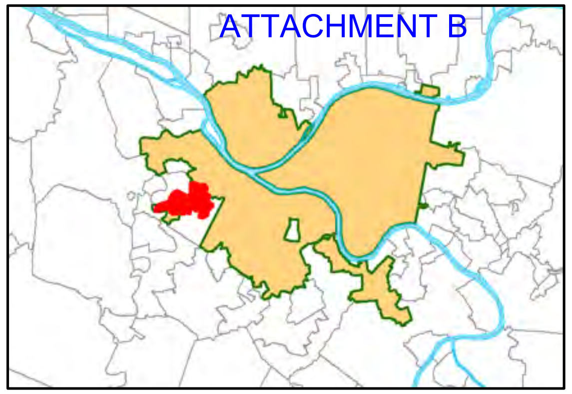
July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

- ● PWSA CSO Diversion Structure
- ━ Trunk Sewer
- ━ Collector Sewer
- 🟨 C-25 Sewershed Boundary
- ╍ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ╍ Deep Tunnel
- ━ Shallow Cut

1,000 500 0 1,000 Feet

Figure 1 - 2: C-25 Bells Run Existing Facilities

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Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\BELLS RUN (C-25)\FIGURE 1-2_C-25Existing Overflows.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR MUNICIPALITIES TRIBUTARY TO C-25

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY		
	City of Pittsburgh	Crafton Borough[1]	Green Tree Borough
Tributary Area (Acres)	447	19.96	260
Population	1,772	171	931
Combined			
Inch-Miles	160	5.80	8
Linear Feet	48,200	3,418	2,500
Inch-Miles/Acre	0.35	0.29	0.03
Separate			
Inch-Miles	16	0	44
Linear Feet	5,900	0	28,800
Inch-Miles/Acre	0.04	0	0.17

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows that are not released to the environment by the upstream PWSA diversion structures are regulated by the C-25 ALCOSAN CSO diversion structure located along Angora Road.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to C-25*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

---

[1] Data provided by Crafton Borough per municipal RFI.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO C-25

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
039E001	DC039E001	CSO039E001	Oakwood Road	Bells Run
039J001	DC039J001	CSO039J001	Steen Street	Bells Run
039K001	DC039L001 DC039M001 DC039M002 DC040R001 DC040R002	CSO039K001	Baldwick Road	Bells Run
068H001	DC068H001	CSO068H001	Balver Avenue	Bells Run
068H002	DC068H002	CSO068H002	Oakwood Road	Bells Run
104HC25	ADC104HC25	ACSO104HC25	Angora Road	Chartiers Creek

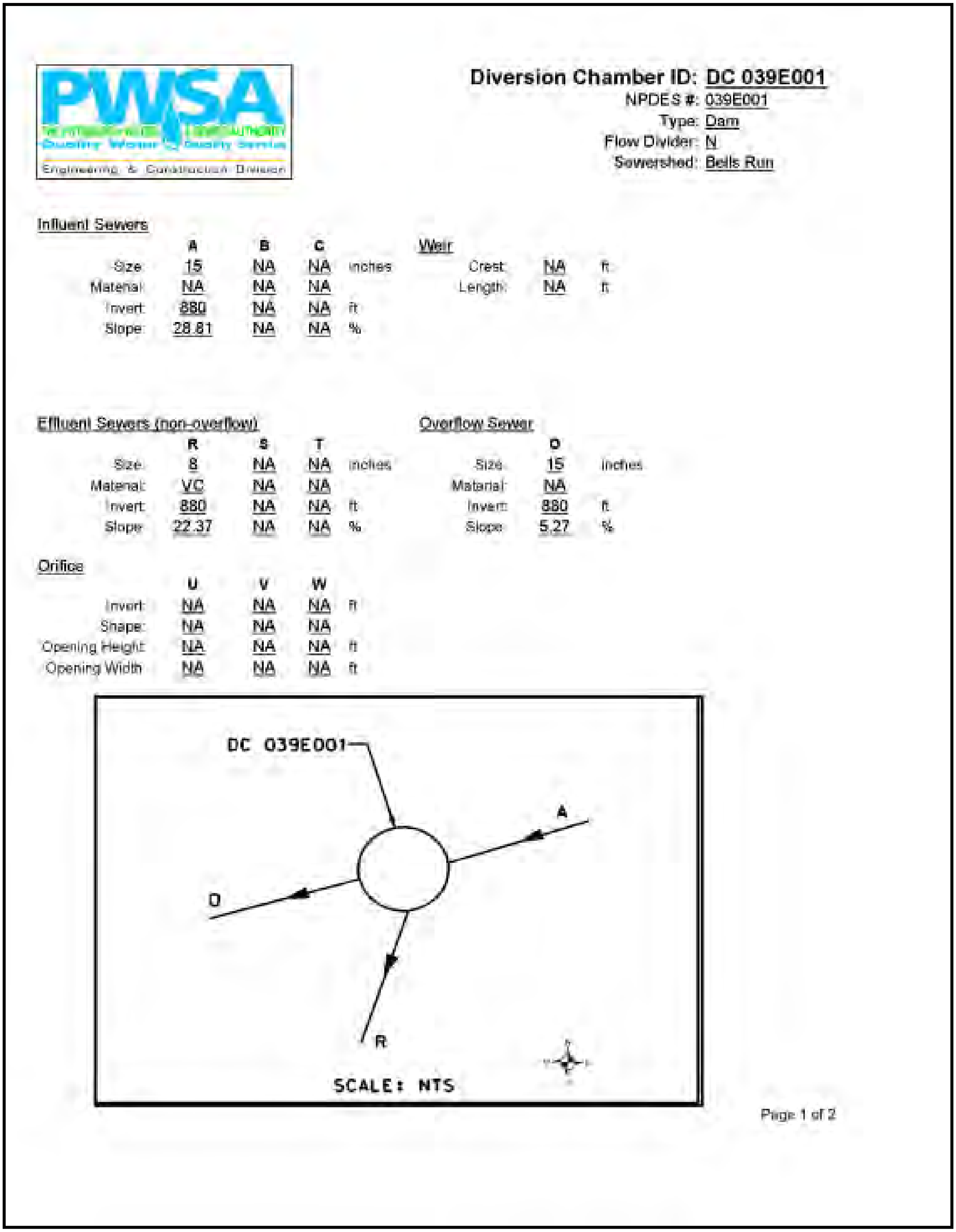
As shown in *Table 1-3: C-25 Sewershed Typical Year Overflow Statistics*, during the typical year these nine structures overflow between one and 72 times. Overflow volumes range from 10,000 gallons to 1.7 million gallons per event, and from 10,000 gallons to 17.5 million gallons annually, on a structure by structure basis. Annual overflow flow volume for this sewershed is 26.08 million gallons.

TABLE 1-3: C-25 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC039E001	1	4.3	N/A	N/A	0.05	N/A	N/A	0.05
DC039J001	4	7.7	N/A	N/A	0.09	N/A	N/A	0.133
DC039L001	2	6.3	N/A	N/A	0.16	N/A	N/A	0.20
DC039M001	72	69.3	33.3	15.9	1.65	1.00	0.70	17.46
DC039M002	50	9.1	6.4	2.7	0.29	0.22	0.21	2.35
DC040R001	5	2.5	0.04	N/A	0.03	0.001	N/A	0.06
DC040R002	2	0.8	N/A	N/A	0.01	N/A	N/A	0.01
DC068H001	33	15.4	1.9	0.6	0.19	0.04	0.01	0.68
DC068H002	67	60.9	7.5	2.7	0.78	0.23	0.14	5.14
Total Annual Volume								**26.08**

1.2.1 Diversion Structure Sketches

The following sketches of the C-25 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.



PWSA
The Pittsburgh Water & Sewer Authority
Quality Water & Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 039E001
NPDES #: 039E001
Type: Dam
Flow Divider: N
Sewershed: Bells Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	NA	NA	NA	
Invert:	880	NA	NA	ft
Slope:	28.81	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	VC	NA	NA	
Invert:	880	NA	NA	ft
Slope:	22.37	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	NA	
Invert:	880	ft
Slope:	5.27	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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PWSA
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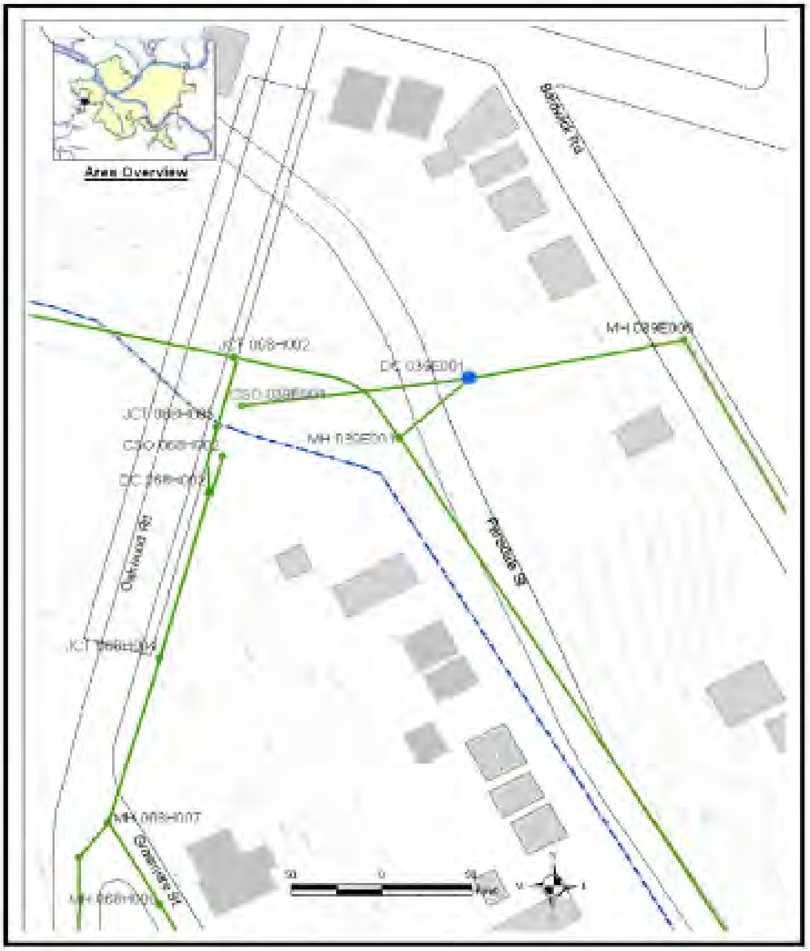
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 039E001



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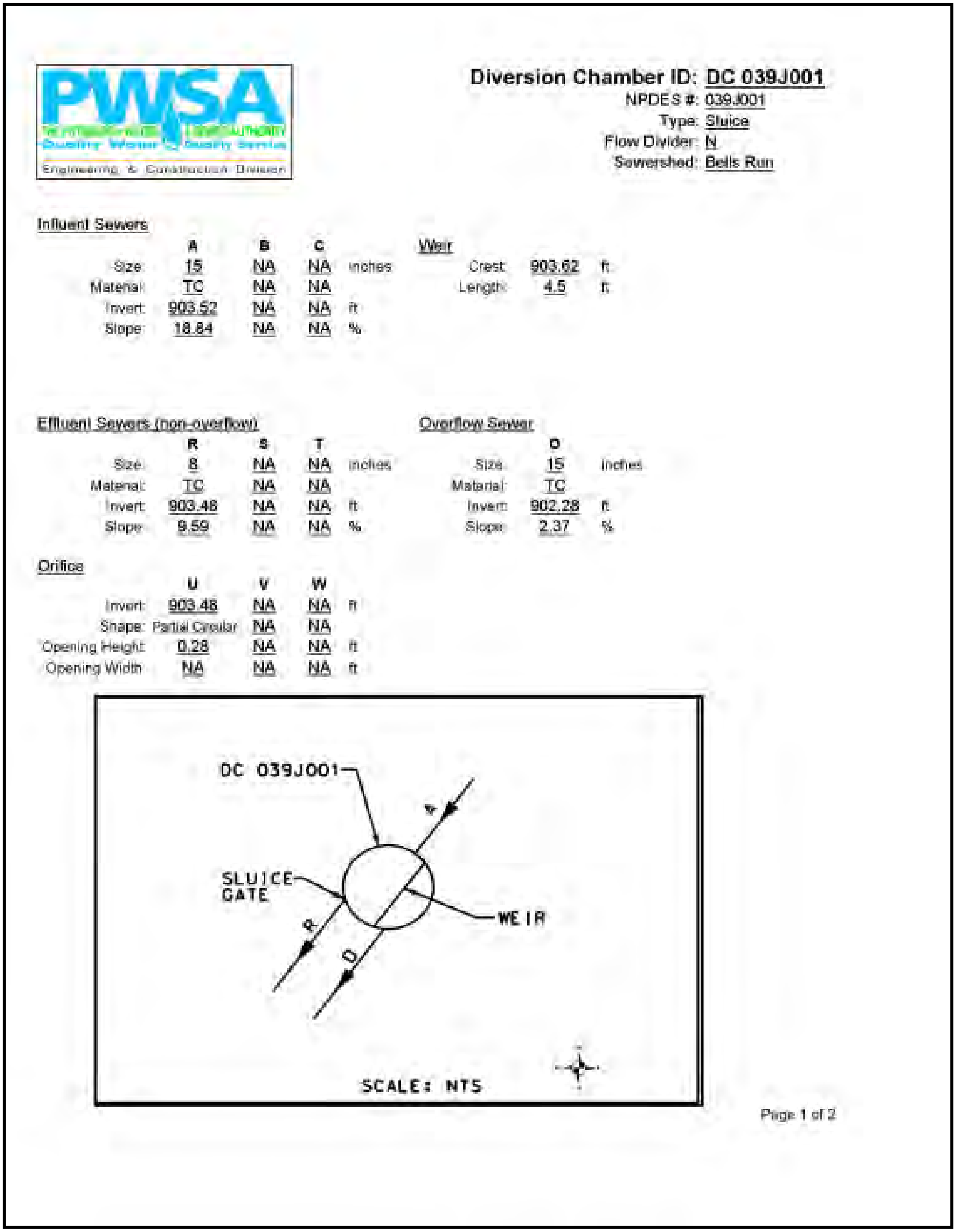

PWSA
The Pittsburgh Water and Sewer Authority
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 039J001
NPDES #: 039J001
Type: Sluice
Flow Divider: N
Sewershed: Bells Run

Influent Sewers

	A	B	C	
Size	15	NA	NA	inches
Material	TC	NA	NA	
Invert	903.52	NA	NA	ft
Slope	18.84	NA	NA	%

Weir

Crest	903.62	ft
Length	4.5	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	TC	NA	NA	
Invert	903.48	NA	NA	ft
Slope	9.59	NA	NA	%

Overflow Sewer

	O	
Size	15	inches
Material	TC	
Invert	902.28	ft
Slope	2.37	%

Orifice

	U	V	W	
Invert	903.48	NA	NA	ft
Shape	Partial Circular	NA	NA	
Opening Height	0.28	NA	NA	ft
Opening Width	NA	NA	NA	ft

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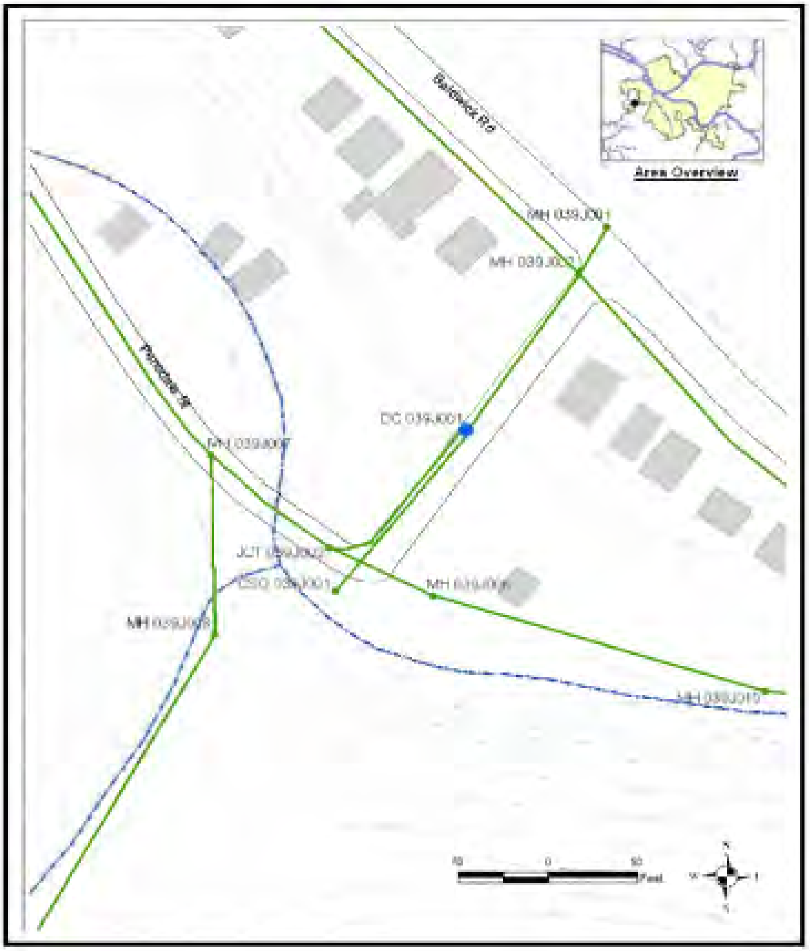
PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 039J001



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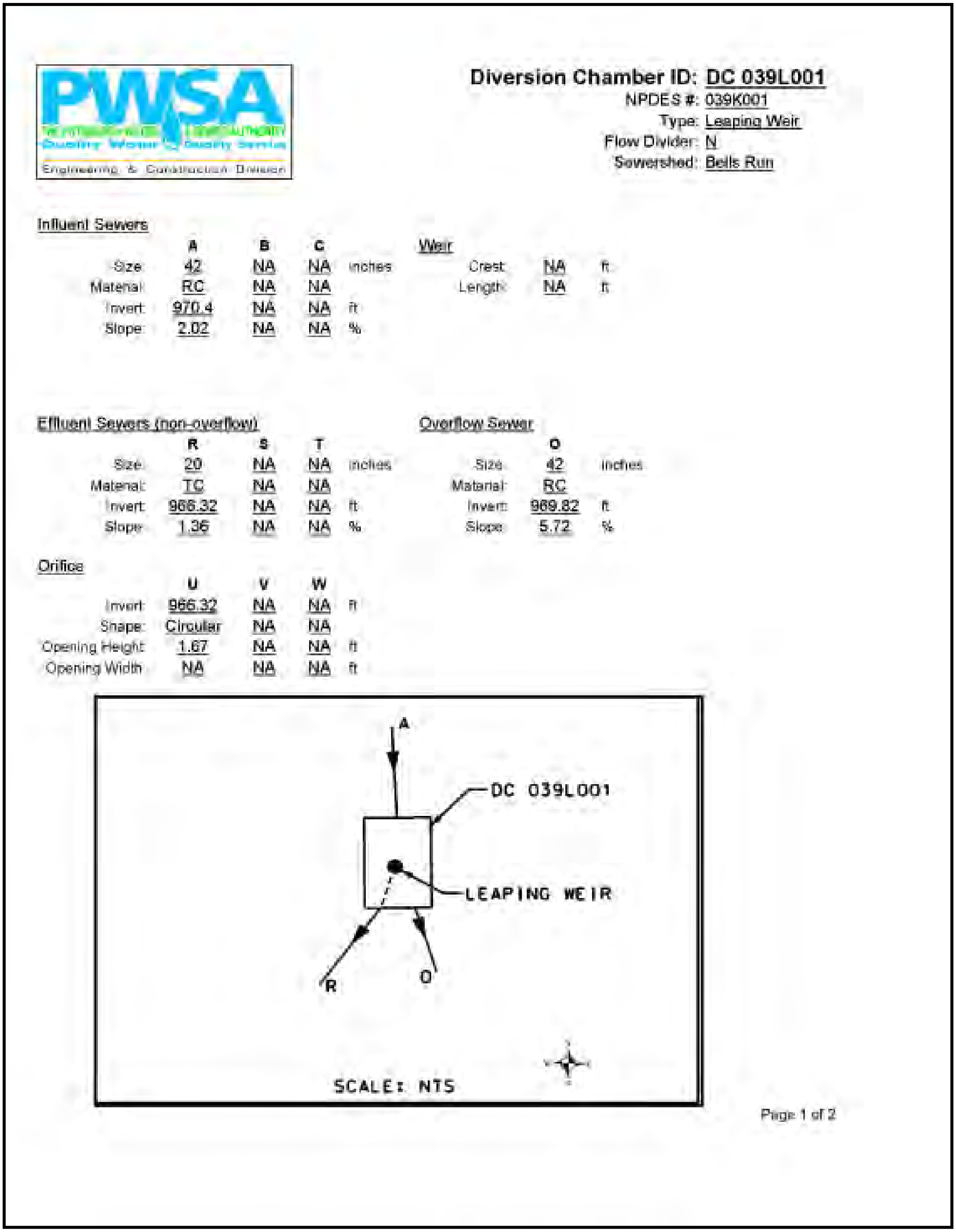

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 039L001
NPDES #: 039K001
Type: Leaping Weir
Flow Divider: N
Sewershed: Bells Run

Influent Sewers

	A	B	C	
Size:	42	NA	NA	inches
Material:	RC	NA	NA	
Invert:	970.4	NA	NA	ft
Slope:	2.02	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	20	NA	NA	inches
Material:	TC	NA	NA	
Invert:	966.32	NA	NA	ft
Slope:	1.36	NA	NA	%

Overflow Sewer

	O	
Size:	42	inches
Material:	RC	
Invert:	969.82	ft
Slope:	5.72	%

Orifice

	U	V	W	
Invert:	966.32	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	1.67	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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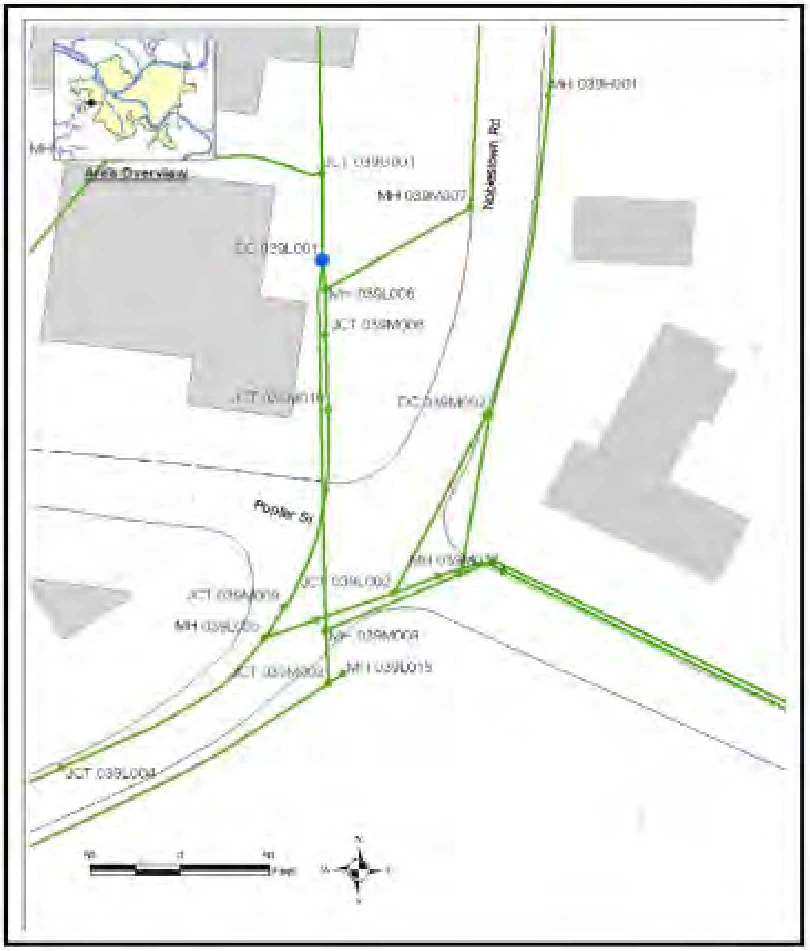
PWSA THE PITTSBURGH WATER & SEWER AUTHORITY Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 039L001



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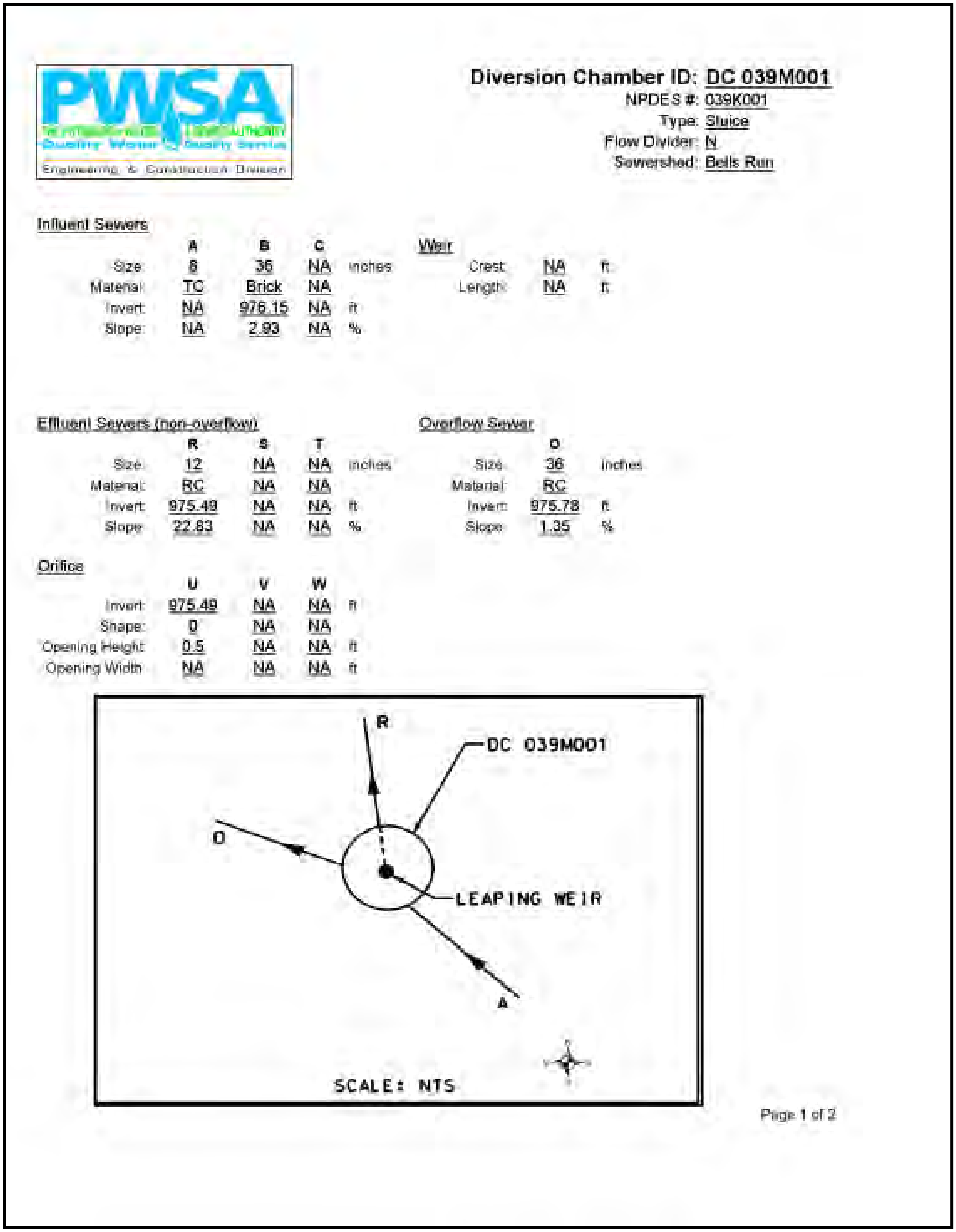

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 039M001
NPDES #: 039K001
Type: Sluice
Flow Divider: N
Sewershed: Bells Run

Influent Sewers

	A	B	C	
Size:	8	36	NA	inches
Material:	TC	Brick	NA	
Invert:	NA	976.15	NA	ft
Slope:	NA	2.93	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	12	NA	NA	inches
Material:	RC	NA	NA	
Invert:	975.49	NA	NA	ft
Slope:	22.83	NA	NA	%

Overflow Sewer

	O	
Size:	36	inches
Material:	RC	
Invert:	975.78	ft
Slope:	1.35	%

Orifice

	U	V	W	
Invert:	975.49	NA	NA	ft
Shape:	0	NA	NA	
Opening Height:	0.5	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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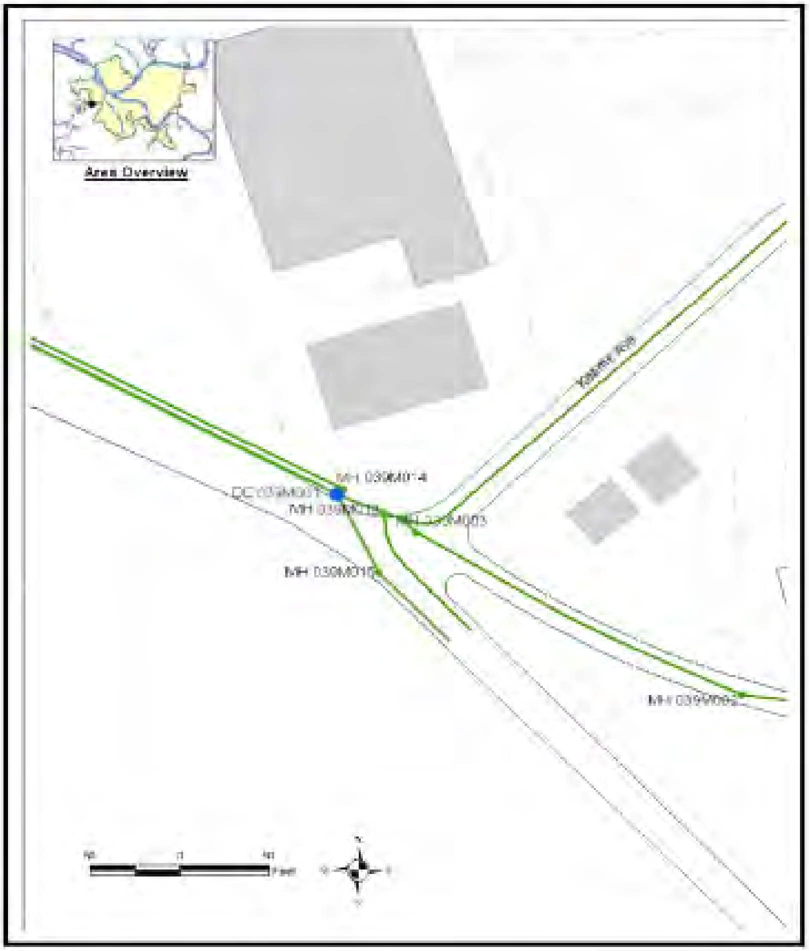
PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 039M001



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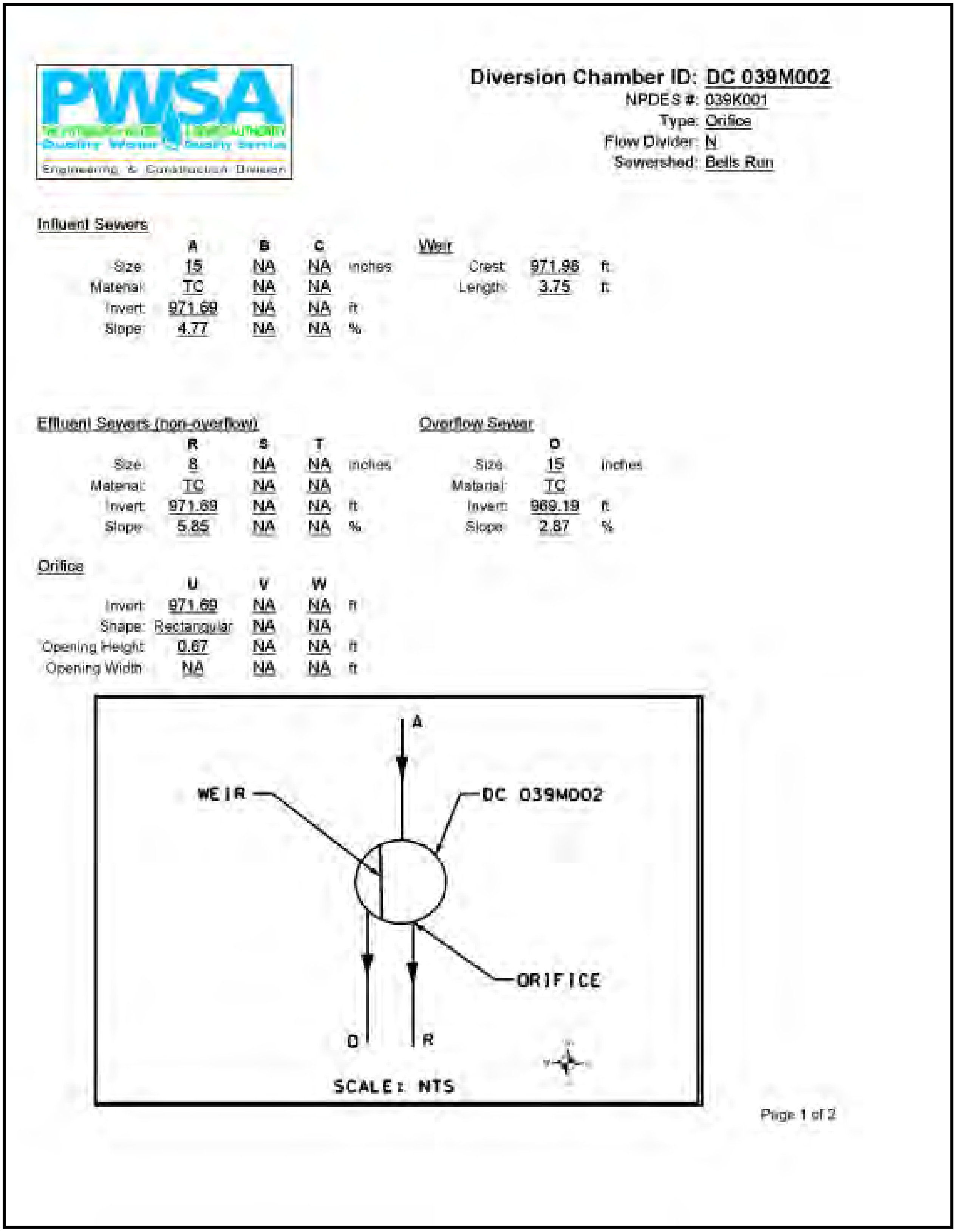

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 039M002
NPDES #: 039K001
Type: Orifice
Flow Divider: N
Sewershed: Bells Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	TC	NA	NA	
Invert:	971.69	NA	NA	ft
Slope:	4.77	NA	NA	%

Weir

Crest:	971.98	ft
Length:	3.75	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	971.69	NA	NA	ft
Slope:	5.85	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	969.19	ft
Slope:	2.87	%

Orifice

	U	V	W	
Invert:	971.69	NA	NA	ft
Shape:	Rectangular	NA	NA	
Opening Height:	0.67	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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PWSA THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 039M002

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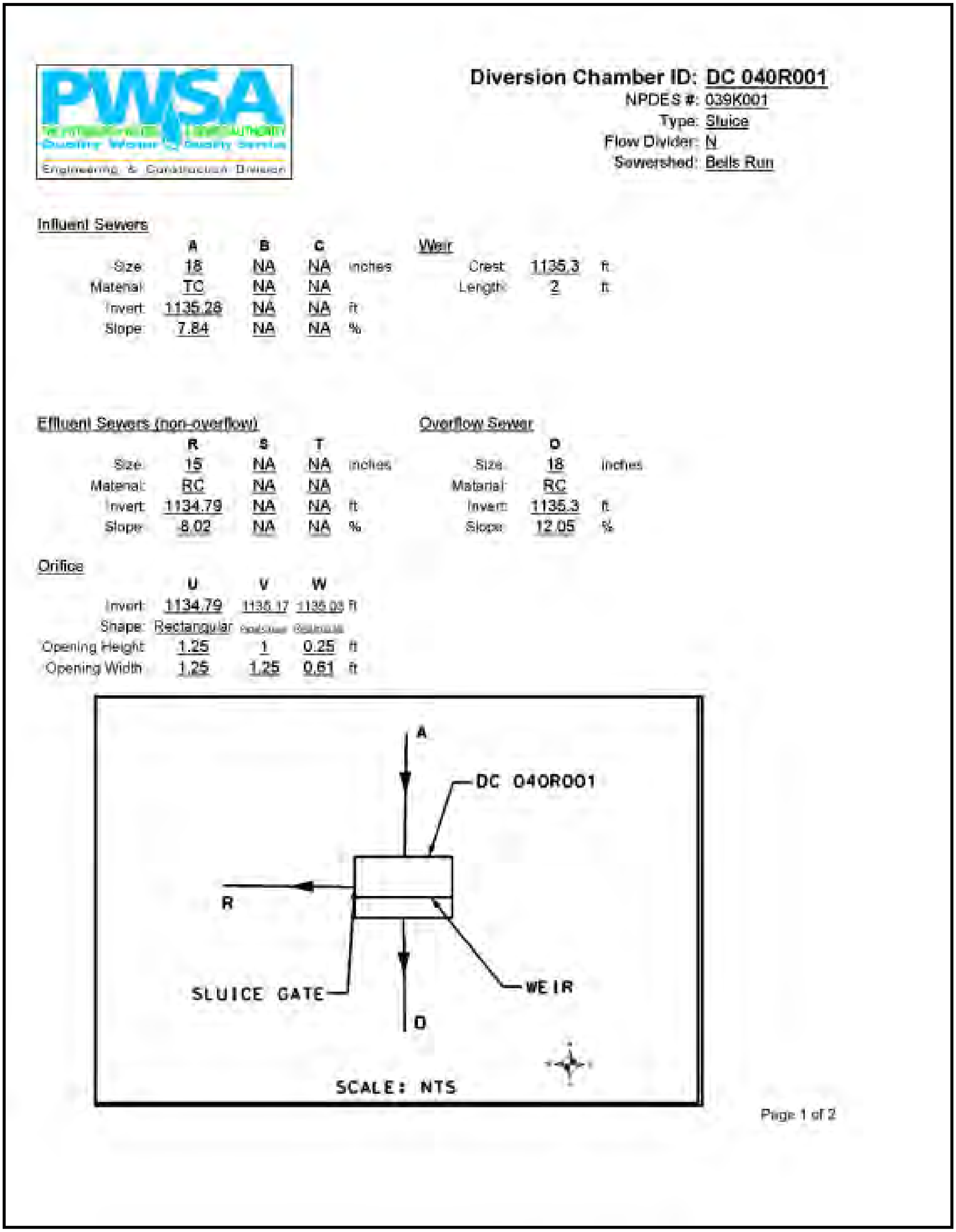

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 040R001
NPDES #: 039K001
Type: Sluice
Flow Divider: N
Sewershed: Bells Run

Influent Sewers

	A	B	C	
Size:	18	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1135.28	NA	NA	ft
Slope:	7.84	NA	NA	%

Weir

Crest:	1135.3	ft
Length:	2	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	15	NA	NA	inches
Material:	RC	NA	NA	
Invert:	1134.79	NA	NA	ft
Slope:	8.02	NA	NA	%

Overflow Sewer

	O	
Size:	18	inches
Material:	RC	
Invert:	1135.3	ft
Slope:	12.05	%

Orifice

	U	V	W	
Invert:	1134.79	1135.17	1135.09	ft
Shape:	Rectangular	[illegible]	[illegible]	
Opening Height:	1.25	1	0.25	ft
Opening Width:	1.25	1.25	0.61	ft

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THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 040R001

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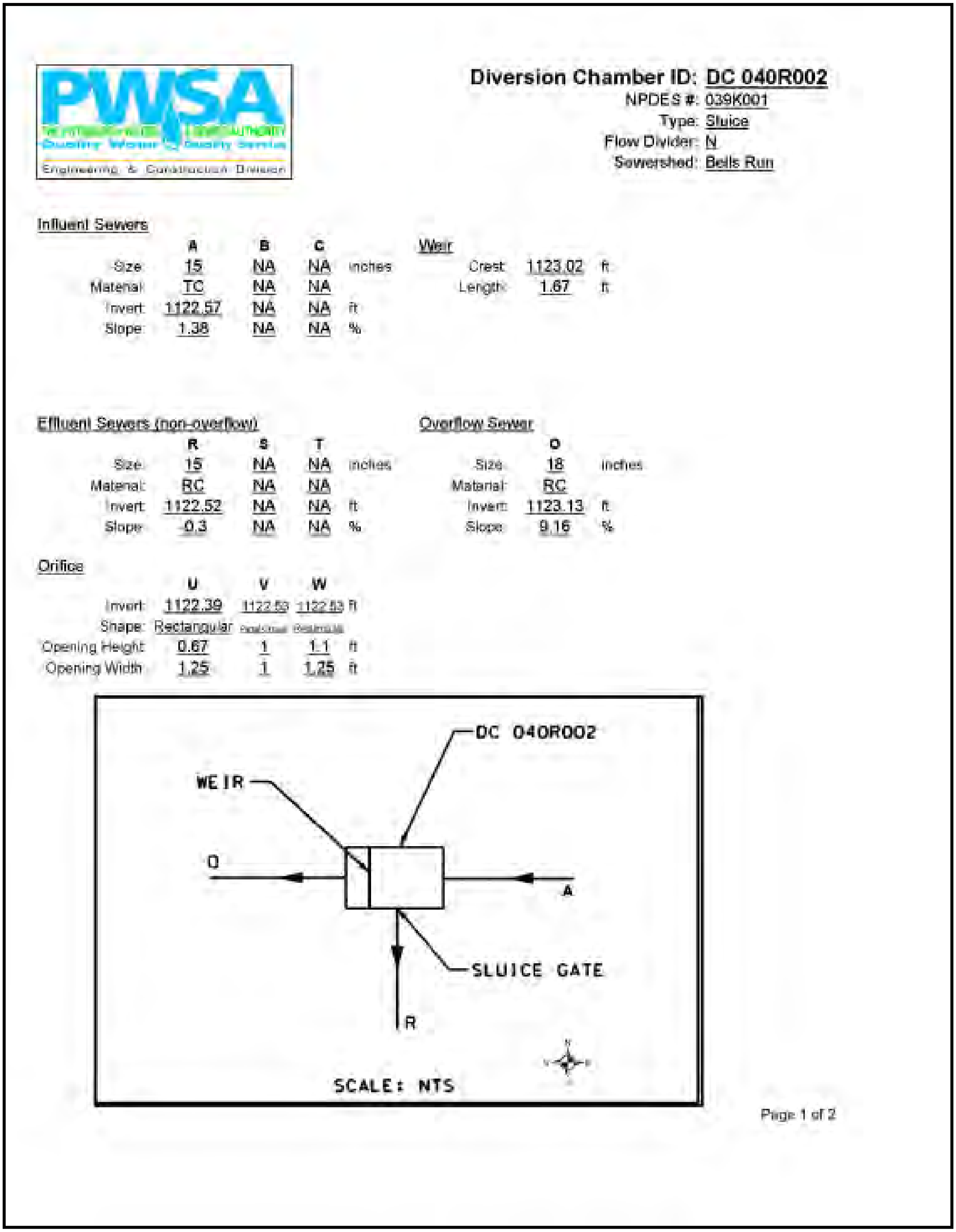

Diversion Chamber ID: DC 040R002
NPDES #: 039K001
Type: Sluice
Flow Divider: N
Sewershed: Bells Run

Influent Sewers

	A	B	C	
Size	15	NA	NA	inches
Material	TC	NA	NA	
Invert	1122.57	NA	NA	ft
Slope	1.38	NA	NA	%

Weir

Crest	1123.02	ft
Length	1.67	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	15	NA	NA	inches
Material	RC	NA	NA	
Invert	1122.52	NA	NA	ft
Slope	-0.3	NA	NA	%

Overflow Sewer

	O	
Size	18	inches
Material	RC	
Invert	1123.13	ft
Slope	9.16	%

Orifice

	U	V	W	
Invert	1122.39	1122.53	1122.53	ft
Shape	Rectangular	[illegible]	[illegible]	
Opening Height	0.67	1	1.1	ft
Opening Width	1.25	1	1.25	ft

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THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 040R002

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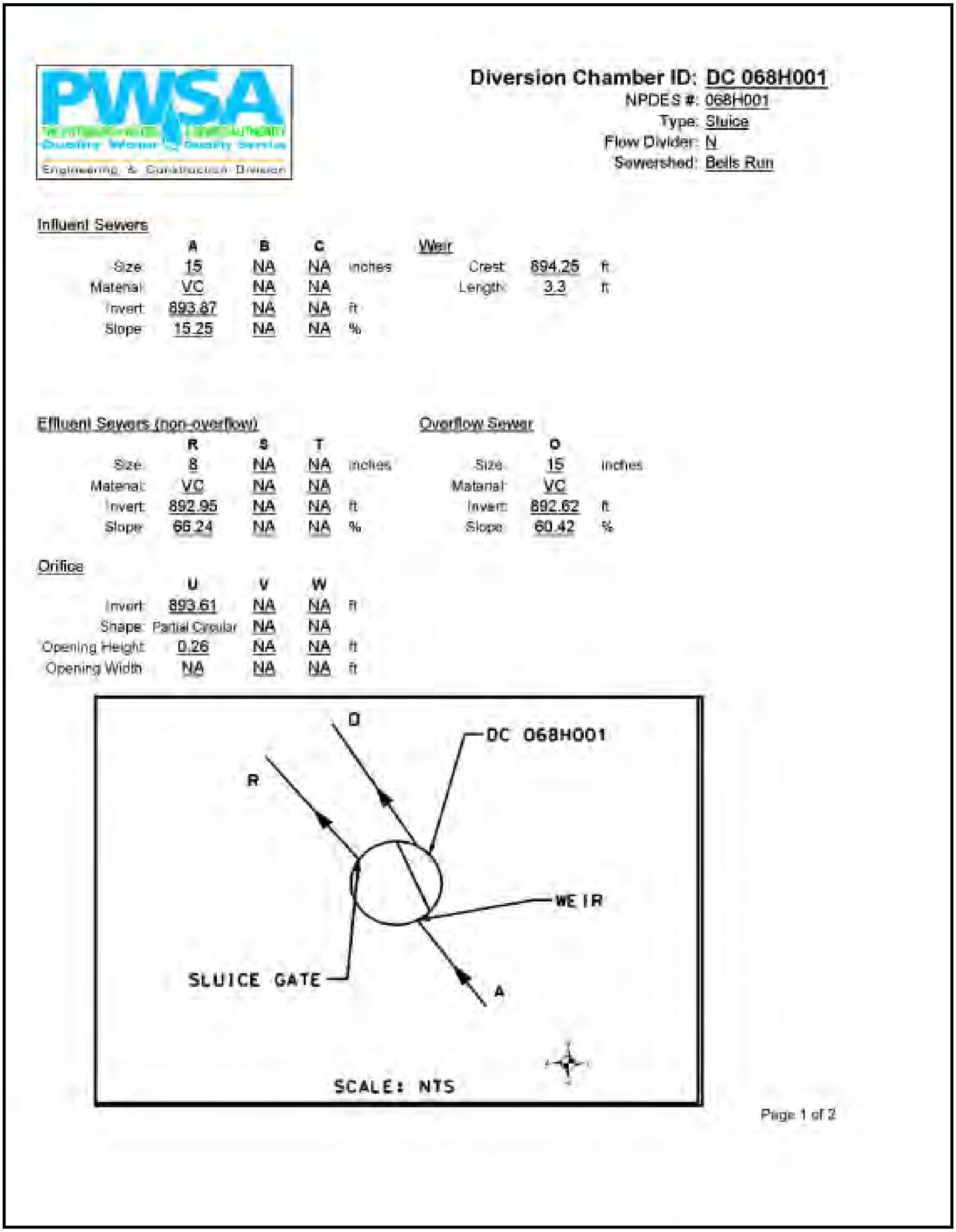

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 068H001
NPDES #: 068H001
Type: Sluice
Flow Divider: N
Sewershed: Bells Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	VC	NA	NA	
Invert:	893.87	NA	NA	ft
Slope:	15.25	NA	NA	%

Weir

Crest:	894.25	ft
Length:	3.3	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	VC	NA	NA	
Invert:	892.95	NA	NA	ft
Slope:	66.24	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	VC	
Invert:	892.62	ft
Slope:	60.42	%

Orifice

	U	V	W	
Invert:	893.61	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.26	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 068H001

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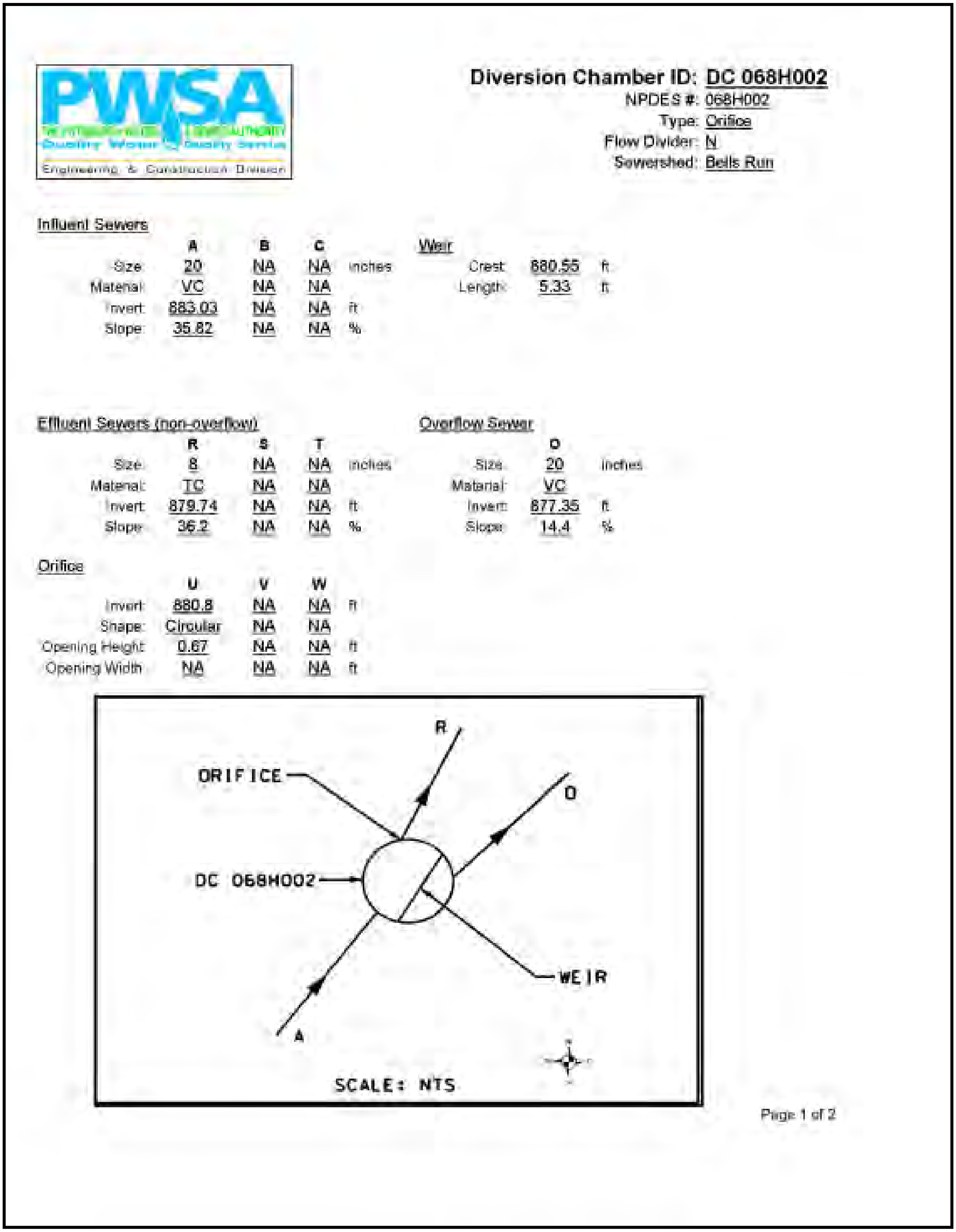

PWSA
THE PITTSBURGH WATER AND SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 068H002
NPDES #: 068H002
Type: Orifice
Flow Divider: N
Sewershed: Bells Run

Influent Sewers

	A	B	C	
Size:	20	NA	NA	inches
Material:	VC	NA	NA	
Invert:	883.03	NA	NA	ft
Slope:	35.82	NA	NA	%

Weir

Crest:	880.55	ft
Length:	5.33	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	879.74	NA	NA	ft
Slope:	36.2	NA	NA	%

Overflow Sewer

	O	
Size:	20	inches
Material:	VC	
Invert:	877.35	ft
Slope:	14.4	%

Orifice

	U	V	W	
Invert:	880.8	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	0.67	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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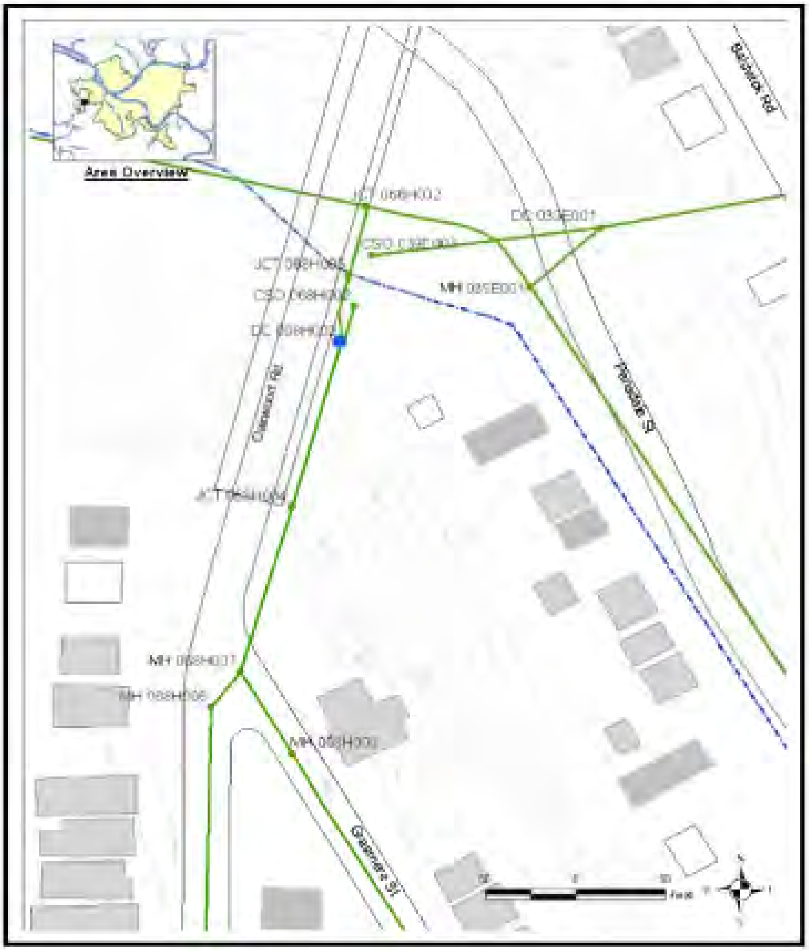
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 068H002



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2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC C-25: Bells Run through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Chartiers Creek Basin Planners (CC_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for C-25.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the *Hydraulic and Hydrologic Characterization Report (September, 2008)* and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The flow monitoring data were used to help develop and calibrate the H&H model upon

which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. Twelve (12) flow meters located within the C-25 sewershed were used in the RCS-FMP. Details on the twelve (12) RCS-FMP flow monitors installed within the C-25 sewershed are found in Table C25-2-1.

TABLE C25-2-1: C-25 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Type	Monitor Term[1]
C2500__-MB_-L-04_	Green Tree Borough	MB	L
C2500__-MB_-S-03_	Green Tree Borough	MB	S
C2500__-MM_-L-02_	City of Pittsburgh	MM	L
C2500__-OSC-M-05_	City of Pittsburgh	OSC	M
C2500__-OSC-M-05O	City of Pittsburgh	OSC	M
C2500__-OSC-M-06_	City of Pittsburgh	OSC	M
C2500__-OSC-M-06O	City of Pittsburgh	OSC	M
C2500__-OSC-M-07_	City of Pittsburgh	OSC	M
C2500__-OSC-M-07O	City of Pittsburgh	OSC	M
C2500__-OSC-M-08_	City of Pittsburgh	OSC	M
C2500__-OSC-M-08O	City of Pittsburgh	OSC	M
C2500__-POC-L-01_	City of Pittsburgh	POC	L

[1] S=Short Term: 3-months to 6 months, M=Medium Term: 6 months to 9 months, L=Long Term: 1-year minimum to 21-month maximum.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).
- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.

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[1] The flow monitor information in this Table is from a file titled "Summary of Program Monitors by Name, Type and Dates.xls". This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled "Summary and Report of Flow Monitoring June 2009".

- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.

- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the C-25 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the C-25 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.

- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The average annual DWF, average annual GWI, and the Average Annual GWI per inch-mile of sewer at the POC C-25 are listed in Table C25-2-2.

TABLE C25-2-2: C-25 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

POC	Average Annual DWF (mgd)	Average Annual GWI (mgd)	Average Annual GWI per inch-mile (gpd per in-mile)
C-25	2.6	213	1.5

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table C25-2-3.

TABLE C25-2-3: C-25 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
C-25	0.78	0.81	3.8%

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event.

RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

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[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Chartiers Creek Planning Basin – Table 4-4.

[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Chartiers Creek Planning Basin – Table 2.6

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for C-25 are presented in Table C25-2-4.

TABLE C25-2-4: C-25 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	**Future Baseline Conditions (mgd)**	**Percent Difference**
C-25	54	54	0.0%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and the 2-year, 5-year and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total.

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[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Chartiers Creek Planning Basin – Table 2.7

Figure C25-2-1 present the computed hydraulic profiles of the existing Bells Run main trunk sewer system under projected 2-year design storm peak flow conditions. As is indicated in the figures, under the current system configuration, including existing CSO diversion chamber settings, flows are conveyed through the system with no surcharging. This indicates that the system operates acceptably under projected 2-year design storm conditions.

Figure C25-2-2 present the computed hydraulic profiles of the existing Bells Run main trunk sewer system under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, surcharging occurs at several locations along the interceptor. This surcharging is relatively minor, however, indicating that the system operates generally acceptably under projected 5-year design storm conditions.

Figure C25-2-3 present the computed hydraulic profiles of the existing Bells Run main trunk sewer system under projected 10-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, a significant amount of surcharging occurs at a number of locations along the interceptor although the modeling does not predicts the manhole flooding. The existing system can be considered only marginally capable of transporting 10-year design storms.

Computed flow hydrographs for each of the design storms at POC C-25 are presented in Figure C25-2-4. It is noted that the peak flows reaching the POC are truncated due to extensive manhole surcharging and manhole flooding.

FIGURE C25-2-1: C-25 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation under Peak 2-Year Design Storm and Future Baseline Conditions

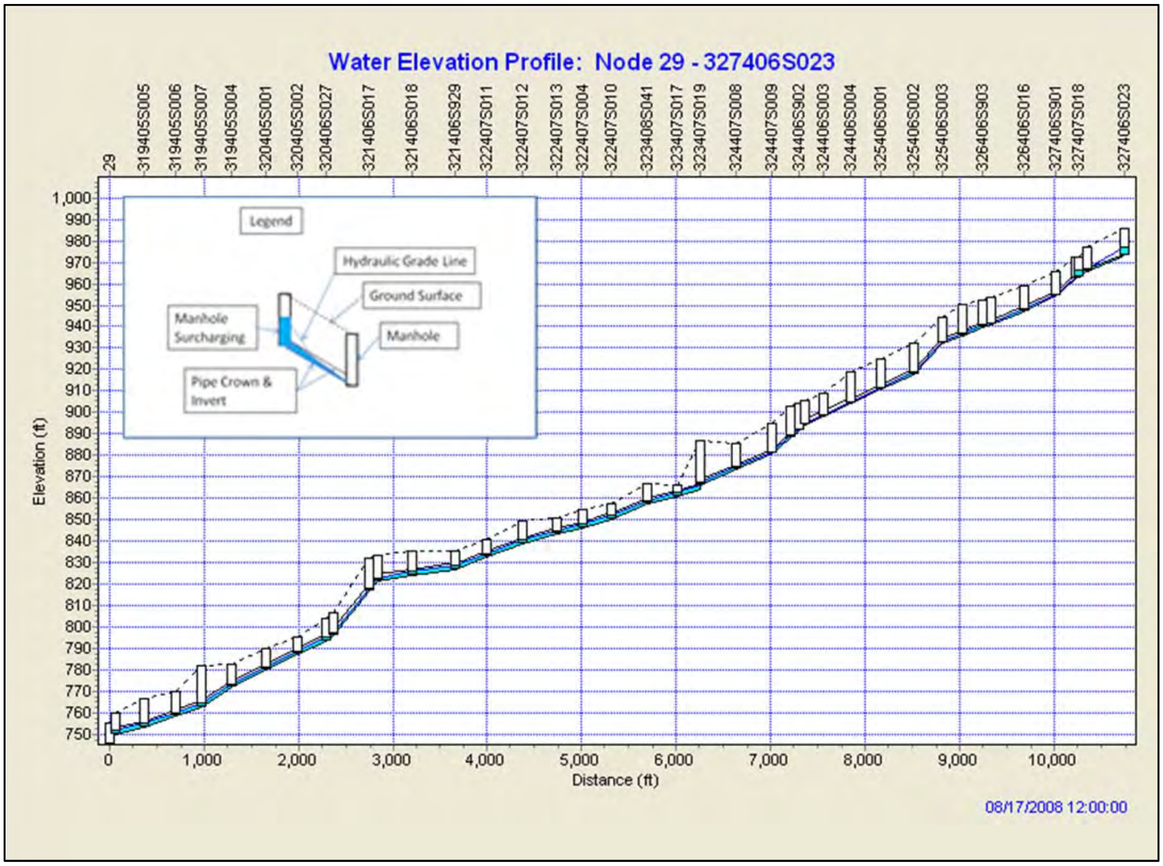


FIGURE C25-2-2: C-25 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation under Peak 5-Year Design Storm and Future Baseline Conditions

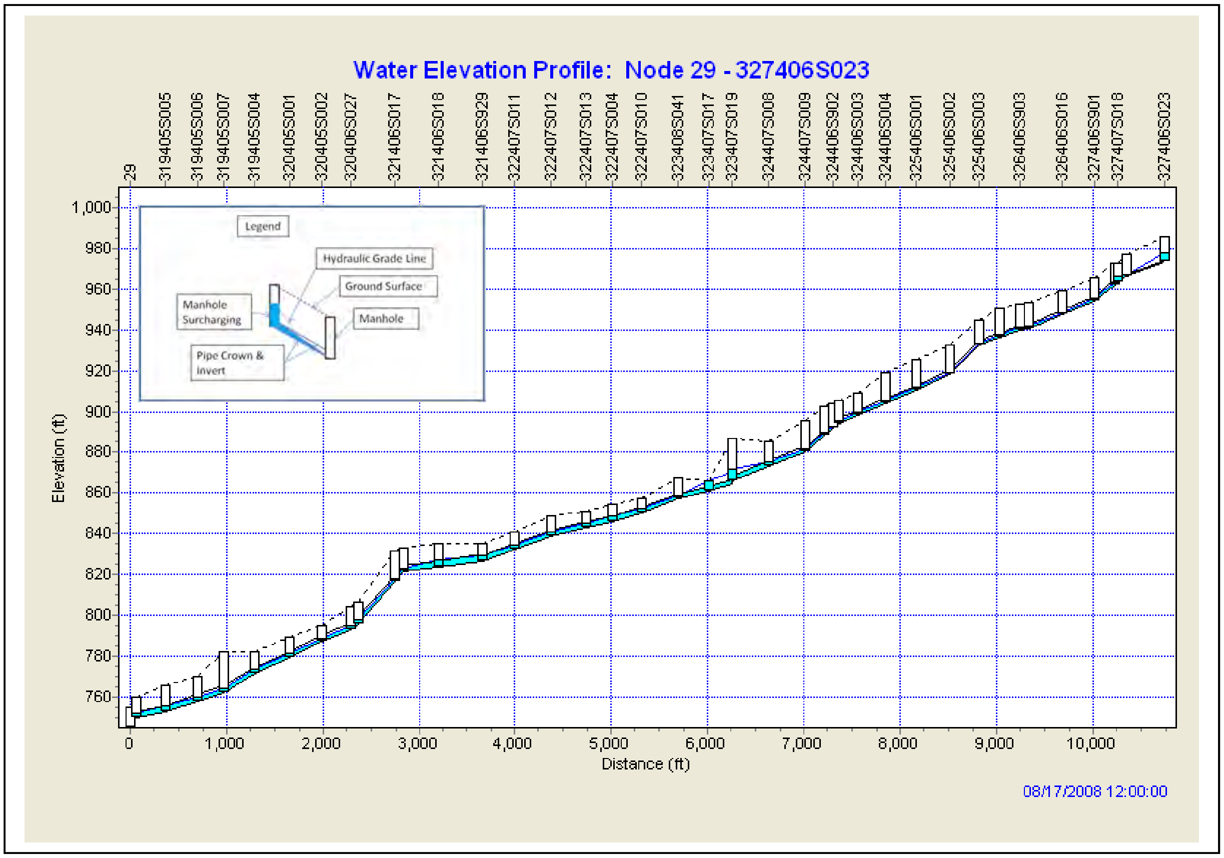


FIGURE C25-2-3: C-25 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation under Peak 10-Year Design Storm and Future Baseline Conditions

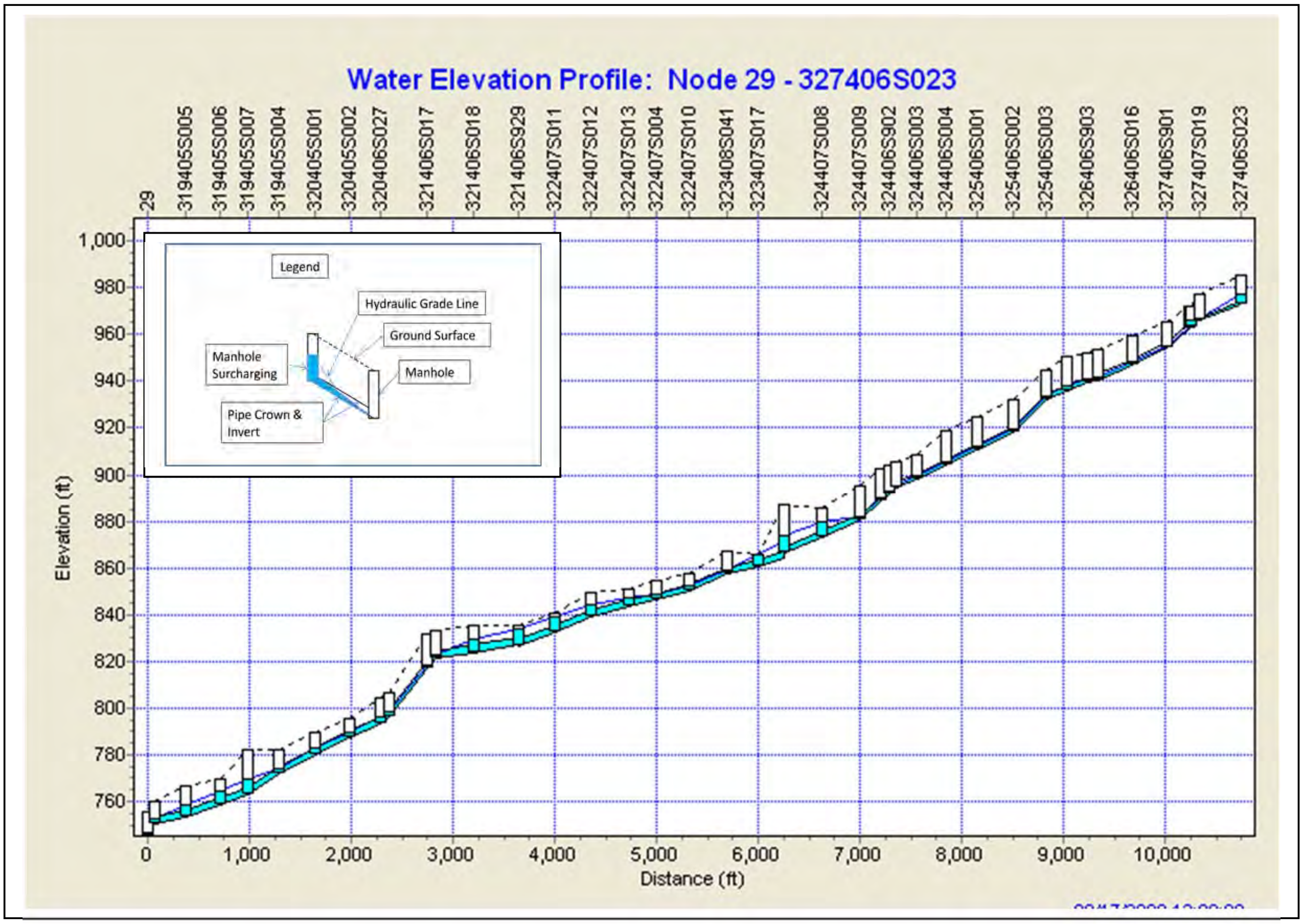
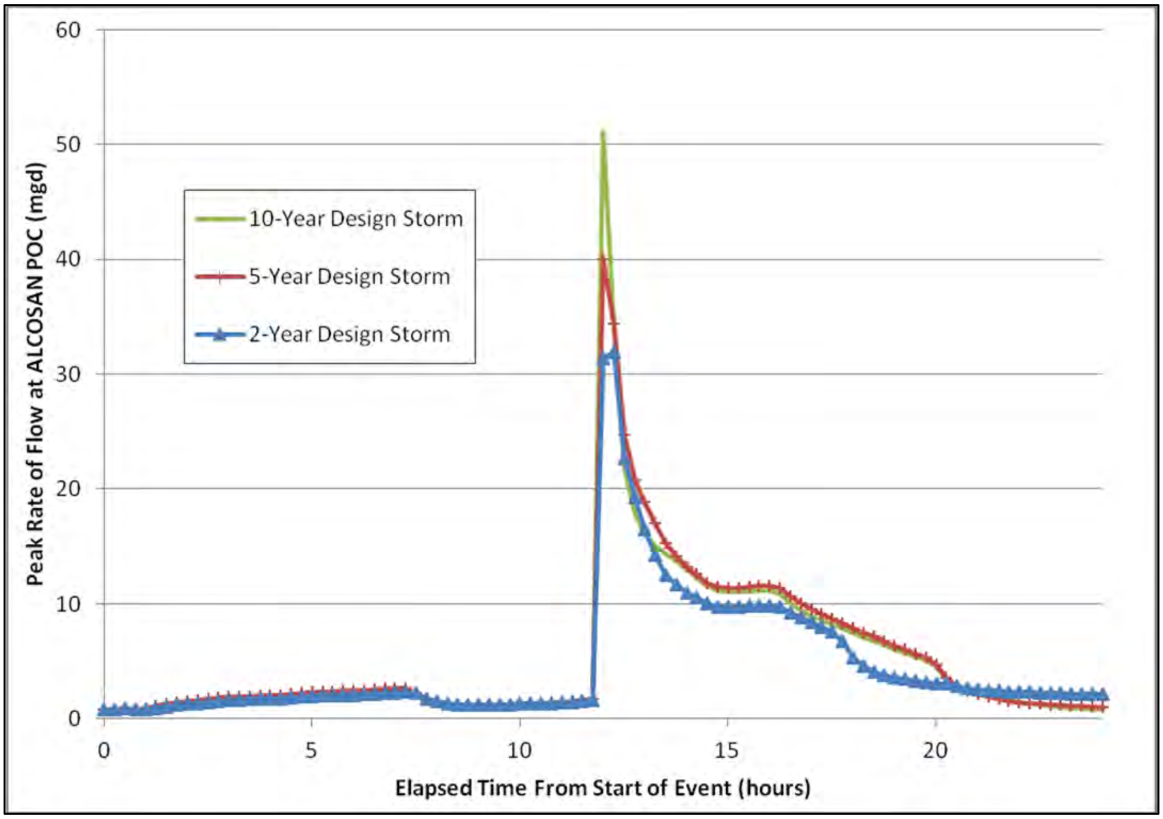


FIGURE C25-2-4: C-25 SEWERSHED PEAK FLOW RATES TO THE POC

Existing System Configuration and Mode of Operation under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

Table C25-2-5 presents a summary of the identified chronic basement flooding locations within the PWSA portion of the C-25 sewershed. Most neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. Via a request for information letter, Crafton Borough indicated they do not have any basement flooding in C-25, however there is apparent surface flooding at the underpass for the PAT busway at Morange Street during heavy rain events. Since April 1, 2013 CCTV work was performed which verified the source of the flooding to be a storm sewer issue and not a combined sewer trunk line issue.

The data presented in Table C25-2-5 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.
- Eliminating repeat complaints from the same address for the same incident.
- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE C25-2-5: C-25 CHRONIC BASEMENT BACKUP LOCATIONS (PWSA SYSTEM)[5]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
1901 Ovid Street	2	2008

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the C-25 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

---

[5] Information from analysis of PWSA SAP system

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures 2-5 and 2-6. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figures shows that under this range of operating conditions, the existing trunk sewer system does not have sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding. These results validate the findings and recommendations of the Draft Feasibility Study that anticipated the need to construct a consolidation/relief sewer to supplement the capacity of the existing trunk sewer system.

FIGURE C25-2-5: C-25 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF per Typical Year

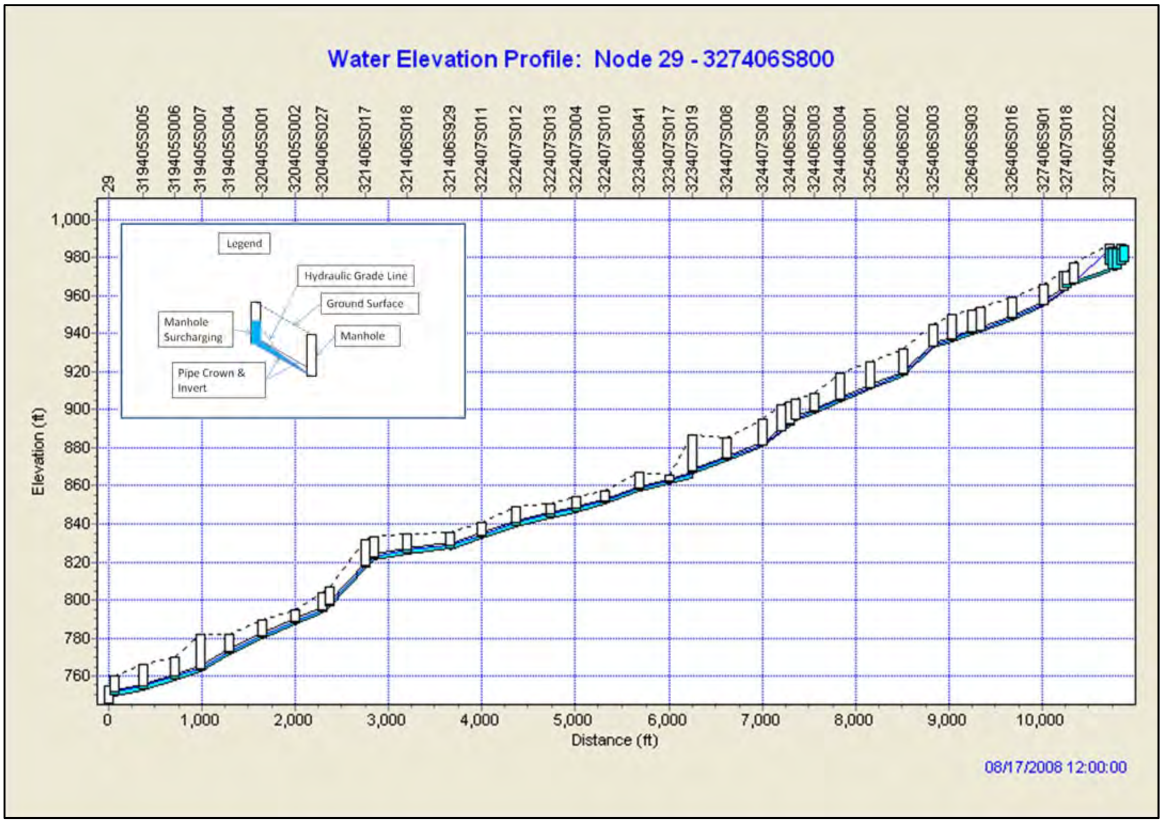
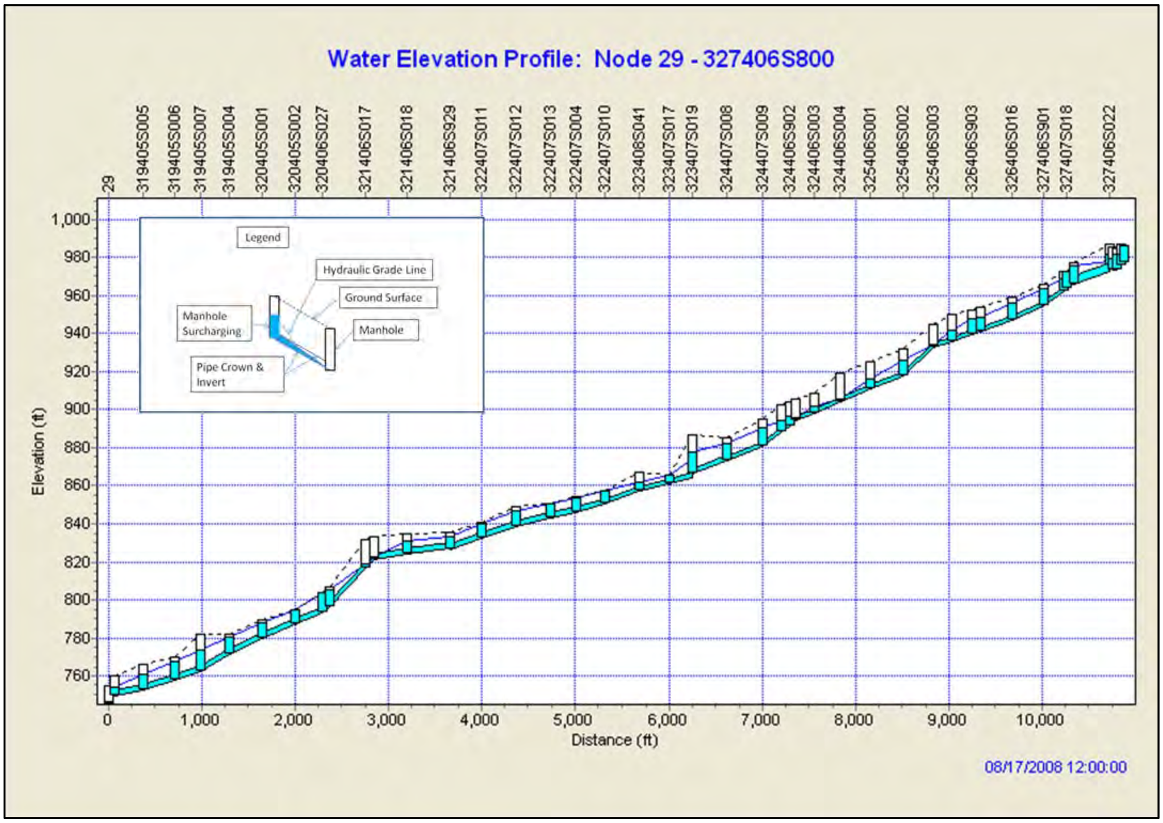


FIGURE C25-2-6: C-25 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF per Typical Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the C-25 sewer system performed by PWSA produced computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are presented in Table C25-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the C-25: Bells Run sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. Five (5) of these outfalls are found within the C-25 or Bells Run Sewershed, as shown in Table C25-3-1.

TABLE C25-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE C-25: BELLS RUN SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF068H002	CC	C-25	Bells Run	WWF[1]	N	Y
OF039E001	CC	C-25	Bells Run	WWF	N	Y
CSO039J001	CC	C-25	Bells Run	WWF	N	Y
OF039K001	CC	C-25	Bells Run	WWF	N	Y
OF068H001	CC	C-25	Bells Run	WWF	N	Y

As shown in the table, the five (5) PWSA owned outfalls discharges into Bells Run. This receiving water is classified as warm water fishery (WWF) and currently does not meet its assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

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[1] Warm Water Fishery

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.
- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical

characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the C-25 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO

controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the C-25 sewershed, Table C25-3-2 lists the untreated CSO statistics that were computed for each control level.

TABLE C25-3-2: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE C-25: BELLS RUN SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC040R001	0	0	3	0.05	10	0.19
DC040R002	0	0	2	0.01	2	0.01
DC039L001	0	0	2	0.14	10	0.73
DC039M002	0	0	4	0.48	4	0.72
DC039M001	0	0	3	1.06	7	2.50
DC039J001	0	0	2	0.11	7	0.41
DC039E001	0	0	1	0.05	5	0.14
DC068H002	0	0	3	0.58	10	1.29
DC068H001	0	0	4	0.21	8	0.28
Total Volume		**0**		**2.69**		**6.27**

As will be described later in this report, the C-25 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events) under of the typical year condition.

A range of control levels for the typical year were evaluated for transport of flows. PWSA plans to use the 4 overflows per year which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

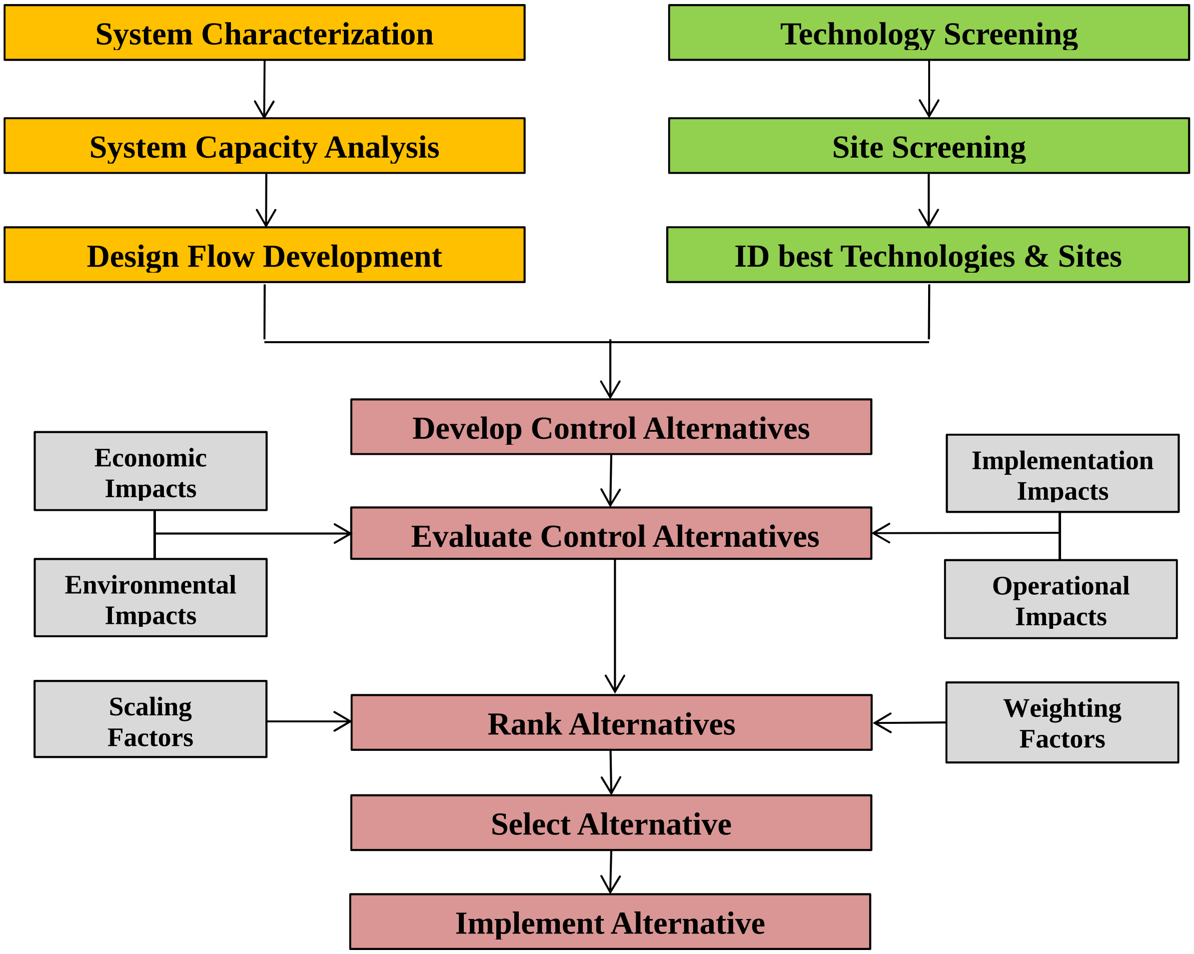
The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. *Figure 4-1: Control Alternative Development and Evaluation Process* shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE 4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered “feasible” for use in the C-25 sewershed are shown below in Table 4-1.

TABLE 4-1: C-25 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies were identified for the C-25 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table 4-2.

Contributing flows from the municipalities that are tributary to the C-25 sewershed, which include Green Tree Borough and Crafton Borough were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as waterways.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning "Objective Scores" to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

TABLE 4-2: C-25 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 104HC25	CS4 104HC25: Sewer separation	Complete sewer separation of tributary area.
	S2-104HC25: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-104HC25: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-104HC25: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-104HC25: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-104HC25: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-104HC25: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 068H002	CS4 068H002: Sewer separation	Complete sewer separation of tributary area.
	S2-068H002: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-068H002: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-068H002: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-068H002: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-068H002: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-068H002: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 039K001	CS4 039K001: Sewer separation	Complete sewer separation of tributary area.
	S2-039K001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-039K001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-039K001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-039K001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-039K001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.

CSO(s)	Control Alternative(s)	Description
	T4-039K001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 039E001	No activations during the typical year.	No control required.
Outfall 039J001		
Outfall 068H001		
Consolidation including Outfalls 039E001, 039J001, 068H001, and 068H002	CS4 039E001 to 068H002: Sewer separation	Complete sewer separation of tributary area.
	S2-039E001 to 068H002: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-039E001 to 068H002: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-039E001 to 068H002: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-039E001 to 068H002: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-039E001 to 068H002: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-039E001 to 068H002: Screening and Disinfection	A stand-alone screening and disinfection facility.
Regional Controls – Upper Chartiers Creek and Bells Run Controls		
Outfalls 039E001, 039J001, 039K001, 068H001 and 068H002	CS4-Bells Run Sewershed: Sewer Separation	Complete sewer separation of tributary areas.
	S2- Bells Run Sewershed: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4- Bells Run Sewershed: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1- Bells Run Sewershed: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2- Bells Run Sewershed: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3- Bells Run Sewershed: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4- Bells Run Sewershed: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 104HC25	CS4-C-25 to C-29 Region: Sewer Separation	Complete sewer separation of tributary areas.
	S2- C-25 to C-29 Region: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4- C-25 to C-29 Region: Surface Storage	An above grade storage tank to temporarily store CSOs.

CSO(s)	Control Alternative(s)	Description
	T1- C-25 to C-29 Region: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2- C-25 to C-29 Region: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3- C-25 to C-29 Region: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4- C-25 to C-29 Region: Screening and Disinfection	A stand-alone screening and disinfection facility.
Sub-system Controls – Chartiers Creek Controls		
Outfalls 104HC25, 039E001, 039J001, 039K001, 068H001 and 068H002	CC-1: Tunnel[2]	A 2.2 mile long tunnel from C-15 to C-02. The C-25 CSOs are controlled by their highest rated alternatives during the Outfall Specific and/or Regional Alternative Evaluations. • 104HC25 - Surface Storage • 039E001, 039J001, 039K001, 068H001 and 068H002 - Sub-Surface Storage
	CC-2: Tunnel[2]	A 4.7 mile long tunnel from C-29 to C-02 with Consolidation Pipe for Bells Run overflows
	CC-3: Tunnel[2]	

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

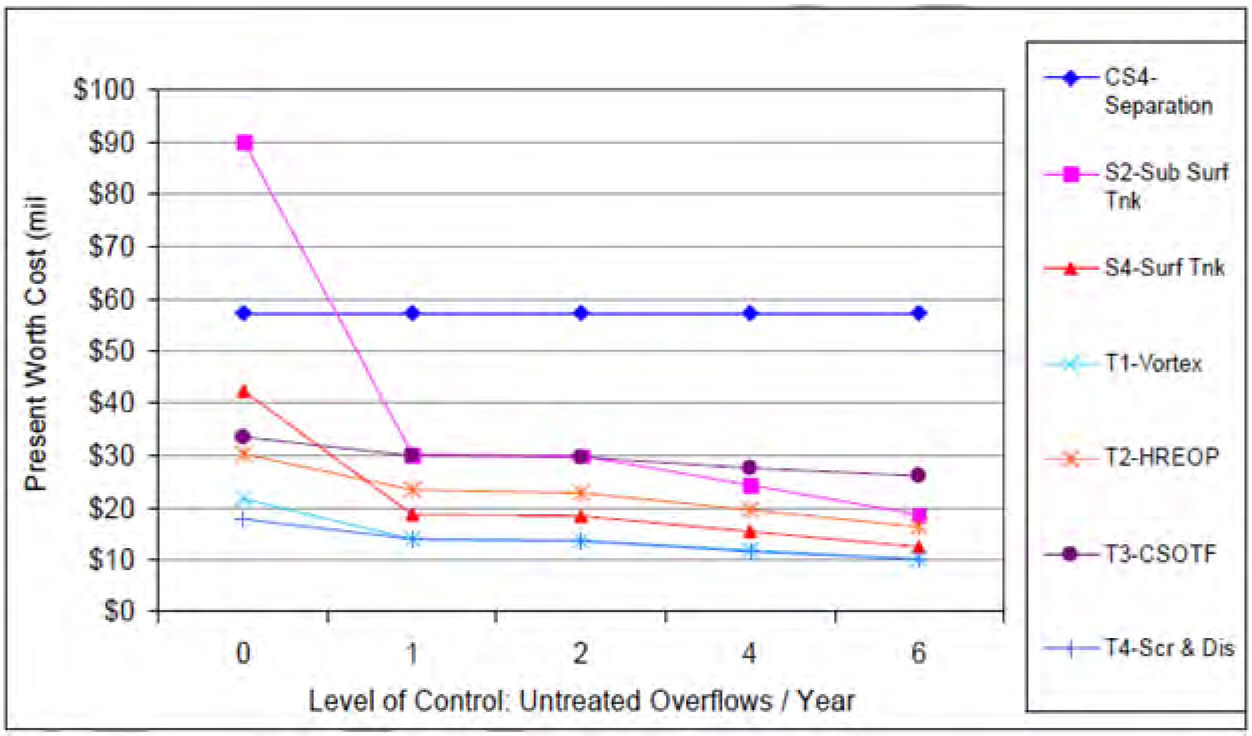
PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

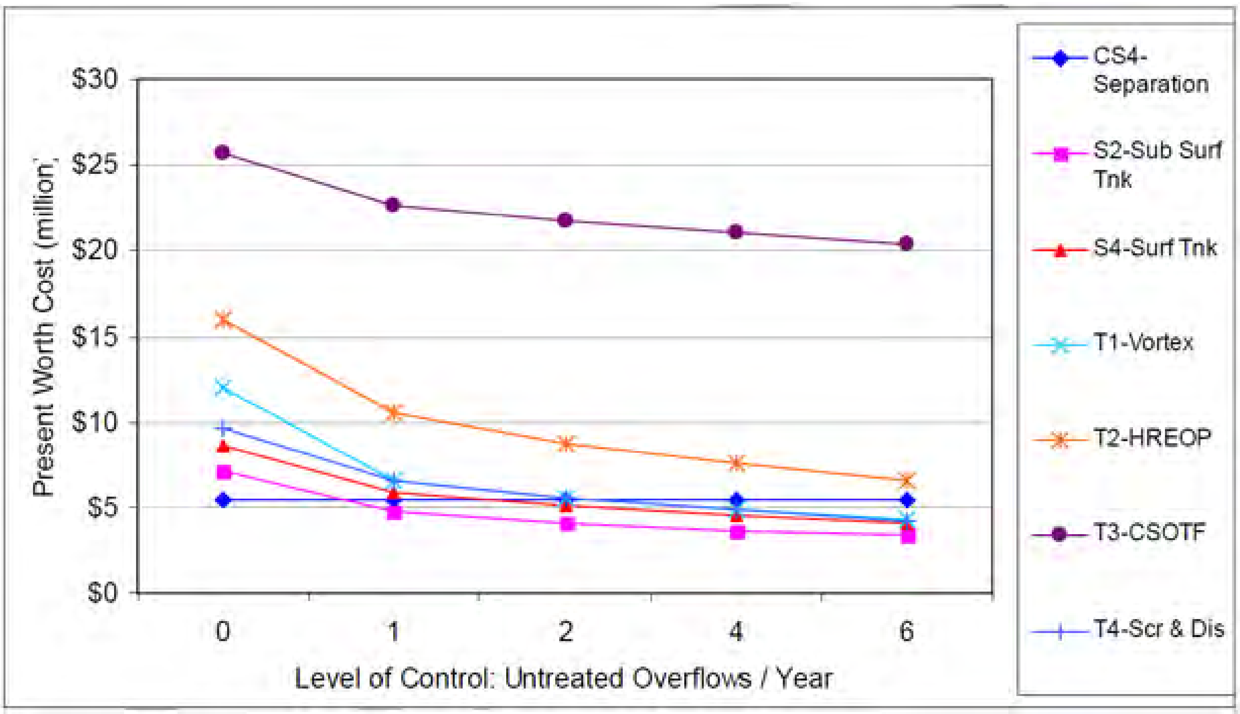
Outfall 104HC25: Cost estimates were produced for outfall-specific control alternatives CS4 104HC25: Sewer separation, S2-104HC25: Sub-Surface Storage, S4-104HC25: Surface Storage, T1-104HC25: Suspended Solids Control, T2-104HC25: High Rate End of Pipe Treatment, T3-104HC25: CSO Treatment Facility, and T4-104HC25: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2a illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2A: OUTFALL 104HC25 ALTERNATIVE COSTS



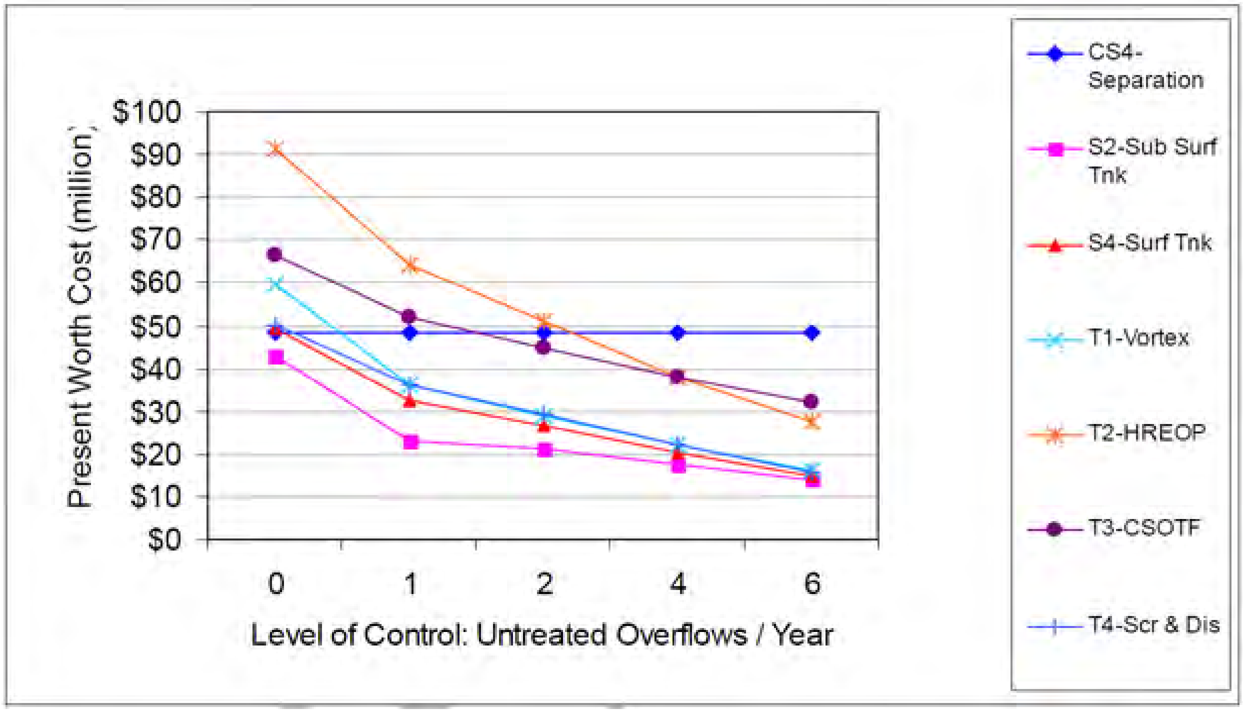
Outfalls 068H002: Cost estimates were produced for outfall-specific control alternatives CS4-068H002: Sewer separation, S2-068H002: Sub-Surface Storage, S4-068H002: Surface Storage, T1-068H002: Suspended Solids Control, T2-068H002: High Rate End of Pipe Treatment, T3-068H002: CSO Treatment Facility, and T4-068H002: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2b illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2B: OUTFALL 068H002 ALTERNATIVE COSTS



Outfalls 039K001: Cost estimates were produced for outfall-specific control alternatives CS4-039K001: Sewer separation, S2-039K001: Sub-Surface Storage, S4-039K001: Surface Storage, T1-039K001: Suspended Solids Control, T2-039K001: High Rate End of Pipe Treatment, T3-039K001: CSO Treatment Facility, and T4-039K001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2c illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2C: OUTFALL 039K001 ALTERNATIVE COSTS



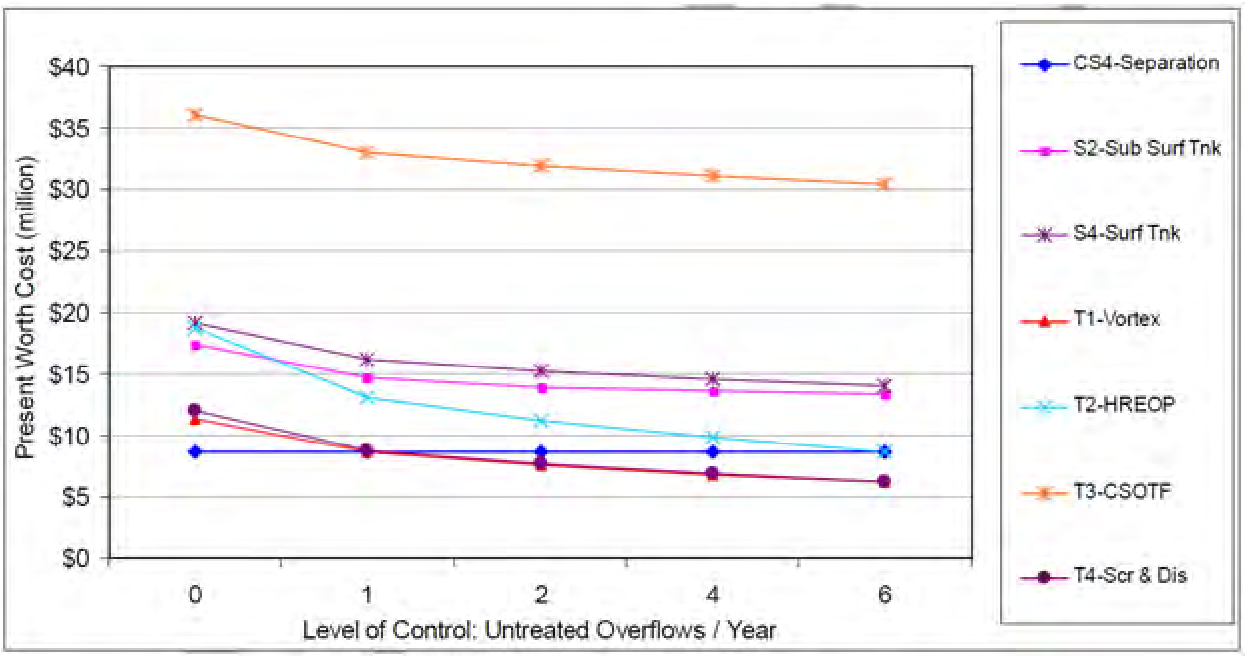
Outfall 039E001: Outfall 039E001 did not activate the typical year, and no control alternatives were required.

Outfall 039J001: Outfall 039J001 did not activate the typical year, and no control alternatives were required.

Outfall 068H001: Outfall 068H001 did not activate the typical year, and no control alternatives were required.

Consolidation including Outfalls 039E001, 039J001, 068H001, and 068H002: Cost estimates were produced for outfall-specific control alternatives CS4- 039E001 to 068H002: Sewer separation, S2-039E001 to 068H002: Sub-Surface Storage, S4-039E001 to 068H002: Surface Storage, T1-039E001 to 068H002: Suspended Solids Control, T2-039E001 to 068H002: High Rate End of Pipe Treatment, T3-039E001 to 068H002: CSO Treatment Facility, and T4-039E001 to 068H002: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2d illustrates the ranges of estimated present worth costs for these alternatives.

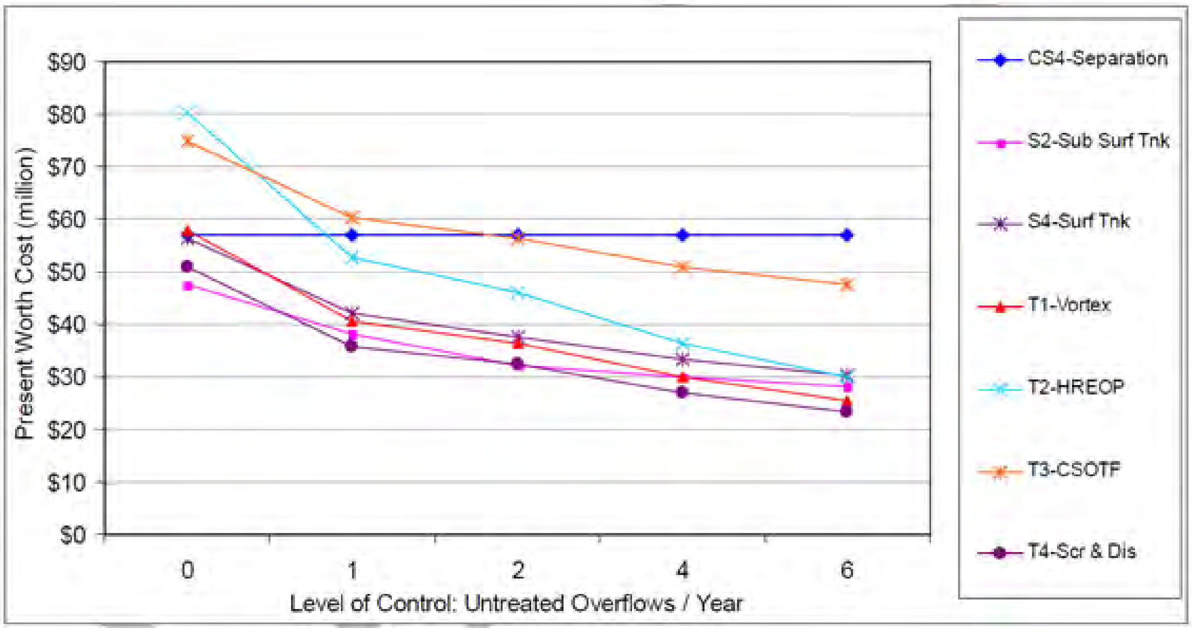
FIGURE 4-2D: OUTFALL 039E001 TO 068H002 ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

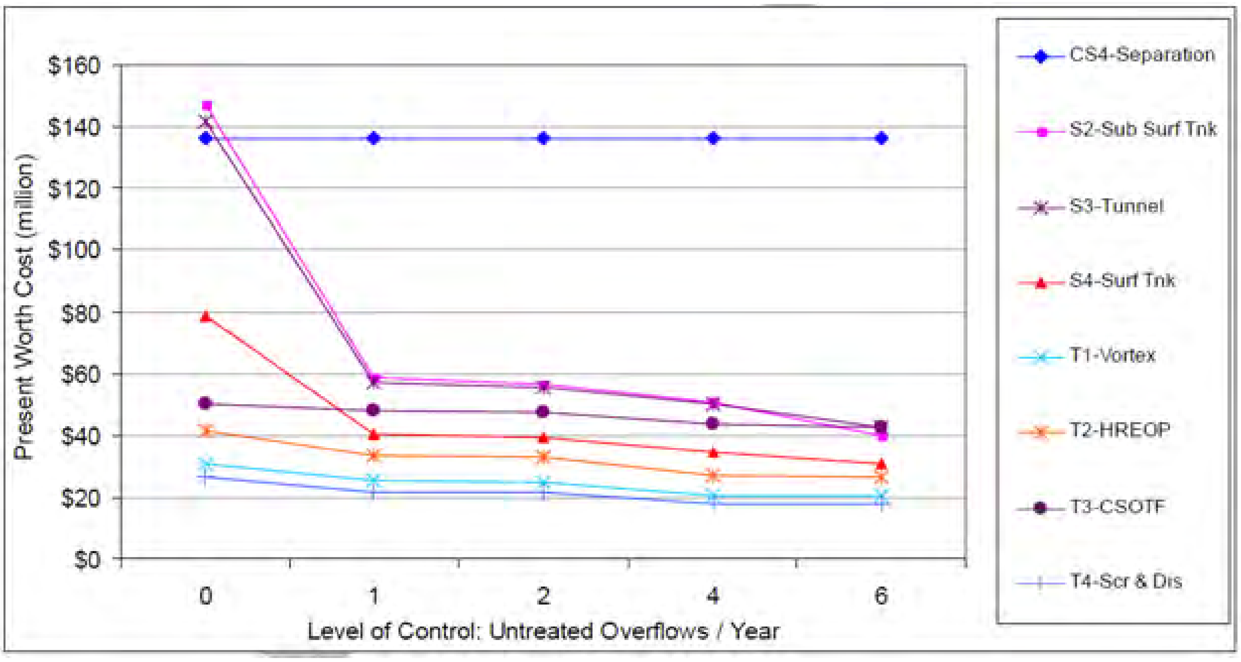
C-25: Bell's Run Region: Cost estimates were produced for regional control alternatives developed for the C-25: Bells Run region. Figure 4-3a illustrates the estimated costs for the C-25 Bells Run alternatives. It is important to note that Alternative S3-Tunnel includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-3A: C-25: BELL'S RUN ALTERNATIVE COSTS



C-25 to C-29 (C-25, C-26A, C-27, C-28, C-29) Region: Cost estimates were produced for regional control alternatives developed for the C-25 to C-29 Region. Figure 4-3b illustrates the estimated costs for the C-25 to C-29 alternatives. It is important to note that Alternative S3-Tunnel includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-3B: C-25 TO C-29 ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Chartiers Creek Sub-system: Cost estimates were produced for sub-system control alternatives developed for the Chartiers Creek sub-system. Table 4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Chartiers Creek. One of the alternatives, CC-3, included the Glen Mawr Region due to cost effectiveness as compared to if Chartiers Creek and Glen Mawr regions remained separated. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE 4-3: CHARTIERS CREEK SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)	PW Cost w/ Glen Mawr Alternative (GM-1) (MM$)
CC-1	113.8	1.3	127.7	179.8
CC-2	134.5	0.9	145.1	197.2
CC-3 (includes Glen Mawr)	169.9	1.1	*	182.8

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining "Objective Scores" relative to each evaluation criteria.
- Applying "scaling" and "weighting" factors.
- Determining "Weighted Objective Scores" relative to each evaluation criteria.
- Ranking each alternative based on the sum of its "Weighted Objective Scores".

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table 4.4.

TABLE 4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

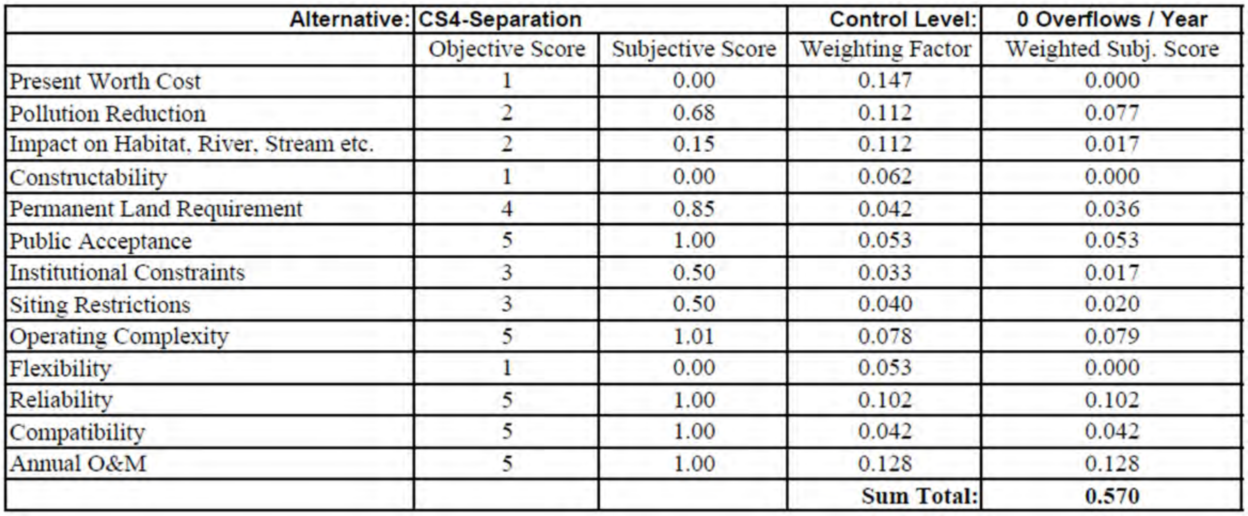
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in Table 4-5.

TABLE 4-5: WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative "CS4-104HC25: Sewer Separation" at a level of control equal to 0 overflows per year, is shown below in Table 4-6.

TABLE 4-6: WEIGHTED SUBJECTIVE SCORING - CS4-104HC25: SEWER SEPARATION



Alternative:	CS4-Separation		Control Level:	0 Overflows / Year
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	1	0.00	0.147	0.000
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.112	0.017
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	3	0.50	0.033	0.017
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.570**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 104HC25: The results of the control alternative evaluation process are shown in Figure 4-4a. It was recommended that, for control level 0, "*T4-104HC25: Screening and Disinfection*" be carried forward and re-evaluated during the regional and sub-system alternatives analyses. For control levels 1 through 6, it is recommended that *S4-104HC25: Surface Storage* be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

Outfalls 068H002: The results of the control alternative evaluation process are shown in Figure 4-4b. For control level 0, it is recommended that Alternative CS4-068H002: Sewer Separation be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses. For control levels 1 through 6, it is recommended that Alternative S2-068H002: Sub-Surface Storage be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

Outfalls 039K001: The results of the control alternative evaluation process are shown in Figure 4-4c. For all levels of control, it is recommended that Alternative *S2-039K001: Sub-Surface Storage* be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

Outfall 039E001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This "no activation" outfall was not considered further in the alternatives analysis process.

Outfall 039J001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This "no activation" outfall was not considered further in the alternatives analysis process.

Outfall 068H001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This "no activation" outfall was not considered further in the alternatives analysis process.

Outfalls 039E001, 039J001, 068H001, and 068H002: The results of the control alternative evaluation process are shown in Figure 4-4d. For control levels 0 to 4, it is recommended that Alternative CS4-039E001, 039J001, 068H001, and 068H002: Sewer Separation be carried forward and re-evaluated with the results of the system-wide alternatives analyses. For control level 6, it is recommended that Alternative T1-039E001, 039J001, 068H001, and 068H002: Suspended Solids Control be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

FIGURE 4-4A: ALTERNATIVE SCORING - OUTFALL 104HC25

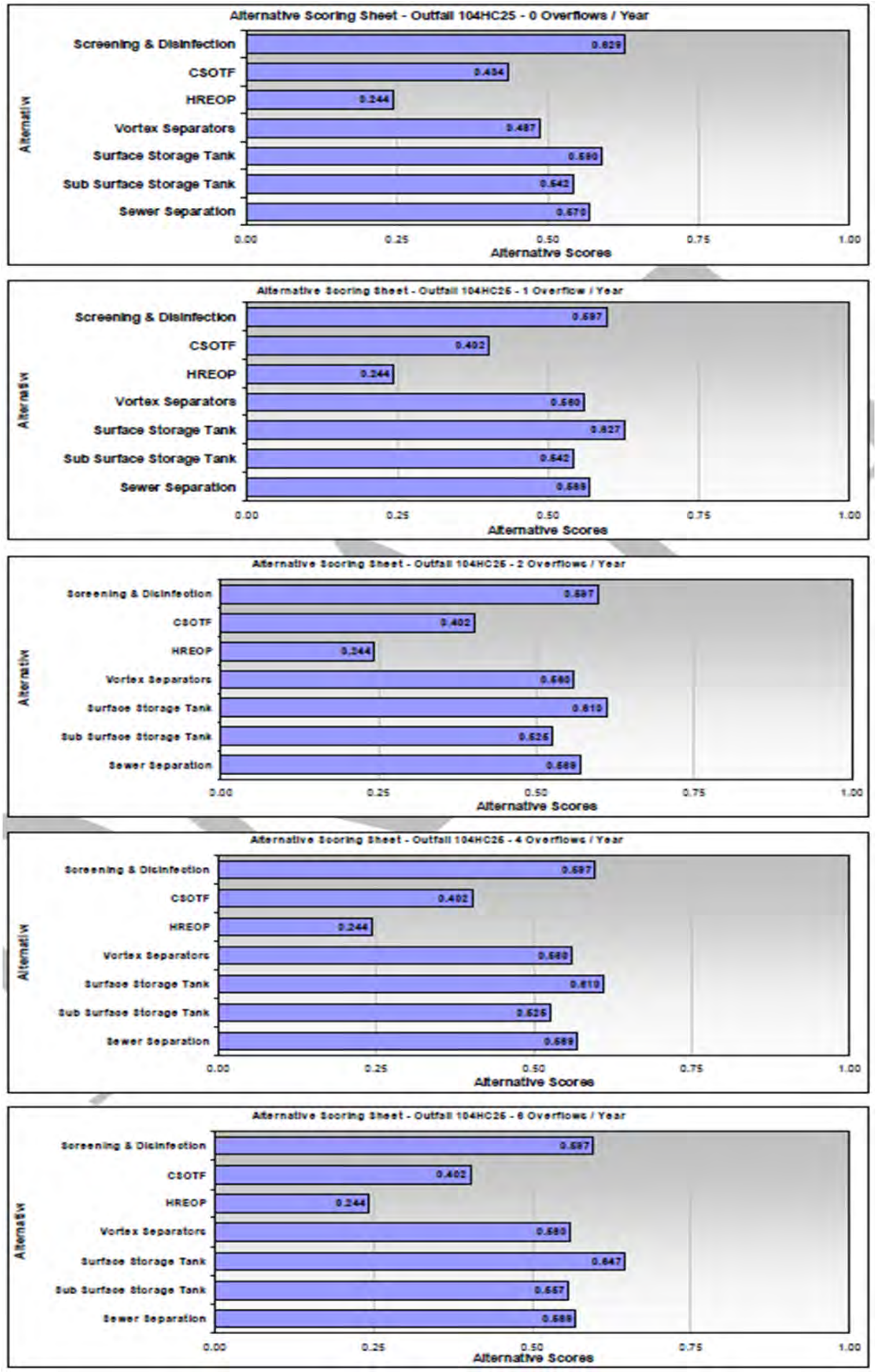


FIGURE 4-4B: ALTERNATIVE SCORING - OUTFALLS 068H002

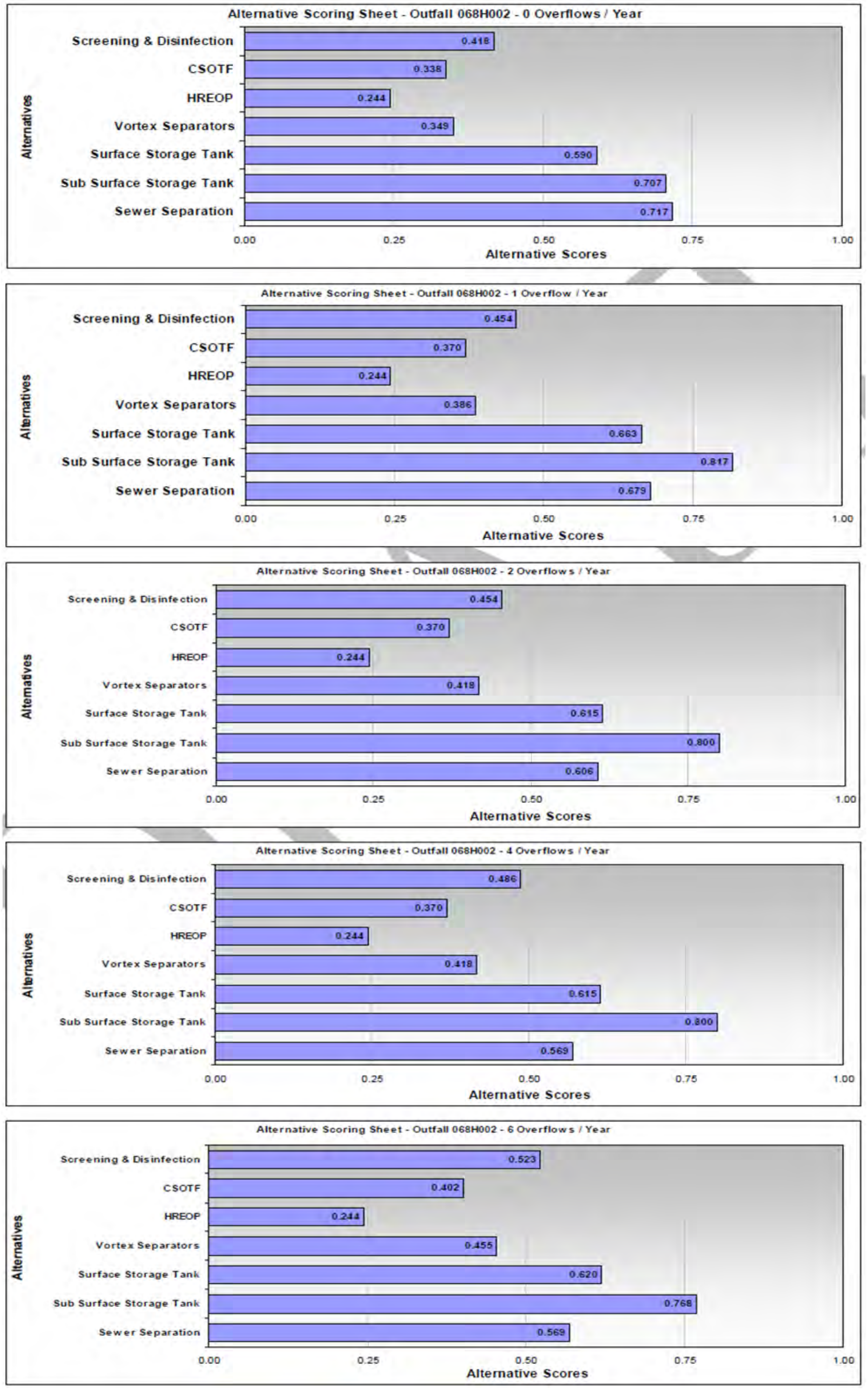


FIGURE 4-4C: ALTERNATIVE SCORING - OUTFALLS 039K001

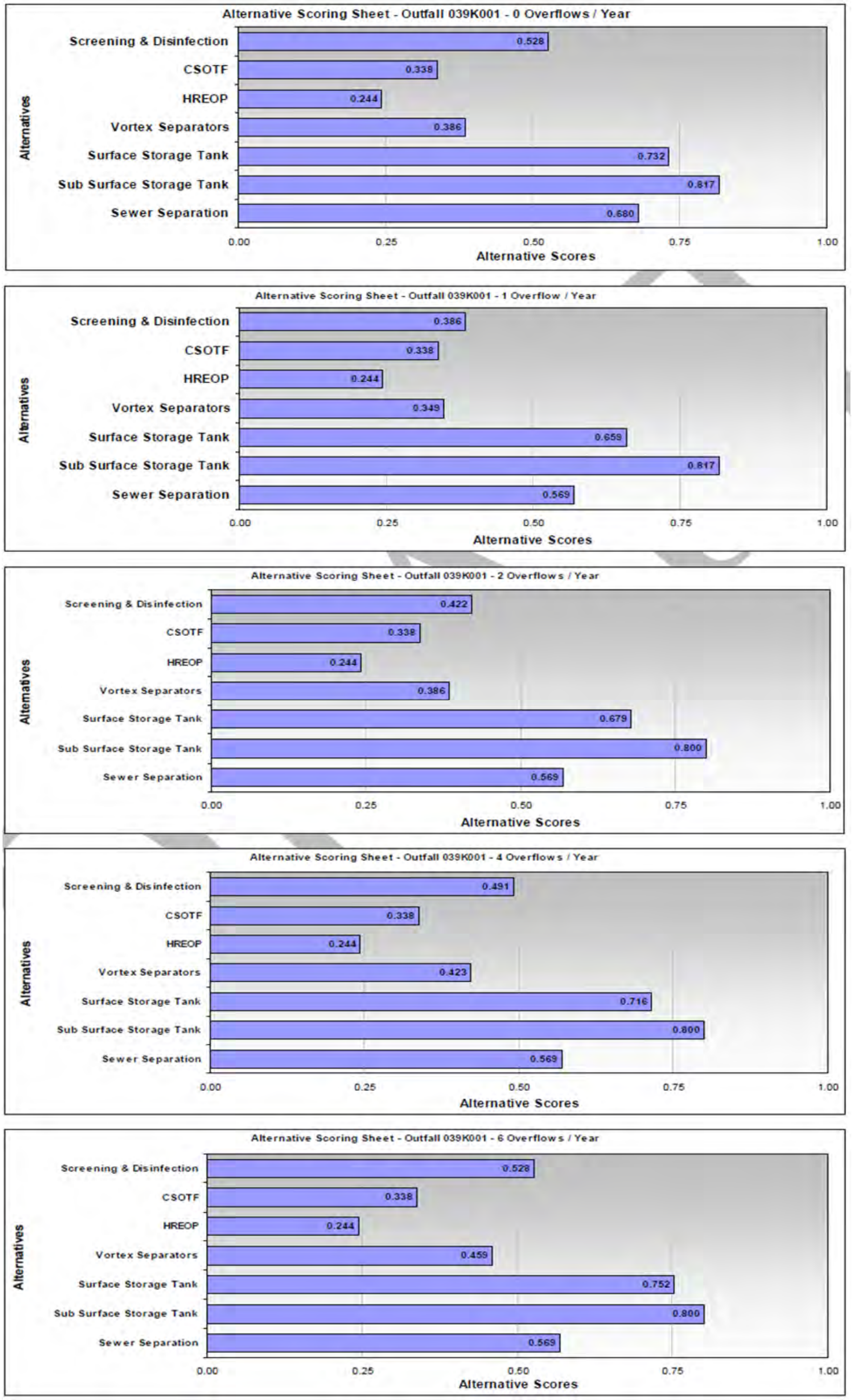
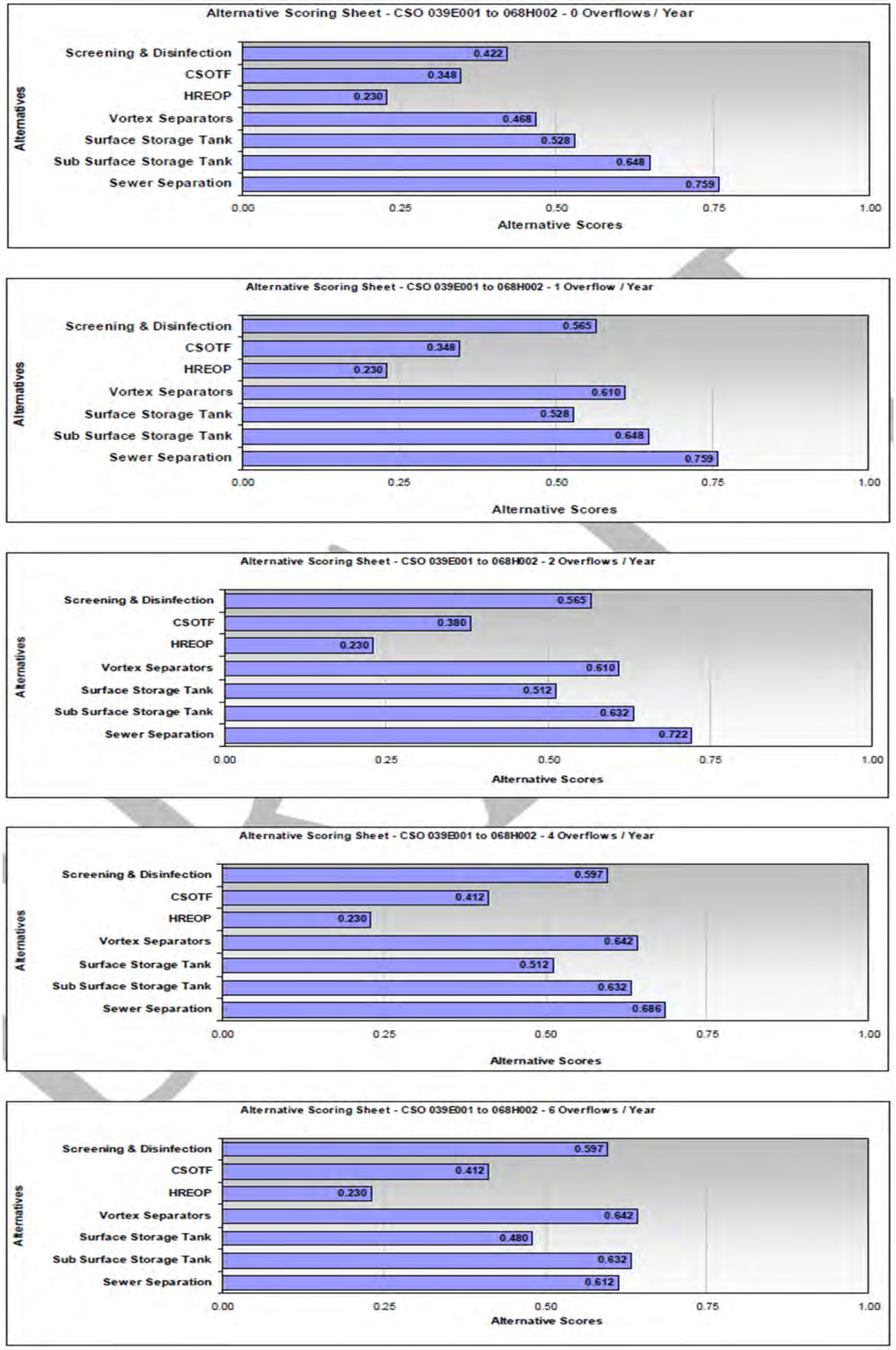


FIGURE 4-4D: ALTERNATIVE SCORING - OUTFALLS 039E001 TO 068H002



4.4.2 Regional Control Alternatives

C-25: Bells Run: The results of the regional control alternative evaluation process are shown below in *Figure 4-5a.* For control levels 0 through 6, it is recommended that Alternative *S2-Bells Run Sewershed: Sub-Surface Storage* be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

C-25 to C-29 Region: The results of the regional control alternative evaluation process are shown below in *Figure 4-5b: Alternative Scoring –* C-25 to C-29 *Region.* For control level 0, it is recommended that Alternative T4- C-25 to C-29 Region: Screening and Disinfection be carried forward and re-evaluated with the results of the system-wide alternatives analyses. For control levels 1 through 6, Alternative CS4-C-25 to C-29 Region: Sewer Separation was the highest ranked CSO control alternative. However, because the sewer separation alternative is significantly higher in cost than the other alternatives, it is recommended that the second highest ranked alternative for control levels 1 through 6, T4- C-25 to C-29 Region: Screening and Disinfection, be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

4.4.3 Sub-System Control Alternatives

Chartiers Creek: The results of the sub-system control alternative evaluation process are shown below in Figure 4-6. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It is recommended that CC-3: Tunnel Storage for control level of 4 events per year, be carried forward as part of the Chartiers Creek component of the PWSA overall System-Wide alternative.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative CC-3: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative CC-3* included only those components required to deliver flows to the C-25 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the C-25 POC would become the responsibility of ALCOSAN.

FIGURE 4-5A: ALTERNATIVE SCORING – C-25: BELLS RUN REGION

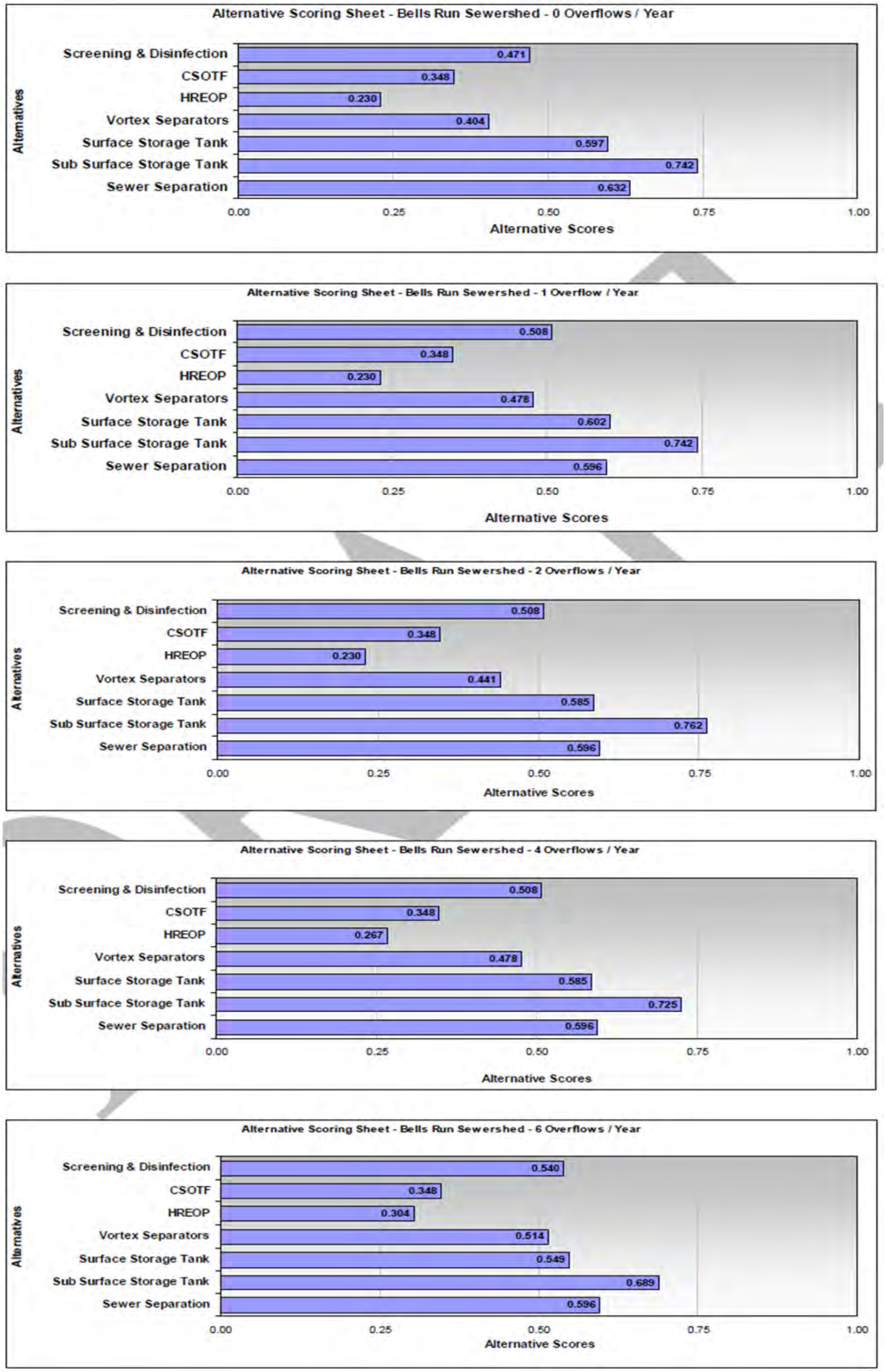


FIGURE 4-5B: ALTERNATIVE SCORING – C-25 TO C-29 REGION

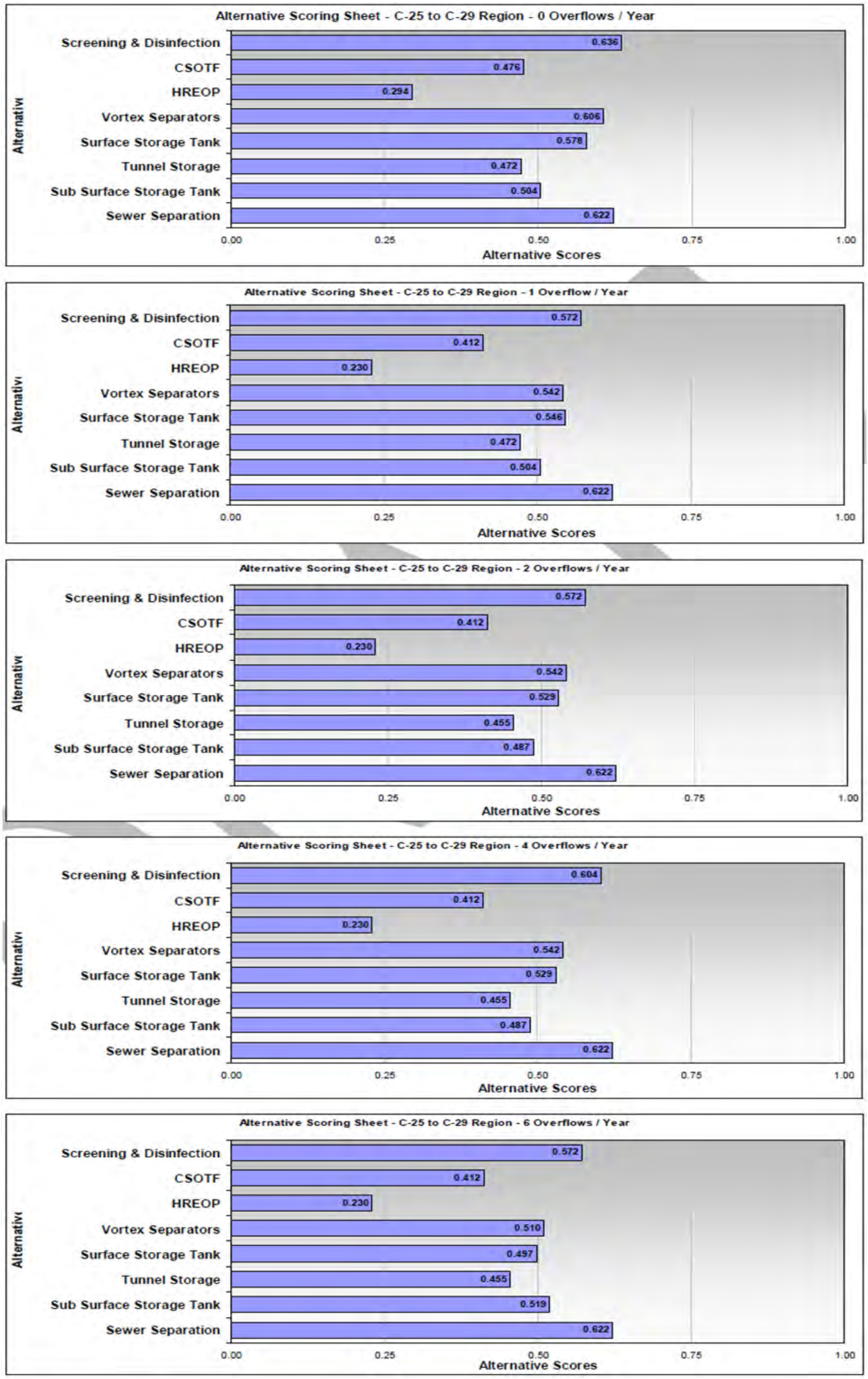
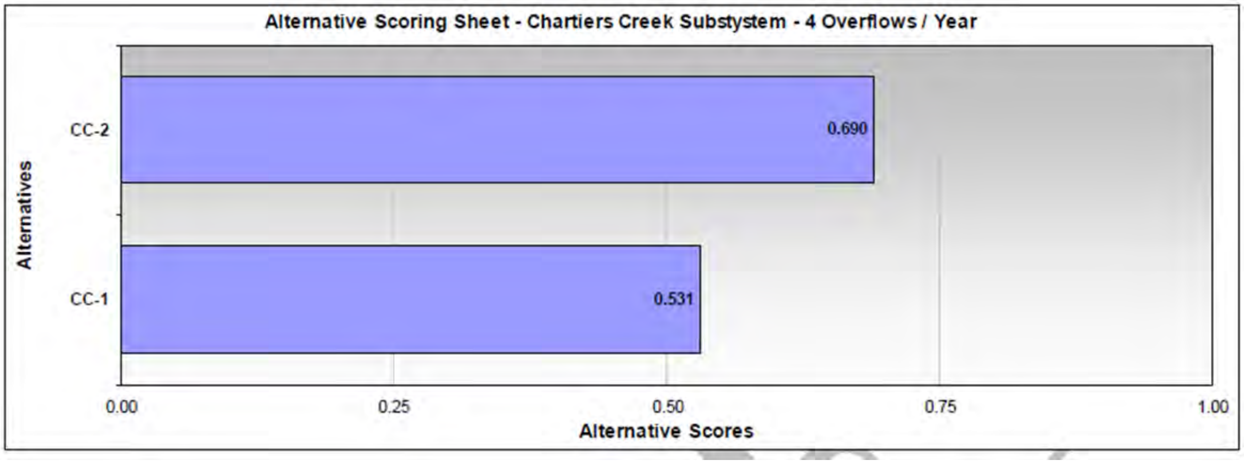


FIGURE 4-6: C-25: ALTERNATIVE SCORING – CHARTIERS CREEK SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Bells Run sewershed would best be accomplished by implementing *Alternative CC-3: Tunnel Storage*. Within the C-25 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the five PWSA permitted CSOs to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the C-25 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative CC-3* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-C25-C-0*, *POC-C25-C-4* and *POC-C25-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **C25 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.

- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the C-25 POC without significant manhole surcharging and flooding.

Crafton Borough has indicated that they are considering removing the Crafton flow from the Kingston Area from the C-25 POC. This may be accomplished by either removing some flow from C-25 (via the removal of inlets) or by directing all existing flow to C-24. The impact of these actions, should they occur, will be considered during the finalization of the design of the system improvements and during the negotiation of final cooperative agreements.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the C-25 sewershed is four untreated overflows per year. The recommended control alternative for the C-25 Bells Run sewershed has been designated as POC-C25-C-4. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **C25** The C-25 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **4** The selected level of control is four untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of four (4) untreated overflows per year, the required consolidation / conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-C25-C-4 are summarized in Table C25-5-1.

TABLE C25-5-1: ALTERNATIVE POC-C25-C-4 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
C-25	DC039E001	039E001	C*	4
	DC039J001	039J001		
	DC039L001 DC039M001 DC039M002 DC040R001 DC040R002	039K001		
	DC068H001	068H001		
	DC068H002	068H002		

*To be achieved via additional conveyance piping and regulator modifications.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, any stream removal projects that may be included, its integration with the ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-C25-C-0 and/or POC-C25-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. Both analyses determined that the optimal method of increasing the level of control of CSO overflows in the C-25 sewershed would be to reduce the number of overflows by conveying the additional wastewater to the ALCOSAN point of connection. To accomplish this, the PWSA and/or their tributary municipalities must:

- Modify existing diversion structures to achieve desired level(s) of control.
- Construct additional consolidation piping to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

For each of the diversion structures in the C-25 sewershed, the H&H model was employed to identify the type and extent of modifications required to achieve four overflows during the typical year.

The required modifications to the flow diversion settings were determined by the current typical year overflow statistics. Table C25-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control. The upstream municipalities of Green Tree Borough and Crafton Borough are tributary to many of the PWSA CSO diversion structures. Future changes to Green Tree tributary flows are not anticipated to have an impact on the planned diversion structure modifications. Crafton however, through the Memorandum of Understanding Process (MOU) discussed in more detail in Section 6 of this POC report, determined that there are two inlets along Kingston Avenue that can easily be removed from the system and be outletted directly to an adjacent stream. Willard Avenue contains no inlets and should therefore be considered as functioning as a separate sanitary sewer system. The only remaining true combined C-25 sewershed area would be along Baldwick Road. Per Crafton, this new characterization of the two areas from Crafton flowing to PWSA and C-25 reduces the perceived flow contribution from these areas.

TABLE C25-5-2: ALTERNATIVE POC-C25-C--(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC039E001	Diversion structure replacement*	9.0	No change	No change
DC039J001	Diversion structure replacement*	11.0	No change	No change
DC039L001	Diversion structure replacement*	25.5	No change	No change
DC039M001	Diversion structure replacement*	100.0	33.3	15.9
DC039M002	Diversion structure replacement*	18.5	6.4	2.7
DC040R001	Diversion structure replacement*	4.3	0.04	No change
DC040R002	Diversion structure replacement*	2.0	No change	No change
DC068H001	Diversion structure replacement*	16.0	1.9	0.6
DC068H002	Diversion structure replacement*	65.0	7.5	2.7

*The installation of screening is planned for all PWSA diversion structures.

As can be seen from the table, new consolidation piping to convey flows at the four OF/yr level of control must be designed to carry flows ranging from 0.1 to 34 mgd.

5.1.2 Consolidation Piping

The H&H model was employed to identify the capacity improvements necessary to consolidate and convey increased flows from the existing diversion structures to the C-25 POC. The modeling was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the C-25 POC without significant manhole surcharging and flooding. These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008)* that anticipated the construction of consolidation / relief sewers to supplement the capacity of the existing trunk sewer system.

It was anticipated that the required increase in conveyance capacity would be achieved by constructing parallel relief sewers designed to convey flows associated with four overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Note that the upstream municipality of Green Tree Borough has not reported any plans to modify their system to reduce their tributary flows. As previously stated, Crafton determined that there are two inlets along Kingston Avenue that can easily be removed from the system. Willard Avenue contains no inlets and should therefore be considered as functioning as a separate sanitary sewer system. Per Crafton, this new characterization of the two areas from Crafton flowing to PWSA and C-25 reduces the perceived flow contribution from these areas.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table C25-5-3 and in Figure C25-5-1.

TABLE C25-5-3: POC-C25-C-4 CONSOLIDATION PIPING

Diameter (in)	Length (ft)
12	83
30	6,998
36	5,789

*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

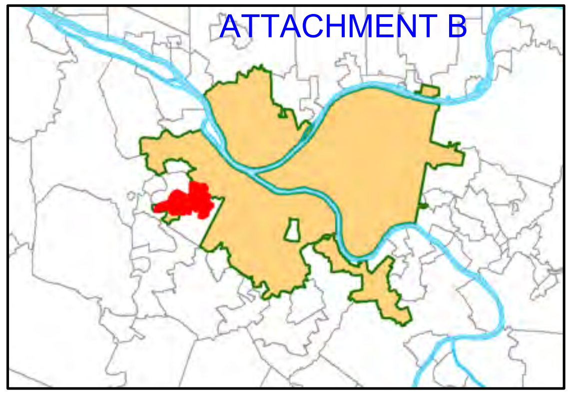
5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table C25-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 26 MG in the typical year.

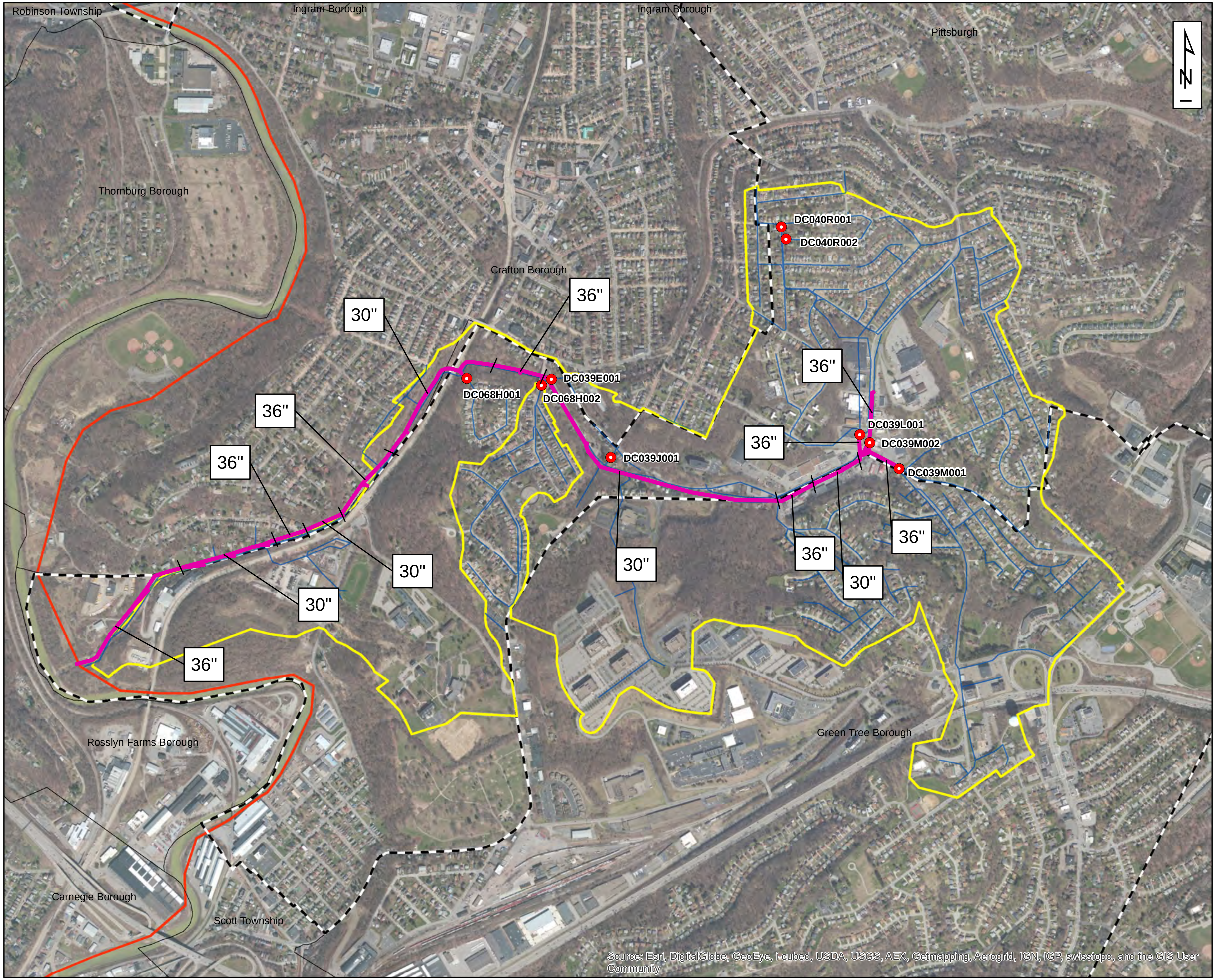
TABLE C25-5-4: C-25 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name					
	POC-C25-C-0		POC-C25-C-4		POC-C25-C-10	
	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)
DC039E001	0	0	1	0.1	5	0.1
DC039J001	0	0	2	0.1	7	0.4
DC039L001	0	0	2	0.1	10	0.7
DC039M001	0	0	3	1.1	7	2.5
DC039M002	0	0	4	0.5	4	0.7
DC040R001	0	0	3	0.1	10	0.2
DC040R002	0	0	2	0.01	2	0.01
DC068H001	0	0	4	0.2	8	0.3
DC068H002	0	0	3	0.6	10	1.3
Total Volume		**0**		**2.8**		**6.2**

ATTACHMENT B



PWSA Service Area Overview



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- ● PWSA Diversion Structure Modification
- Relief/Consolidation Sewers
- Collector Sewer
- C-25 Sewershed Boundary
- PWSA Service Area Boundary
- Municipal Boundary
- River

Existing ALCOSAN Interceptor

- Deep Tunnel
- Shallow Cut

1,000 500 0 1,000 Feet

Figure C25-5-1: POC-C25-C-4 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\BELLS RUN (C-25)\FIGURE 5-1_C-25.mxd

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The combination of regulator modifications and additional consolidation piping will result in increased flow rates and volumes to the C-25 POC. Peak flow rates to the C-25 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-C25-C-0, POC-C25-C-4 and POC-C25-C-10 are presented in Figure C25-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the C-25 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table C25-5-5.

FIGURE C25-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE C-25 POC

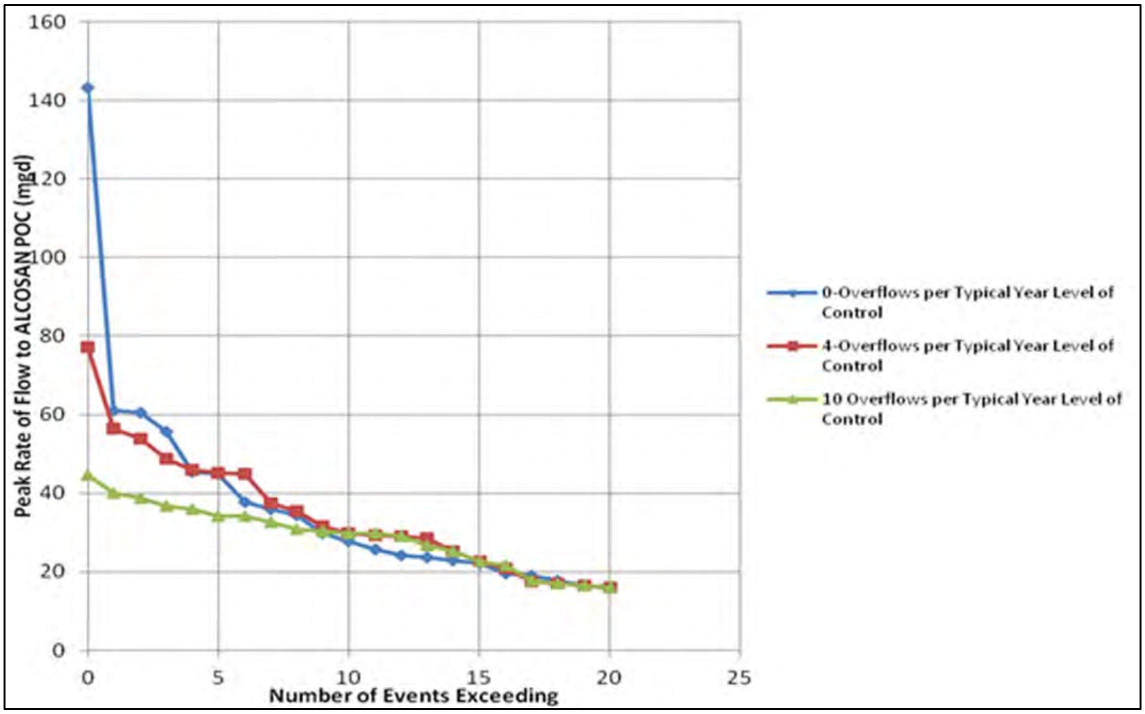


TABLE 5-5: C-25 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-C25-C-0	128.6	172.9	302.3	7.9	9.9	12.9
POC-C25-C-4	78.7	92.4	118.4	7.0	7.8	9.6
POC-C25-C-10	46.4	48.4	53.2	5.7	6.7	7.7

5.1.5 Recommended Control Alternative Integration

In the spring of 2013, 3 Rivers Wet Weather facilitated a series of meetings between the PWSA and the municipalities tributary to this sewershed. All associated parties in the POC sewershed have participated in these planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements.

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. Please note while Crafton has agreed to the idea of sharing costs, they have not agreed to the proposed cost allocation or flow contribution estimates. The sections of Crafton that are flowing to C-25 are not functioning as a typical “combined sewer system.” Therefore, Crafton Borough will use future metering to quantify the actual flows being contributed to C-25 from Crafton Borough. Crafton expects these results will reduce and/or correctly reflect the actual flow contribution and resulting cost allocations to Crafton for C-25. Green Tree Borough has also informed PWSA, via e-mail dated July 12, 2013, that they have decided against the MOU format. MOU updates can be found in Addendum S15-6-1.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-C25-C-4 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through the construction of parallel relief sewers designed to convey flows associated with four overflows per typical year, under 2-year design storm conditions (4 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the C-25 sewershed, both before and after implementation of the recommended alternative:

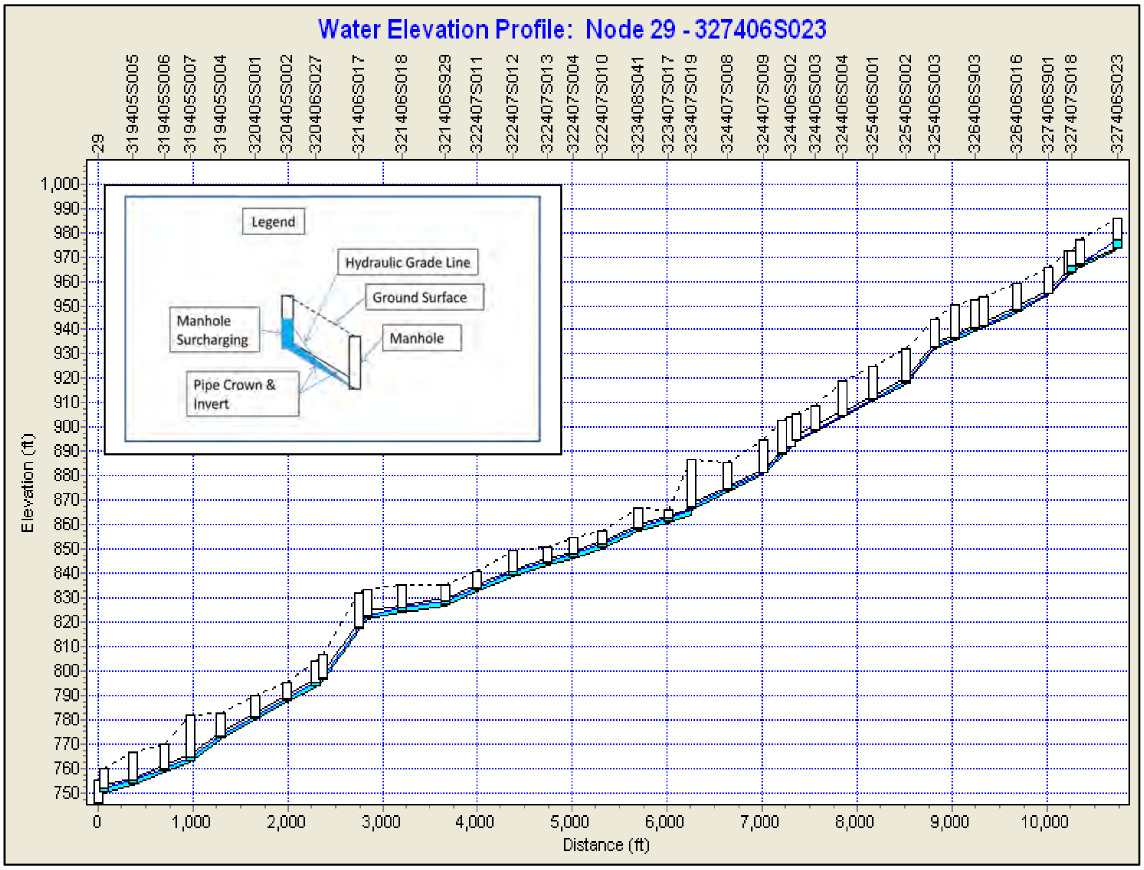
- Peak flow hydraulic grade line (HGL) of the trunk sewer
- 2046 peak flows and volumes to the C-25 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figure 3 from that report presented a profile of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. This figure is reproduced below as Figure C25-5-3. Under the current system configuration, including existing CSO diversion chamber settings, flows are conveyed through the system with no surcharging. This indicates that the system operates acceptably under projected 2-year design storm conditions.

The HGL along the main trunk sewer following implementation of alternative POC-C25-C-4 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with four overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, modification of the diversion structures combined with additional conveyance capacity (4 OF/yr; 2-yr storm) will satisfactorily control manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE C25-5-3: C-25 MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



5.2.2 2046 Peak Flows and Volumes to C-25 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the PWSA system. ALCOSAN made similar assumptions[1], and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve four overflows per typical year, as well as additional consolidation piping to convey increased flows to the C-25 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the C-25 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances from ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This compares well with the PWSA's water quality based decision to recommend a four (4) OF/yr level of control within the Chartier's Creek planning basin.

The control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the C-25 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from the Green Tree Borough indicates that they plan to convey all their flows to the C-25 trunk sewer for the duration of the planning period. They have no plans to implement controls that would alter the modeled flows upon which the recommended alternative was based. Crafton is proposing to remove two upstream inlets from the system along Kingston Avenue and change the flow type designation along Willard Avenue since it contains no inlets and functions as a separate sanitary sewer system. Per Crafton, this new characterization of the two areas from Crafton flowing to PWSA and C-25 reduces the perceived flow contribution from these areas. This information is summarized in Table C25-5-6.

TABLE C25-5-6: C-25 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

Tributary Municipality	Volume*		
	Captured	Treated	Conveyed
Green Tree Borough	N/A	N/A	All modeled flows
Crafton Borough	N/A	N/A	All modeled flows; excluding proposed modifications to Kingston & Willard Ave.

*Following implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve four overflows per typical year, as well as increased conveyance piping to convey increased flows to the C-25 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first five years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

As the primary flow contributor within this sewershed, the PWSA intends to extend the incorporation of IWP to the entire sewershed. The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of regulator modifications and additional consolidation piping designed to control CSOs from the PWSA diversion structures to four overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the C-25 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-C25-C-4 are consolidation piping, CSO screening facilities, and diversion structure modifications. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment C25-5-1.

5.4.1 Consolidation Piping

In the C-25 sewershed, additional conveyance capacity was provided through the use of parallel relief sewers to convey flows to the C-25 POC. As detailed earlier, relief sewers were added to areas of the system that exhibited manhole flooding or surcharging to within three feet of the crown of the manhole at any time during the 24-hour design storm events. All improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewer.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street

5.4.2 CSO Screening Facilities

It was assumed that each outfall location will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

It was assumed that adjustments to existing regulator settings, including more effective and improved methods of flow control and monitoring, improved access, etc., would be sufficiently extensive as to make it more cost effective to simply replace each structure. The unit cost associated with the installation of each new diversion structure was assumed to be $200,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $360,000.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure C25-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. A slight "knee of the curve" is evident at the 4 OF/yr data point on all three curves.

These costs are also presented in a tabular format in Table C25-5-7.

The selected level of CSO control - 4 OF/yr - was determined based upon water quality considerations. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-C25-C-4 are summarized in Table C25-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE C25-5-4: C-25 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

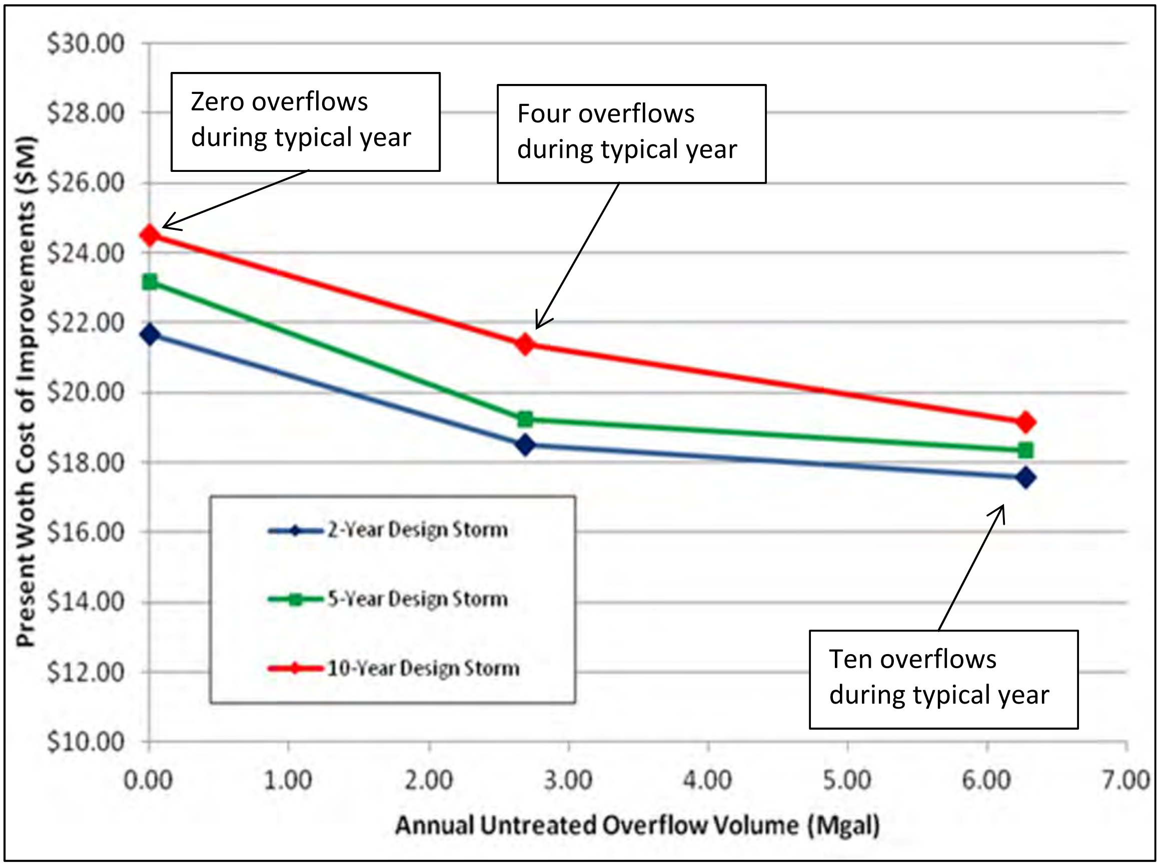


TABLE C25-5-7: C-25 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	**CSO Control**				
	Untreated CSO Volume (MG)	**CSO Control Level (OF/yr)**	**PW Capital Cost ($MM)**	**PW O&M Cost* ($MM)**	**TPW CSO Control ($MM)**
POC-C25-C-0	0	0	$21.3	$0.4	$21.7
POC-C25-C-4	2.7	4	$18.1	$0.4	$18.5
POC-C25-C-10	6.3	10	$17.2	$0.4	$17.6
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-C25-C-0	0	2-year	$0	$0	$0
POC-C25-C-4	0	2-year	$0	$0	$0
POC-C25-C-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE C25-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-C25-C-4

Capital Improvements	Size/ Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Replace diversion structures: DC039E001 DC039J001 DC039L001 DC039M001 DC039M002 DC040R001 DC040R002 DC068H001 DC068H002	4 OF/yr Each	$3.24	$3.24	$3.28
Add screening to diversion structures: DC039E001 DC039J001 DC039L001 DC039M001 DC039M002 DC040R001 DC040R002 DC068H001 DC068H002	0.04 to 33.3 mgd overflow rates	$4.05	$4.05	$4.09
Conveyance piping	12-in dia.	$0.08	$0.08	$0.08
Conveyance piping	30-in dia.	$4.71	$4.71	$4.87
Conveyance piping	36-in dia.	$6.05	$6.05	$6.18

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA and their tributary municipalities have agreed that the basis of allocation for future operation and maintenance costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the C-25 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new

wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC C-25 overflow is intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the "Selected Plan" to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the "Recommended Plan". This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the "Selected Plan" is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

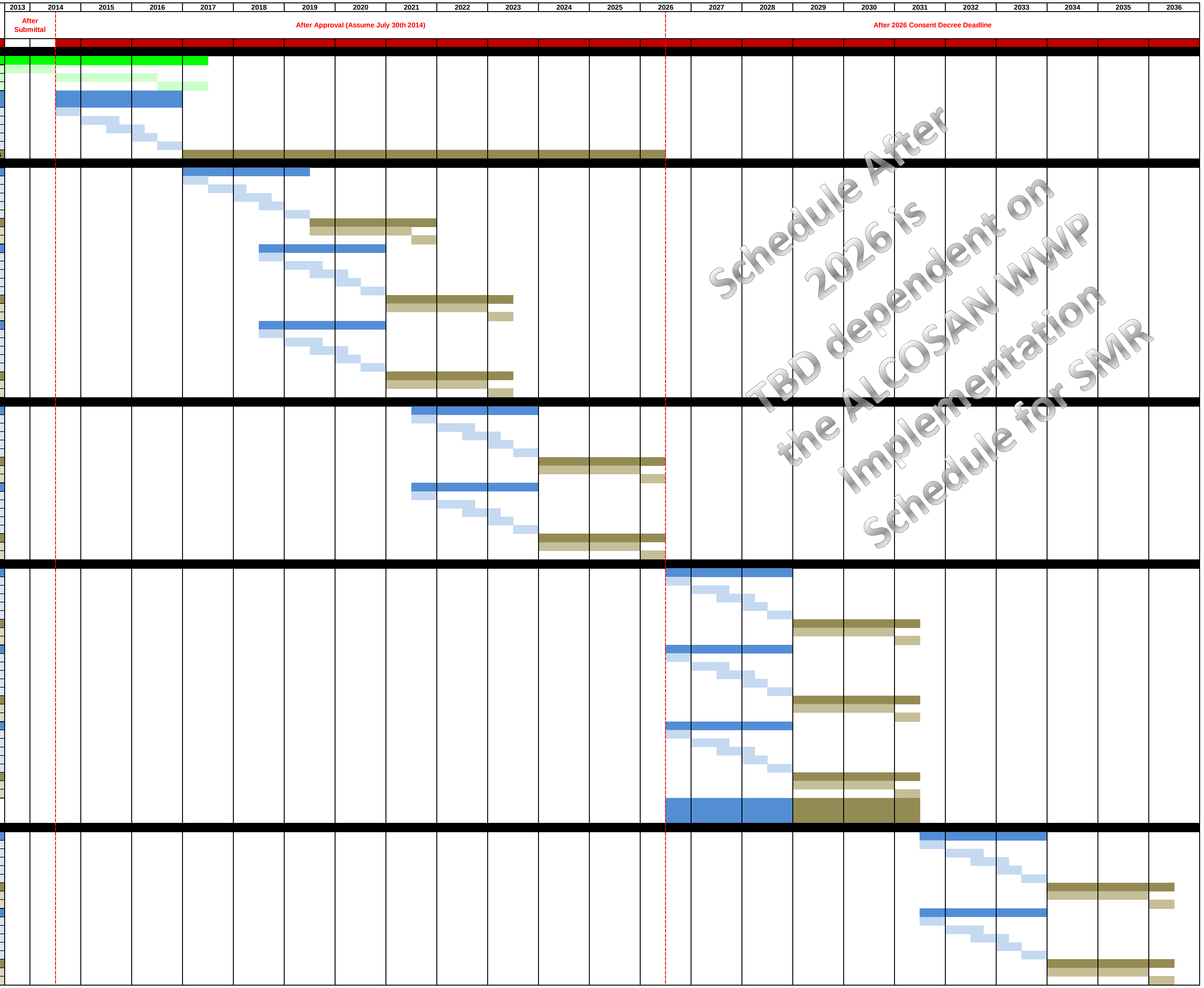
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it's important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the Ohio River tunnel segment and the Chartiers Creek conveyance facilities extending toward C-25 portion of the regional plan is being implemented by 2022 And the mid-2026 respectively. Per PWSA's implementation schedule, C-25 is included in Phase 2 (2017 to mid-2023) due to the preference to follow the design /construction of the ALCOSAN Ohio River tunnel segment and the Chartiers Creek conveyance facilities as well as to apply considerations for balanced distribution of costs and resources throughout the duration of the implementation schedule.

ATTACHMENT B

FIGURE C25-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the C-25 sewershed. These considerations include Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Green Tree Borough, Crafton Borough, and the Pittsburgh Water and Sewer Authority. Other considerations regarding the C-25 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the "2-year design storm" for the municipal separate sanitary system portions and "4 OF/ typical year" for the PWSA's combined system outside of Saw Mill Run where "0 OF/ typical year" is proposed.

A set of guiding principles were produced for use in developing cost allocation procedures. These principles form the basis of a DRAFT Memorandum of Understanding by and between Green Tree Borough, Crafton Borough, and the Pittsburgh Water and Sewer Authority, and include:

- The major goal is to develop a fair and equitable cost allocation process.
- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.

- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.
- Cost allocations should be simple and easy to calculate in the future.
- The final cost allocation methodology should encourage efficiencies between municipalities.
- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.
- Unless agreed to by all parties, existing contracts should not form the only basis for cost allocations.

6.1.1 Cost Sharing Concept and Method

Two distinctive categories of cost allocations will need to be addressed by the PWSA and their tributary municipalities: capital cost allocations and O&M cost allocations. A number of methods for capital cost allocation were considered, based on the following:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution
- Proportion of internal municipal costs

All of these approaches could be modified by the addition of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc. The following discussion describes each of these methodologies.

"Agreed Upon" Basis: This approach could be as simple as each party agreeing to a fixed share of each element of cost or all costs across the board. Negotiation of the basis of the percent share is left to the discretion of the involved parties. Shares could be fixed for the term of the agreement, or they could be adjustable on a scheduled or otherwise agreed to basis. This approach is usually successful where

there are existing agreements or a long history of collaboration between the affected parties.

Capacity Basis: Capacity based cost sharing is predicated on the design capacity of the shared facilities and the portion that is allocable to the various parties to the Agreement. For the types of facilities being evaluated, wet weather flow rate and volume would be the primary capacity parameters. A Design Engineer's Report, normally submitted as part of the construction permitting process, should clearly specify and set forth the flow rate and volumetric design basis, as well as the capacity needs associated with all municipal entities. This information can serve as the basis for pro rata distribution of cost elements such as Debt Service and initial costs. One issue that should be addressed is how and whether unused and/or excess capacity utilized by "others" will be subject to cost reimbursement.

Expected Annual Flow Contribution: This method would utilize estimated flow rates for a predetermined average year as the basis for the evaluation of cost allocations. This may work well for systems where a hybrid approach of wet weather flow rate and volume is desired.

Proportion of Internal Municipal Cost: This approach requires municipalities to evaluate their own internal projects. This evaluation would include outlining control alternatives and selecting the highest ranked alternative for their internal solution. The municipalities' share of the combined project becomes a "not-to-exceed" or proportional value of its internal cost to the total regional cost.

6.1.2 Evaluation and Selection of Capital Cost Allocation Methodology

Four sewersheds, not including the C-25 POC sewershed, were selected by 3RWW and their PM Team as pilot sewersheds for cost allocation evaluations. Monthly meetings were held at which the meeting attendees selected the methodologies that they thought were appropriate, and the 3RWW/PM Team provided the necessary statistics for use in evaluating and selecting the best methodology.

Statistics intended to support the various allocation methodologies were developed and discussed with each POC participant. Over the course of several meetings, the major point of discussion was the identification of ways to ensure the allocation was fair and equitable by assigning the costs proportionally to the cost-causative items. In addition, participants agreed with the idea that it would not be fair for

downstream municipalities pay for upstream sections of the project, given that they did not contribute flows directly into that sewer.

Following these discussions, the first decision regarded the need to use peak wet weather flows as the basis for the cost allocation. The PM Team evaluated three main types of peak flow based analysis:

Percentage of Flow at POC: In this approach, the total flows at the POC and at each connection point tributary to the POC are obtained from the H&H Model. The flow rate for each connection point is then divided by the total POC flow to obtain its ratio. This represents the connection point's portion of the total cost of the regional project. It should be noted that portions of the project dedicated to a single municipality would be subtracted from the total cost of the regional project.

Percentage by Length of Use: In this approach, the distance from the POC is used as a "weighing factor" in the cost allocation calculation.

Segmental: In this approach, areas that are tributary to a project or a portion of a project would divide the cost based on peak wet weather flow rates from each tributary area.

In all of the cost allocation procedures, the calibrated ALCOSAN H&H Model was the accepted tool for determining peak flow rates. In some cases where two or more municipalities were combined into one loading point, the agreement was to use the model to affect the required split through RTK and area adjustments (if separate) and area adjustment (if combined).

6.1.3 Operation & Maintenance Cost Allocation

In the development of O&M cost allocation methods, it is important to define what constitutes O&M. The following is a general list of those items considered for each POC sewershed:

- Sewer Inspection
- CCTV and cleaning
- Utilities and power requirements for pump stations and storage basins
- Chemical costs for CSO facilities

- Minor repair and rehabilitation
- Staff salaries, wages and fringe benefits
- Replacement costs (sewers and structures - 100 years; mechanical equipment – 25 years)
- SSO Response Plan

The next step was to categorize these expenses into at least groups – those items impacted by peak flow (such as CCTV and sewer cleaning) and those items impacted by volume of wastewater (such as storage basins). Once categorized, various methodologies for O&M cost allocation could be investigated. A number of approaches to O&M cost allocation were considered, and three of those chosen for capital cost allocation were also chosen for O&M cost allocations:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution

As was the case for the capital cost allocation methods, each of these approaches can be modified by the application of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc.

6.1.4 Selected Capital Cost Allocation Method

The selected method of capital cost allocation between the PWSA and their tributary municipalities is based upon the use of peak wet weather flows, as determined using the segmental approach.

Using this approach, areas of each municipality tributary to a section of new consolidation / conveyance piping would divide the cost based on peak wet weather flow rates from each municipal tributary area. The calibrated ALCOSAN H&H Model was the accepted tool for use in determining those peak flow rates.

For the purposes of this Feasibility Study, alternative POC-C25-C-4 has been divided into eight (8) segments. Seven (7) of these segments receive flows from one or more tributary municipalities, and are subject to the allocation of capital costs. The remaining segment conveys flows generated solely by the City of Pittsburgh. General locations of the seven (7) inter-municipal segments of the recommended alternative are illustrated in Figure C25-6-1.

It is proposed that the conceptual capital cost allocation estimates for each segment will be based on the municipal peak wet weather flow percentages shown in Table C25-6-1. While Crafton Borough has generally agreed to the methodology used develop the recommended projects, they have not agreed to the cost allocation or flow contribution pending potential changes to flows associated with flows from the Kingston Area.

TABLE C25-6-1: MUNICIPAL PEAK WET WEATHER FLOW PERCENTAGES

Segment	Percentage (%)		
	PWSA	Green Tree Borough	Crafton Borough
1	100	0	0
2	80.0	20.0	0
3	94.4	0	5.6
4	87.3	10.8	1.9
5	83.0	15.2	1.8
6	80.1	11.3	8.6
7[1]	Not Provided	Not Provided	Not Provided
8	76.1	9.1	14.8

[1] The Kingston Street area (part of project 7) is proposed by Crafton to be re-routed to the C-24 POC system. Flow percentages and capital cost allocation must be recalculated without the Kingston Street area.

If work is done by a municipality to reduce flow below the flows currently predicted and the municipality wants to revise these percentages, that municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other parties prior to the commencement of design. Crafton Borough has indicated that they are considering removing the Crafton flow from the Kingston area from the C-25 POC. This may be accomplished by either removing some flow from C-25 (via the removal of inlets) or by directing all existing flow to C-24. The impact of these actions, should they occur, will be addressed using this mechanism.

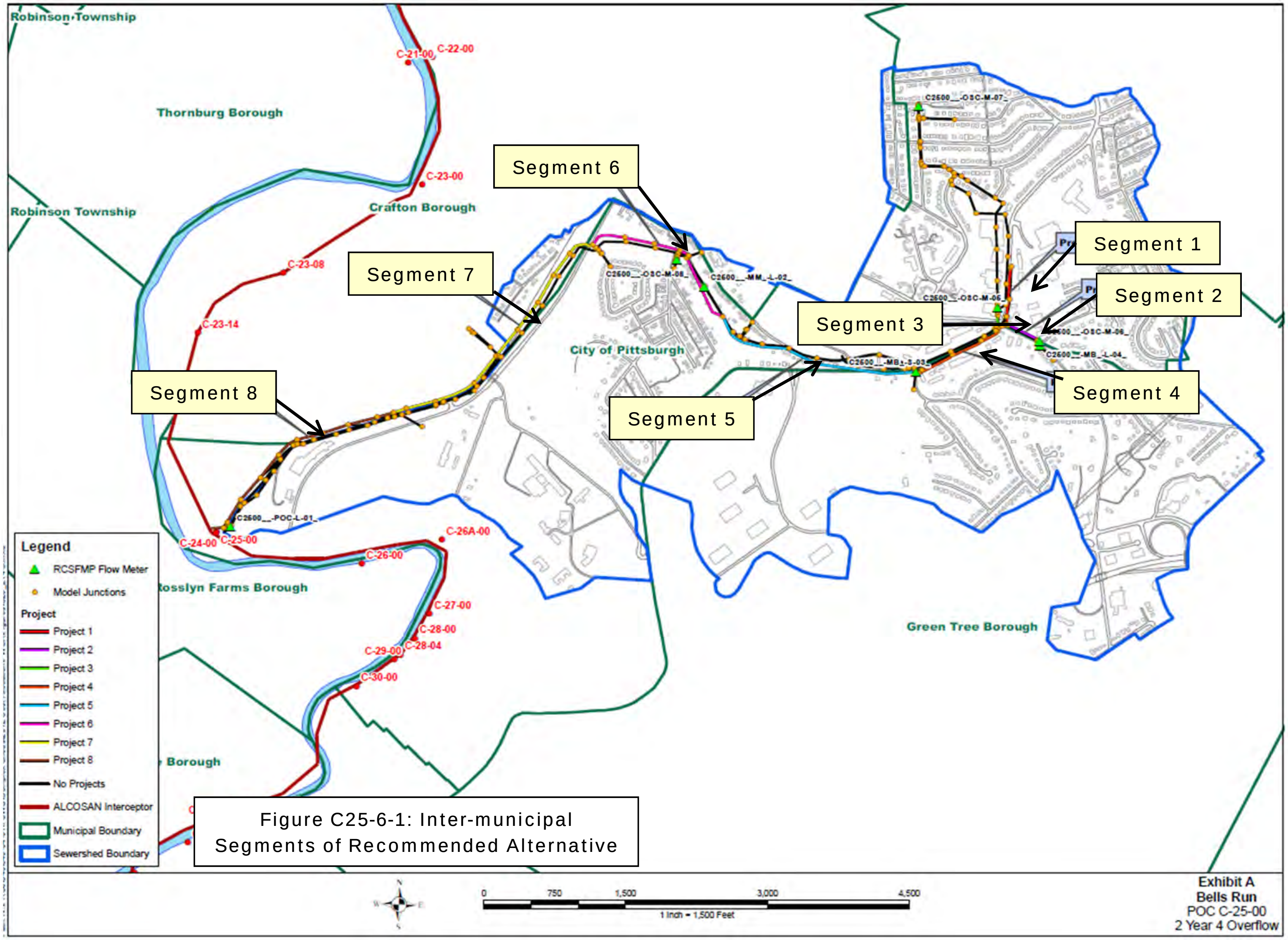


Figure C25-6-1: Inter-municipal Segments of Recommended Alternative

6.1.5 Selected O&M Cost Allocation Method

For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

One of the early steps taken to facilitate the development of up-to-date and relevant MOUs and/or inter-municipal agreements was to determine whether or not there were any existing, applicable MOUs or service agreements. 3RWW, working with the University of Pittsburgh, collected many of the existing agreements. The FSWG also formed an inter-municipal agreements subcommittee to review those existing agreements, develop an agreement outline for use by the municipalities, and prepare draft agendas for use in multi-municipal meetings.

The various inter-municipal agreements that have been compiled by 3RWW were reviewed for the purpose of summarizing the provisions that are relevant to allowable flow contributions. The results of this review are presented below. All specific references to “sanitary sewers”, “sanitary sewage” or other characterizations of the tributary sewer systems were extracted and presented below. In addition, specific information regarding cost sharing arrangements was also extracted from the agreements and is presented below.

1. In an agreement dated July 3, 1950, the City of Pittsburgh and Green Tree reached an agreement. Relevant terms of that agreement are:
    - Green Tree is given permission to discharge **“the sewage”** from 38 acres southeast of Noblestown Road near the intersection of School Street opposite Baldwick Road into the City Bells Run Trunk Sanitary Sewer;
    - Green Tree agrees to pay the City $3,600.00 upon connection;
    - “The City agrees to maintain and keep in repair the Bells Run Trunk Sanitary Sewer within the City limits, to reconstruct or extend as may be necessary in the future, and the Borough agrees to pay 1.00% of such costs….The necessity for any of the above work and the cost of the same will be determined by the Director of the Department of Public Works.”

2. In an agreement dated October 3, 1956, the City of Pittsburgh and Green Tree reached an agreement. Relevant terms of that agreement are:
   - Green Tree is given permission to discharge **"sanitary sewage"** from 25.81 acres in the School Street and Poplar Street Drainage areas into the Bells Run Trunk Sanitary Sewer System in the City of Pittsburgh;
   - Green Tree agrees to pay the City $705.10 upon connection;
   - "The City agrees to maintain and keep in repair the Bells Run Trunk Sanitary Sewer within the City limits, to reconstruct or extend as may be necessary in the future, and the Borough agrees to pay 0.60% of such costs….The necessity for any of the above work and the cost of the same will be determined by the Director of the Department of Public Works."

An update to this agreement was reached, even though a date for the agreement is not provided. The agreement includes the following relevant terms:

- Green Tree is given permission to discharge **"the sewage"** from 149.24 acres in the vicinity of School Street and Poplar Street (area C) and in the vicinity of Noblestown Road (area D) into the Bells Run Trunk Sanitary Sewer System in the City of Pittsburgh;
- Green Tree agrees to pay the City $4,077.24 upon connection;
- "The City agrees to maintain and keep in repair the Bells Run Trunk Sanitary Sewer within the City limits, to reconstruct or extend as may be necessary in the future, and the Borough agrees to pay 3.49% of such costs….The necessity for any of the above work and the cost of the same will be determined by the Director of the Department of Public Works."
- "The Borough of Green Tree agrees to cooperate to the extent of the total of the percentage involved in the proportionate areas of Green Tree and the City of Pittsburgh when and if it becomes necessary to construct a relief sewer or reconstruct a portion of the main sewer"

3. In an agreement dated April 2, 1963, the City of Pittsburgh and Green Tree reached an agreement. Relevant terms of that agreement are:
   - The City and Borough agree to reconstruct certain storm and **sanitary** sewers and manholes at the intersection of Poplar Street and Karns Avenue;
   - "The City and Borough agree that all costs chargeable to the project shall be borne by the parties as follow:

a. That the costs of the intersection chamber shall be borne by the borough.

b. That the costs of the diversion chamber and sewer reconstruction incidental thereto, shall be borne 75% by the City and 25% by the Borough."

4. In an agreement dated December 13, 1982, the City of Pittsburgh and Green Tree reached an agreement. Relevant terms of that agreement are:
   - Green Tree is given permission to discharge **"sanitary sewage for residents and occupants of buildings and structures"** in the Foster Plaza Development Plan to the City of Pittsburgh's Bell's Run Trunk Sewer;
   - Green Tree is authorized to construct a storm sewer to relocate a portion of Bell's Run Creek;
   - Green Tree agrees to remove a storm sewer connection to the City sanitary sewer.
   - Green Tree agrees to make a one-time payment of $3,750.

It should be emphasized that the agreements listed above are not anticipated to be used as the inter-municipal agreements for this project. The draft MOU developed per the following subsections would serve as an initial understanding of what would form a new future agreement between the municipalities.

6.2.1 Development of MOU and Inter-Municipal Agreements

When more than one municipality is involved in the design, construction and operation of wet weather control facilities, it is intended that they will develop inter-municipal agreements to outline their mutual understanding of the project as well as their municipal, customer and legal responsibilities. These responsibilities include, but are not limited to, joint permitting, joint ownership, joint cost sharing, and who will operate and maintain the facility on a long term basis.

In addition, it is the PWSA's position that any agreements or MOUs should contain provisions for periodic review and amendment as necessary by the respective parties and their solicitors.

6.2.2 MOU and Inter-Municipal Agreements

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. It is currently being reviewed by each of the parties.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

In summary, the draft MOU states that, for the purpose of submitting the feasibility study, the municipalities agree that the preliminary estimated total cost to be expended on the inter-municipal segments of the recommended alternative, as shown in Figure C25-6-1, is $10,840,000. This cost represents the cost associated with the elements of the required improvements in the sewershed that provide multi-municipal service (i.e. convey or otherwise handle flows generated by more than one municipality). Each municipality shall have the right to void the MOU if the total cost exceeds $13,000,000. The draft MOU also states that the municipalities agree that the basis of allocation for costs of each segment is based on percentage of peak flow contributed to each segment at the time of the MOU, multiplied by the preliminary estimated total cost of each segment agreed to by the municipalities that will share in such costs.

It is intended that an agreement will be entered into by all parties after an implementation order has been issued by the PADEP and/or the ACHD. Such an order would indicate that the cost to each party would be based on the cost of each segment, to be adjusted for changes in costs made during construction.

The draft MOU further states that, for the purpose of submitting the Feasibility Study, the municipalities agree that the preliminary estimate of the percentage and amount of the total cost of implementation of the recommended alternative for each municipality **was** as indicated below:

- Crafton Borough 8.1% ($880,000)
- Green Tree Borough 11.1% ($1,200,000)
- The Pittsburgh Water and Sewer Authority 80.8% ($8,760,000)

However, as indicated in Table C26-6-1, since the peak flow contribution percentage has to be recalculated. This is due to the Kingston Street area, which was part of project 7 in recommended alternative, is proposed by Crafton to be re-routed to the C-24 POC system. Consequently, the capital cost allocation must be recalculated without the Kingston Street area. This has not been recalculated yet.

It is noted that these costs represent the allocated costs for joint conveyance facilities. These costs do not include additional costs that may be associated with other recommended improvements in the sewershed within individual municipalities. The draft MOU is provided in Attachment C-25-6-1. Also, signed copies of the MOU, if provided by the municipality, would be provided in Addendum C25-6-1.

It should be noted that the draft MOU, which is in the attachment C25-6-1 herein, does not have the recalculated flow percentages and capital cost allocations among municipalities to account for the change proposed by Crafton Borough. The Kingston Street area (part of project 7) is proposed by Crafton to be re-routed to the C-24 POC system. An updated draft MOU with the recalculation was not made available for this report. Green Tree Borough has also informed PWSA, via e-mail dated July 12, 2013, that they have decided against the MOU format.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended C-25 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after C-25 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

- Phase I 2013 through 2017
- Phase II 2017 through 2023
- Phase III 2021 through 2026
- Phase IV TBD
- Phase V TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure C25-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the C-25 shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

6.3.2 Joint Municipal Planning and Implementation

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. The draft MOU contains provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

The specific municipal tasks and efforts necessary to effect implementation of the Feasibility Study involve the completion of the eight project segments listed above in Table C25-6-1.

All associated parties in the POC sewershed have participated in planning meetings to review and discuss the selected flow management plan and required

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[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. Signature pages of executed MOUs or other expressions of agreement as provided by the municipalities are attached as Addendum C25-6-1 to this POC report.

While Crafton Borough has generally agreed to the methodology used develop the recommended projects, they have not agreed to the cost allocation or flow contribution pending potential changes to flows associated with flows from the Kingston Area. Crafton Borough currently does not intend to sign the proposed MOU, instead, acknowledging the report and approve submittal of said report (with any exceptions noted) to the regulatory agencies.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$18,134,000; $10,840,000 of which would be part of the inter-municipal agreement.

- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance

- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of

annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table C25-6-2. The projected costs per household includes the “normal” current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. According to Table C25-6-2, the total cost for PWSA customers will be tripled from an estimated $399 for the current system in 2012 to a total of $1,113 during the first full year of operation (assume 2027). Projected PWSA cost per household will total $306, including about $98 for Wet Weather Program improvements. The addition of the projected $808 in ALCOSAN to the projected $305 in PWSA system costs results in an estimated cost per household in 2027 of $1,113. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE C25-6-2: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638
Green Tree Borough	Not Available	Not Available	Not Available
Crafton Borough	$688	$1,572	Not Available

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure C25-6-2.

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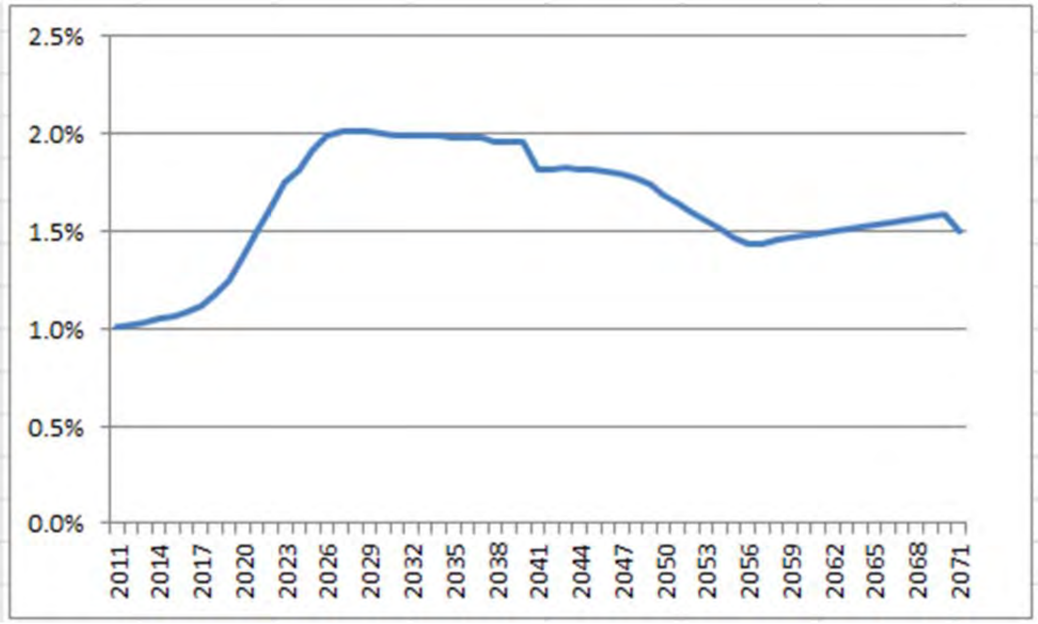
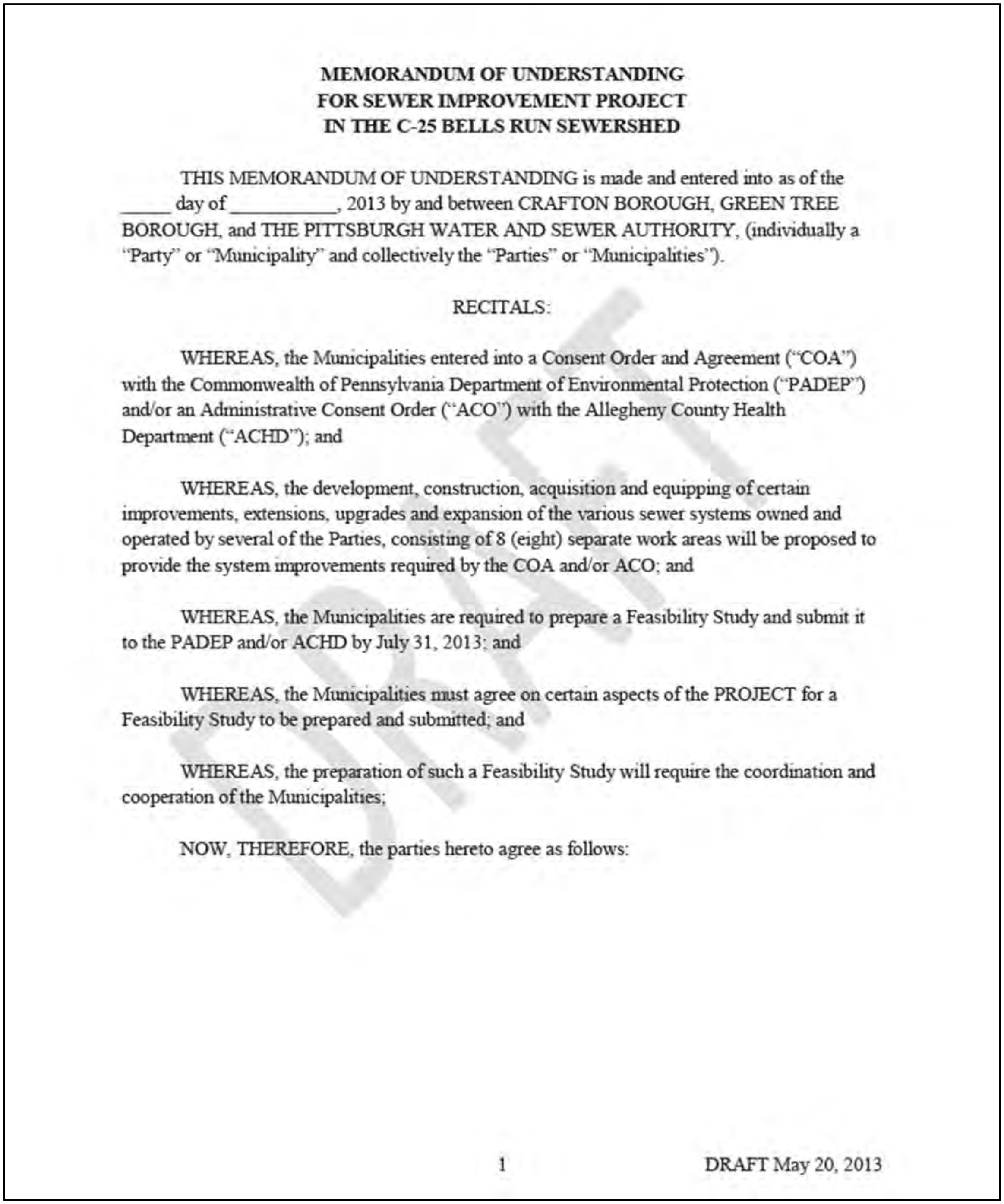
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

FIGURE C25-6-2 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.



MEMORANDUM OF UNDERSTANDING
FOR SEWER IMPROVEMENT PROJECT
IN THE C-25 BELLS RUN SEWERSHED

THIS MEMORANDUM OF UNDERSTANDING is made and entered into as of the _____ day of ___________, 2013 by and between CRAFTON BOROUGH, GREEN TREE BOROUGH, and THE PITTSBURGH WATER AND SEWER AUTHORITY, (individually a "Party" or "Municipality" and collectively the "Parties" or "Municipalities").

RECITALS:

WHEREAS, the Municipalities entered into a Consent Order and Agreement ("COA") with the Commonwealth of Pennsylvania Department of Environmental Protection ("PADEP") and/or an Administrative Consent Order ("ACO") with the Allegheny County Health Department ("ACHD"); and

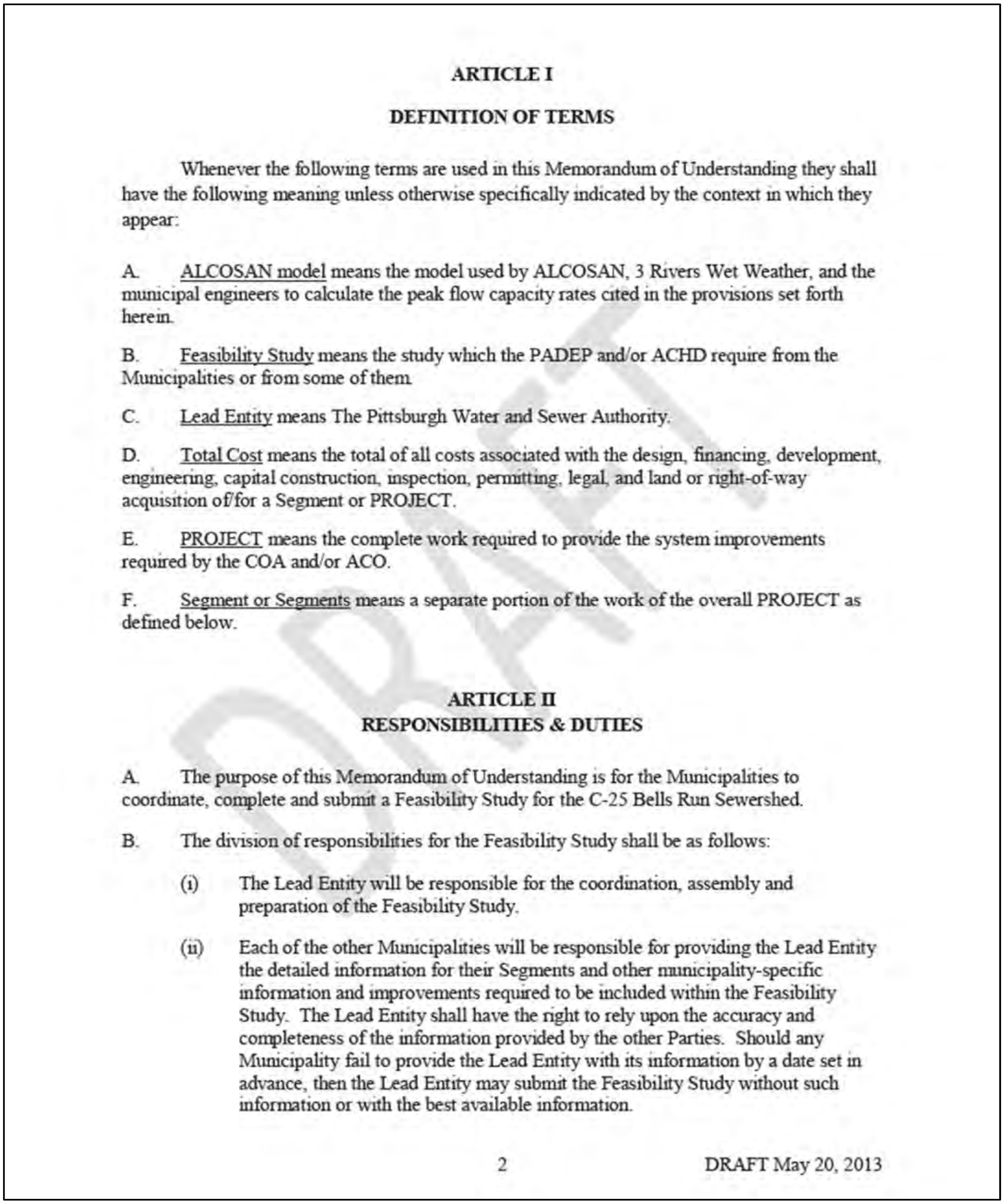
WHEREAS, the development, construction, acquisition and equipping of certain improvements, extensions, upgrades and expansion of the various sewer systems owned and operated by several of the Parties, consisting of 8 (eight) separate work areas will be proposed to provide the system improvements required by the COA and/or ACO; and

WHEREAS, the Municipalities are required to prepare a Feasibility Study and submit it to the PADEP and/or ACHD by July 31, 2013; and

WHEREAS, the Municipalities must agree on certain aspects of the PROJECT for a Feasibility Study to be prepared and submitted; and

WHEREAS, the preparation of such a Feasibility Study will require the coordination and cooperation of the Municipalities;

NOW, THEREFORE, the parties hereto agree as follows:



ARTICLE I

DEFINITION OF TERMS

Whenever the following terms are used in this Memorandum of Understanding they shall have the following meaning unless otherwise specifically indicated by the context in which they appear:

A. ALCOSAN model means the model used by ALCOSAN, 3 Rivers Wet Weather, and the municipal engineers to calculate the peak flow capacity rates cited in the provisions set forth herein.

B. Feasibility Study means the study which the PADEP and/or ACHD require from the Municipalities or from some of them.

C. Lead Entity means The Pittsburgh Water and Sewer Authority.

D. Total Cost means the total of all costs associated with the design, financing, development, engineering, capital construction, inspection, permitting, legal, and land or right-of-way acquisition of/for a Segment or PROJECT.

E. PROJECT means the complete work required to provide the system improvements required by the COA and/or ACO.

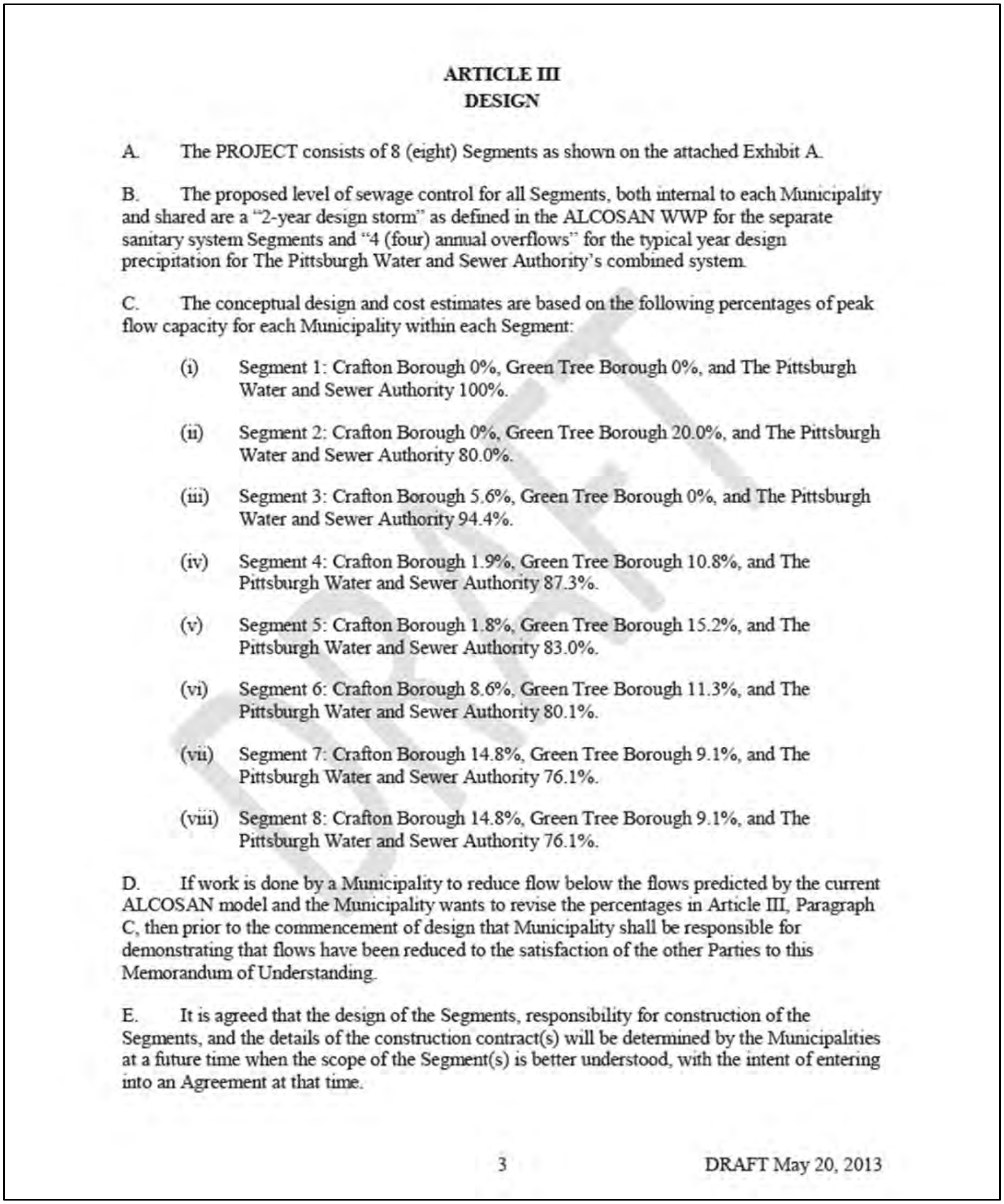
F. Segment or Segments means a separate portion of the work of the overall PROJECT as defined below.

ARTICLE II
RESPONSIBILITIES & DUTIES

A. The purpose of this Memorandum of Understanding is for the Municipalities to coordinate, complete and submit a Feasibility Study for the C-25 Bells Run Sewershed.

B. The division of responsibilities for the Feasibility Study shall be as follows:

- (i) The Lead Entity will be responsible for the coordination, assembly and preparation of the Feasibility Study.
- (ii) Each of the other Municipalities will be responsible for providing the Lead Entity the detailed information for their Segments and other municipality-specific information and improvements required to be included within the Feasibility Study. The Lead Entity shall have the right to rely upon the accuracy and completeness of the information provided by the other Parties. Should any Municipality fail to provide the Lead Entity with its information by a date set in advance, then the Lead Entity may submit the Feasibility Study without such information or with the best available information.



ARTICLE III
DESIGN

A. The PROJECT consists of 8 (eight) Segments as shown on the attached Exhibit A.

B. The proposed level of sewage control for all Segments, both internal to each Municipality and shared are a "2-year design storm" as defined in the ALCOSAN WWP for the separate sanitary system Segments and "4 (four) annual overflows" for the typical year design precipitation for The Pittsburgh Water and Sewer Authority's combined system.

C. The conceptual design and cost estimates are based on the following percentages of peak flow capacity for each Municipality within each Segment:

(i) Segment 1: Crafton Borough 0%, Green Tree Borough 0%, and The Pittsburgh Water and Sewer Authority 100%.

(ii) Segment 2: Crafton Borough 0%, Green Tree Borough 20.0%, and The Pittsburgh Water and Sewer Authority 80.0%.

(iii) Segment 3: Crafton Borough 5.6%, Green Tree Borough 0%, and The Pittsburgh Water and Sewer Authority 94.4%.

(iv) Segment 4: Crafton Borough 1.9%, Green Tree Borough 10.8%, and The Pittsburgh Water and Sewer Authority 87.3%.

(v) Segment 5: Crafton Borough 1.8%, Green Tree Borough 15.2%, and The Pittsburgh Water and Sewer Authority 83.0%.

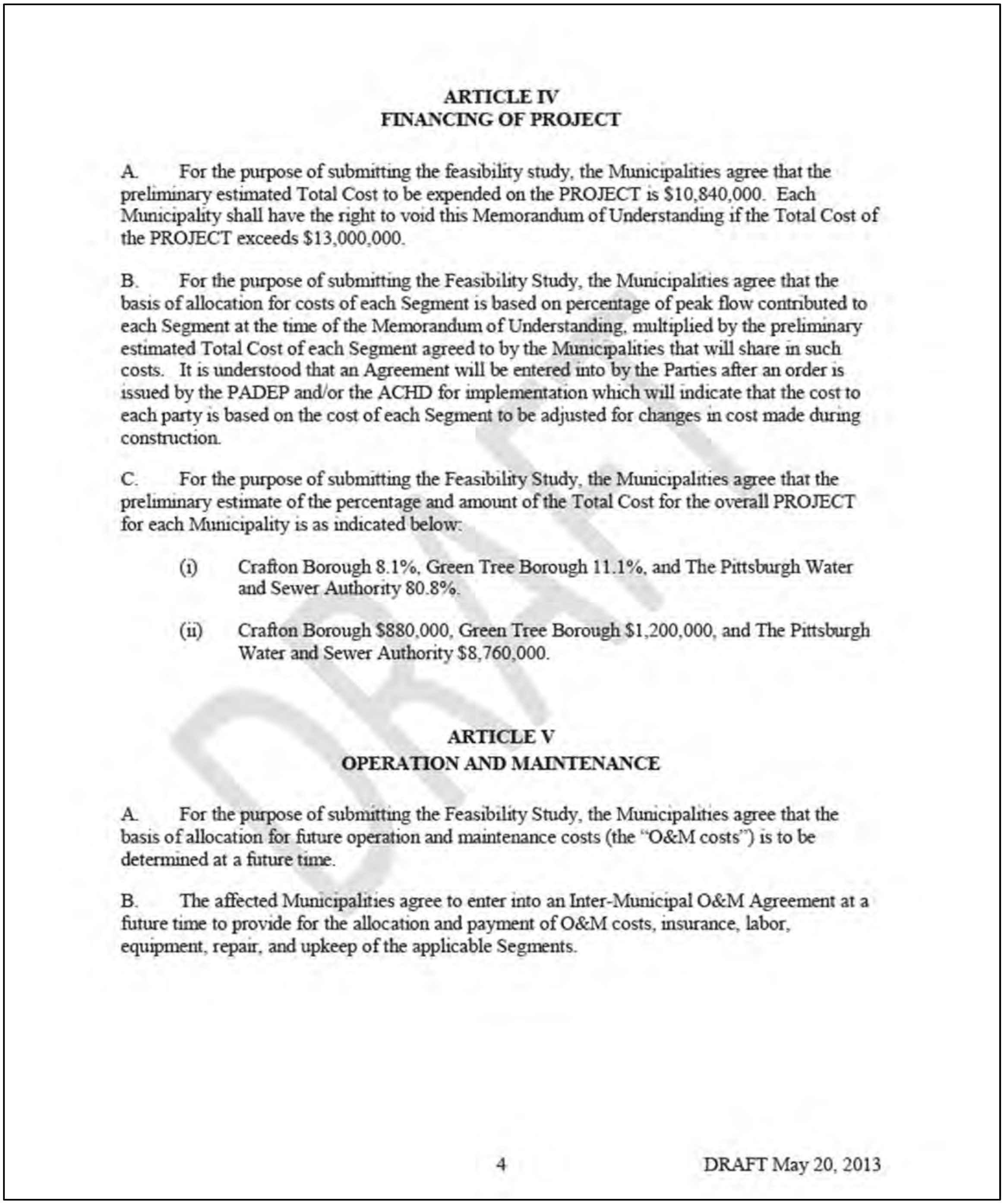
(vi) Segment 6: Crafton Borough 8.6%, Green Tree Borough 11.3%, and The Pittsburgh Water and Sewer Authority 80.1%.

(vii) Segment 7: Crafton Borough 14.8%, Green Tree Borough 9.1%, and The Pittsburgh Water and Sewer Authority 76.1%.

(viii) Segment 8: Crafton Borough 14.8%, Green Tree Borough 9.1%, and The Pittsburgh Water and Sewer Authority 76.1%.

D. If work is done by a Municipality to reduce flow below the flows predicted by the current ALCOSAN model and the Municipality wants to revise the percentages in Article III, Paragraph C, then prior to the commencement of design that Municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties to this Memorandum of Understanding.

E. It is agreed that the design of the Segments, responsibility for construction of the Segments, and the details of the construction contract(s) will be determined by the Municipalities at a future time when the scope of the Segment(s) is better understood, with the intent of entering into an Agreement at that time.



ARTICLE IV
FINANCING OF PROJECT

A. For the purpose of submitting the feasibility study, the Municipalities agree that the preliminary estimated Total Cost to be expended on the PROJECT is $10,840,000. Each Municipality shall have the right to void this Memorandum of Understanding if the Total Cost of the PROJECT exceeds $13,000,000.

B. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for costs of each Segment is based on percentage of peak flow contributed to each Segment at the time of the Memorandum of Understanding, multiplied by the preliminary estimated Total Cost of each Segment agreed to by the Municipalities that will share in such costs. It is understood that an Agreement will be entered into by the Parties after an order is issued by the PADEP and/or the ACHD for implementation which will indicate that the cost to each party is based on the cost of each Segment to be adjusted for changes in cost made during construction.

C. For the purpose of submitting the Feasibility Study, the Municipalities agree that the preliminary estimate of the percentage and amount of the Total Cost for the overall PROJECT for each Municipality is as indicated below:

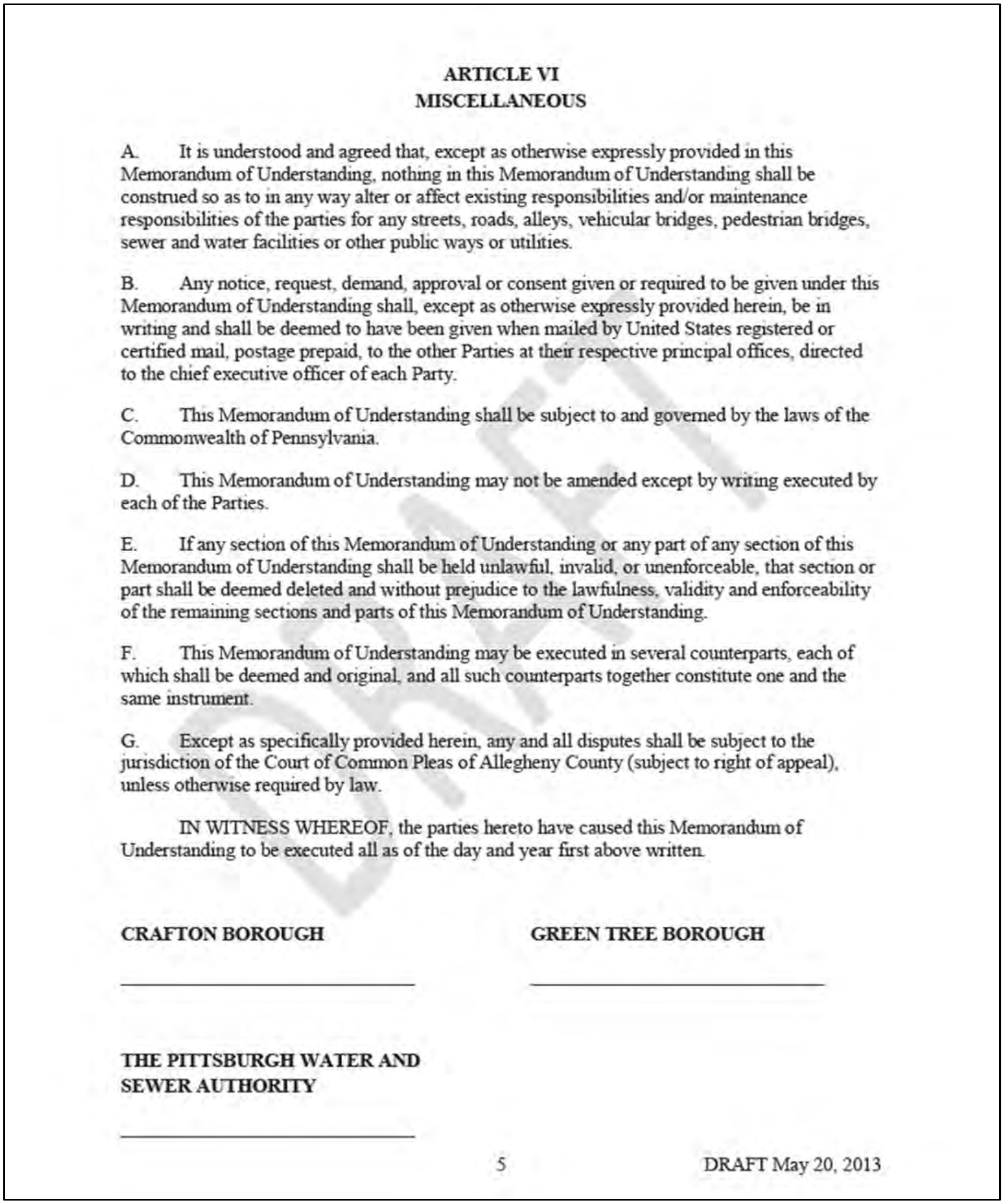
(i) Crafton Borough 8.1%, Green Tree Borough 11.1%, and The Pittsburgh Water and Sewer Authority 80.8%.

(ii) Crafton Borough $880,000, Green Tree Borough $1,200,000, and The Pittsburgh Water and Sewer Authority $8,760,000.

ARTICLE V
OPERATION AND MAINTENANCE

A. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for future operation and maintenance costs (the "O&M costs") is to be determined at a future time.

B. The affected Municipalities agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the applicable Segments.



ARTICLE VI
MISCELLANEOUS

A. It is understood and agreed that, except as otherwise expressly provided in this Memorandum of Understanding, nothing in this Memorandum of Understanding shall be construed so as to in any way alter or affect existing responsibilities and/or maintenance responsibilities of the parties for any streets, roads, alleys, vehicular bridges, pedestrian bridges, sewer and water facilities or other public ways or utilities.

B. Any notice, request, demand, approval or consent given or required to be given under this Memorandum of Understanding shall, except as otherwise expressly provided herein, be in writing and shall be deemed to have been given when mailed by United States registered or certified mail, postage prepaid, to the other Parties at their respective principal offices, directed to the chief executive officer of each Party.

C. This Memorandum of Understanding shall be subject to and governed by the laws of the Commonwealth of Pennsylvania.

D. This Memorandum of Understanding may not be amended except by writing executed by each of the Parties.

E. If any section of this Memorandum of Understanding or any part of any section of this Memorandum of Understanding shall be held unlawful, invalid, or unenforceable, that section or part shall be deemed deleted and without prejudice to the lawfulness, validity and enforceability of the remaining sections and parts of this Memorandum of Understanding.

F. This Memorandum of Understanding may be executed in several counterparts, each of which shall be deemed and original, and all such counterparts together constitute one and the same instrument.

G. Except as specifically provided herein, any and all disputes shall be subject to the jurisdiction of the Court of Common Pleas of Allegheny County (subject to right of appeal), unless otherwise required by law.

IN WITNESS WHEREOF, the parties hereto have caused this Memorandum of Understanding to be executed all as of the day and year first above written.

CRAFTON BOROUGH	**GREEN TREE BOROUGH**
______________________________	______________________________
THE PITTSBURGH WATER AND SEWER AUTHORITY	
______________________________	

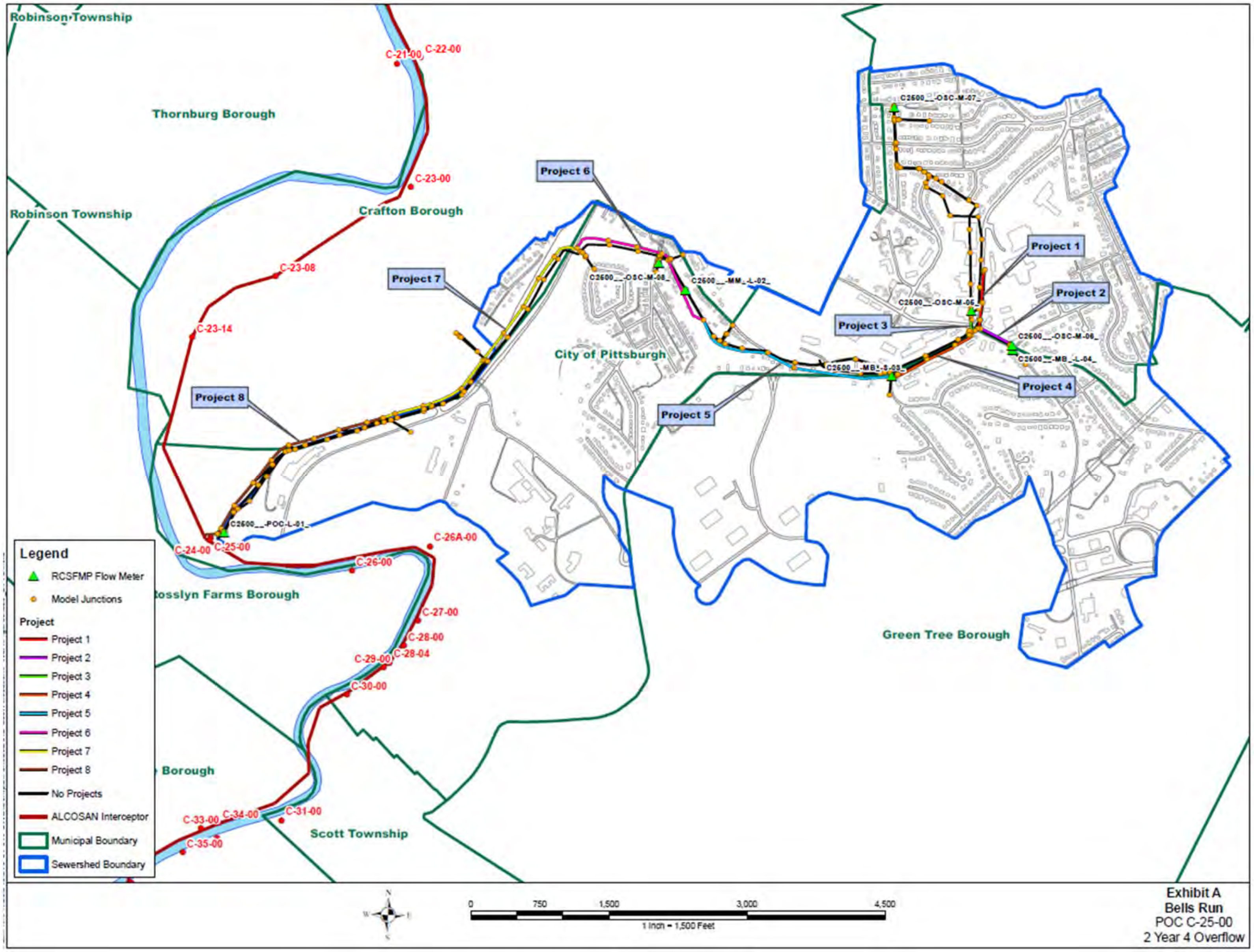


Exhibit A
Bells Run
POC C-25-00
2 Year 4 Overflow

7.0 STAKEHOLDER INVOLVEMENT

Stakeholder meetings titled POC Sewershed Coordination Meetings, facilitated by 3RWW, were held during the site and technology selection and alternative development processes. These meetings facilitated cooperation, information exchange and consensus building between the PWSA, its stakeholders and tributary municipalities essential to the development of the PWSA Feasibility Study Report and supporting POC-based feasibility studies. For the meetings listed in Table 7-1, POC C-25 was the focus of the discussion and representatives from municipalities' tributary to the Bells Run sewershed were in attendance. Meeting topics included source reduction and green infrastructure, alternatives analysis, affordability and implementation schedule, and cost allocation. Other stakeholder involvement efforts were discussed in Section 11 of the Wet Weather Feasibility Study.

The Wet Weather Feasibility Study Coordination Meeting, led by the PWSA, facilitated stakeholder participation between the PWSA and Crafton Borough and Green Tree Borough communities tributary to the Bells Run watershed. The purpose of this meeting was to coordinate the development of planning information specific to the multi-municipal sewershed, reach a consensus agreement on the recommended improvements and receive authorization to submit the results.

TABLE 7-1: BELLS RUN C-25 POC MEETINGS

Title/Purpose	Date	Time	Location
WW Feasibility Study Coordination	3/20/12	1:30 PM	PWSA Office
POC Sewershed Coordination	2/27/13	1:00 PM	PWSA Office
POC Sewershed Coordination	3/19/13	1:00 PM	Green Tree Municipal Building

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
M-42: STREETS RUN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report On The Current Status Of The Development Of The Wet Weather Feasibility Study For The City Of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh, Baldwin Borough, Brentwood Borough, Pleasant Hills Borough, West Mifflin Borough, and Whitehall Borough. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.
- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.
- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.
- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.

- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.

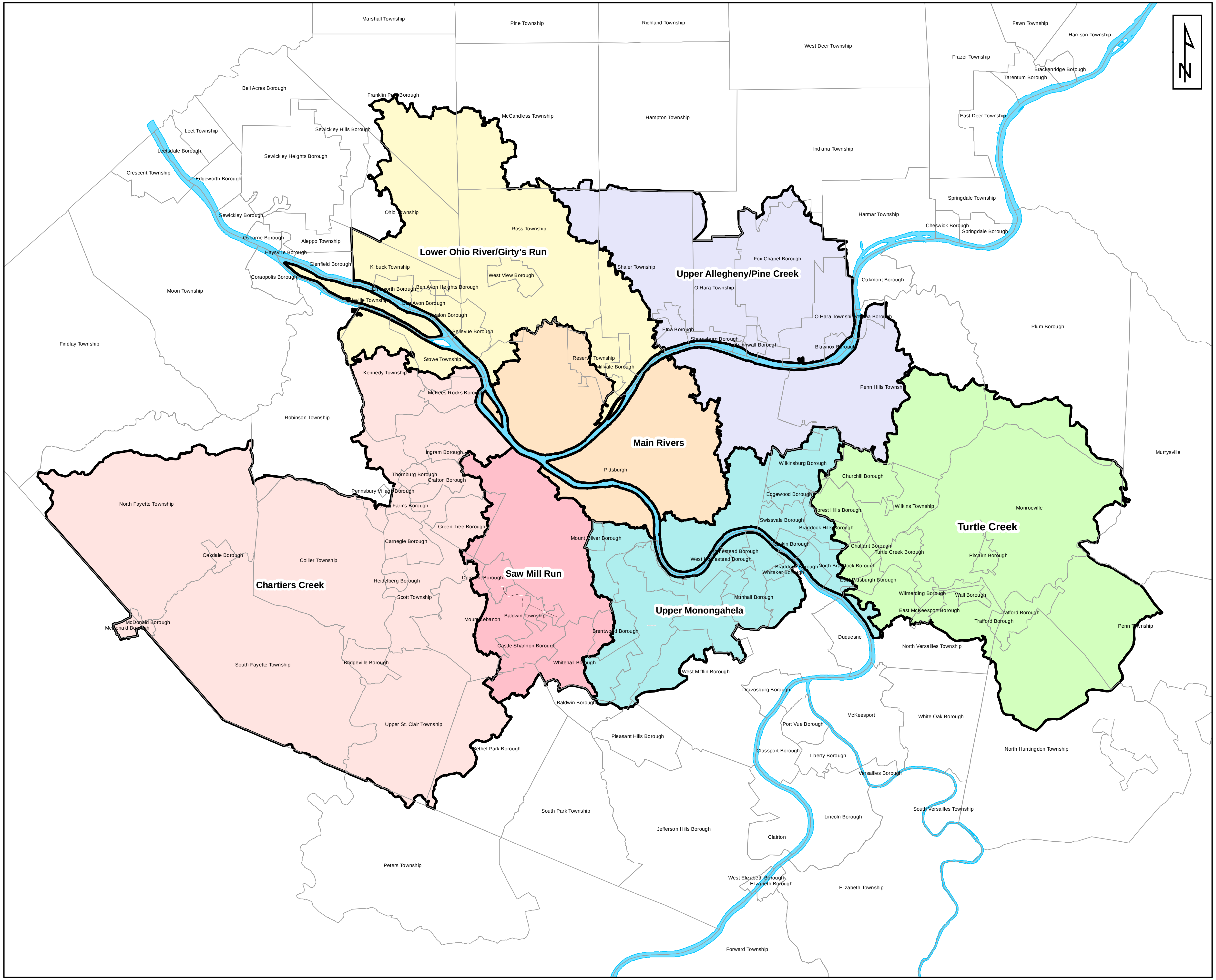
- Section 7.0 describes how stakeholders were included in the plan development.

1.2 EXISTING SYSTEM DESCRIPTION

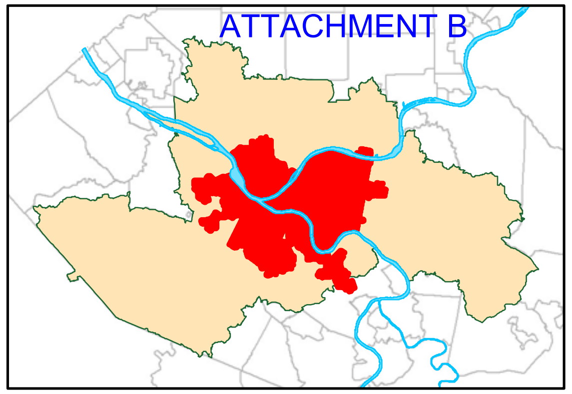
This POC FS Report addresses POC M-42, also known as Streets Run. The M-42 sewershed is located in the Upper Monongahela Planning Basin. The Upper Monongahela basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: M-42 Streets Run Existing Facilities Map*. The M-42 sewershed is served by one main trunk sewer that starts at ALCOSAN diversion structure ADC 091AM42 and runs south and parallel to West Mifflin Road, then Baldwin Road, Calera Street, and West Baldwin Road. This main line is comprised of 24-inch and 33-inch pipes. One major branch joins with the main line at the intersection of Baldwin Road and Glass Run Road. The branch runs parallel to Glass Run Road and is comprised of 18-inch vitrified clay pipes. The other branch diverges from the main line near the intersection of Mifflin Road and Baldwin Road and runs parallel to Mifflin Road. At the intersection of Mifflin Road and Lebanon Road, this 24-inch vitrified clay line branches again and follows Lebanon Road as a 12-inch pipe and follows Mifflin Road with pipe sizes varying from 10-inches to 15-inches.

There are three PWSA CSO diversion chambers in the sewershed that overflow to Irwin Run and Streets Run at four permitted CSOs. The M-42 sewershed encompasses approximately 6,521 acres. The sewershed is made up of 1,449 acres of the City of Pittsburgh, 2,368 acres of Baldwin Borough, 558 acres of Brentwood Borough, 6 acres of Pleasant Hills Borough, 1,280 acres of West Mifflin Borough, and 837 acres of Whitehall Borough. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to M-42* for specific information on this POC.



ATTACHMENT B



ALCOSAN Service Area Overview

Legend

- ☐ Municipal Boundary
- ▨ Chartiers Creek
- ▨ Lower Ohio River / Girty's Run
- ▨ Main Rivers
- ▨ Saw Mill Run
- ▨ Turtle Creek
- ▨ Upper Allegheny / Pine Creek
- ▨ Upper Monongahela
- ▨ River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd

Figure 1 - 2: M-42
Streets Run
Existing Facilities

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\STREETS RUN (M-42)\FIGURE 1-2_M_42Existing Overflows.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR MUNICIPALITIES TRIBUTARY TO M-42

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY					
	City of Pittsburgh	Baldwin Borough	Brentwood Borough[1]	Pleasant Hills Borough	West Mifflin Borough	Whitehall Borough[2]
Tributary Area (Acres)	1,449	2,368	558	6	1,280	837
Population	5,724	10,393	4,686	45	597	3,751
Combined						
Inch-Miles	84	0	0	0	0	0
Linear Feet	23,300	0	0	0	0	0
Inch-Miles/Acre	0.06	0	0	0	0	0
Separate						
Inch-Miles	187	577	180	2	73	188.1
Linear Feet	102,400	337,400	110,695	1,500	43,300	116,135
Inch-Miles/Acre	0.13	0.24	0.32	0.33	0.06	0.22

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows that are not released to the environment by the upstream PWSA diversion structures are regulated by the M-42 ALCOSAN CSO diversion structure located below the East Carson Street-Glenwood Bridge Interchange.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to M-42*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

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[1] Data provided by Brentwood Borough per municipal RFI.
[2] Data provided by Whitehall Borough per municipal RFI.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO M-42

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
134A001	DC134A001	CSO134A001	Hillburn Street	Irwin Run
184E001	DC184E001	CSO184E001	Oakleaf Drive	Irwin Run
185H001	DC185H001	CSO185H001	Glenhurst Road and Mifflin Road	Irwin Run

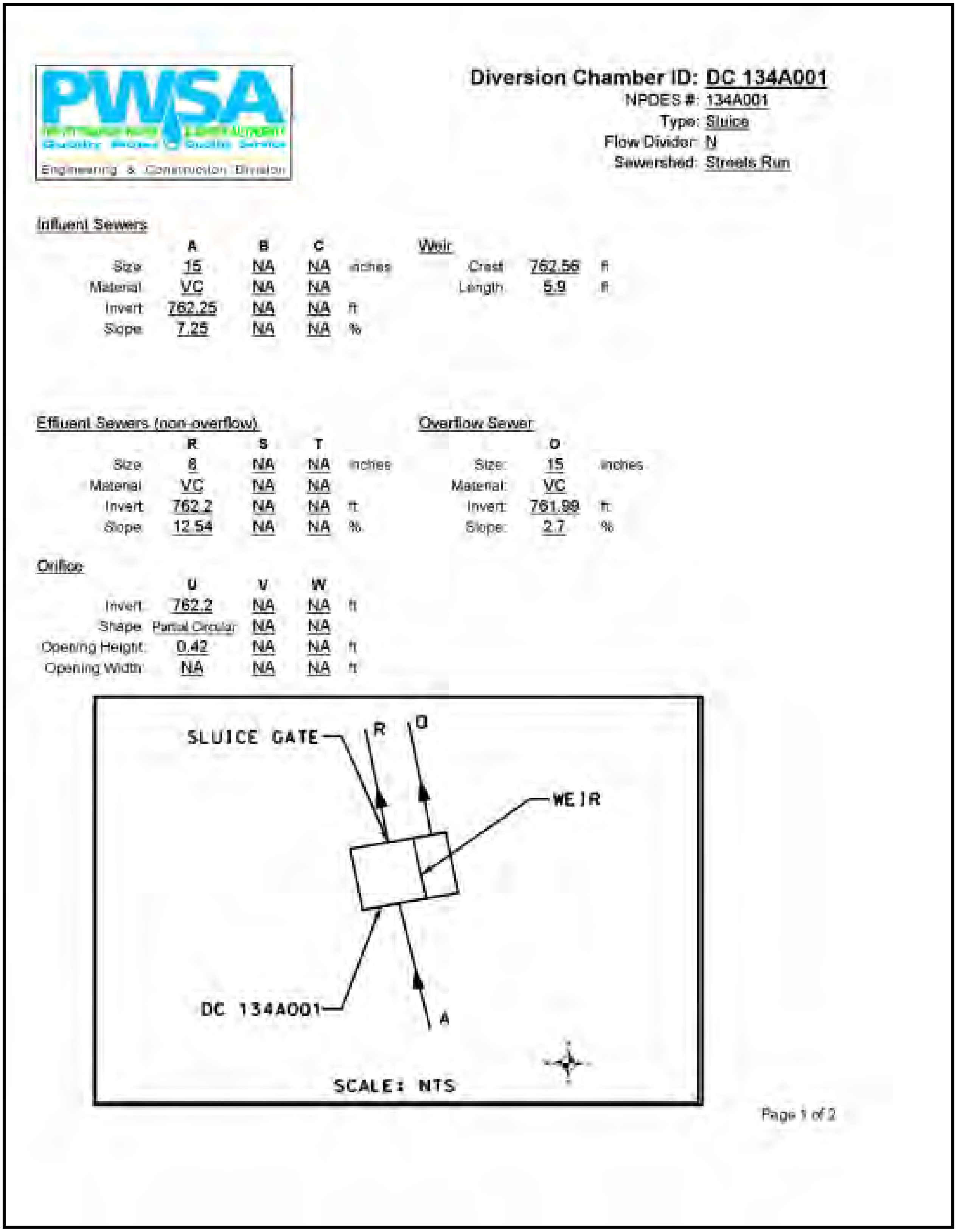
As shown in *Table 1-3: M-42 Sewershed Typical Year Overflow Statistics*, during the typical year these three structures overflow between 18 and 72 times. Overflow volumes range from 110,000 gallons to 450,000 gallons per event, and from 590,000 gallons to 2.3 million gallons annually, on a structure by structure basis. Annual overflow flow volume for this sewershed is 4.38 million gallons.

TABLE 1-3: M-42 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC134A001	18	5.12	2.61	0.76	0.11	0.06	0.02	0.59
DC184E001	21	12.70	5.16	0.33	0.43	0.08	0.01	1.46
DC185H001	72	12..79	2.93	0.83	0.45	0.07	0.04	2.33
							Total Annual Volume	**4.38**

1.2.1 Diversion Structure Sketches

The following sketches of the M-42 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.



PWSA
PITTSBURGH WATER & SEWER AUTHORITY
Quality Proven Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 134A001
NPDES #: 134A001
Type: Sluice
Flow Divider: N
Sewershed: Streets Run

Influent Sewers

	A	B	C	
Size	15	NA	NA	inches
Material	VC	NA	NA	
Invert	762.25	NA	NA	ft
Slope	7.25	NA	NA	%

Weir

Crest	762.56	ft
Length	5.9	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	VC	NA	NA	
Invert	762.2	NA	NA	ft
Slope	12.54	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	VC	
Invert:	761.99	ft
Slope:	2.7	%

Orifice

	U	V	W	
Invert	762.2	NA	NA	ft
Shape	Partial Circular	NA	NA	
Opening Height	0.42	NA	NA	ft
Opening Width	NA	NA	NA	ft

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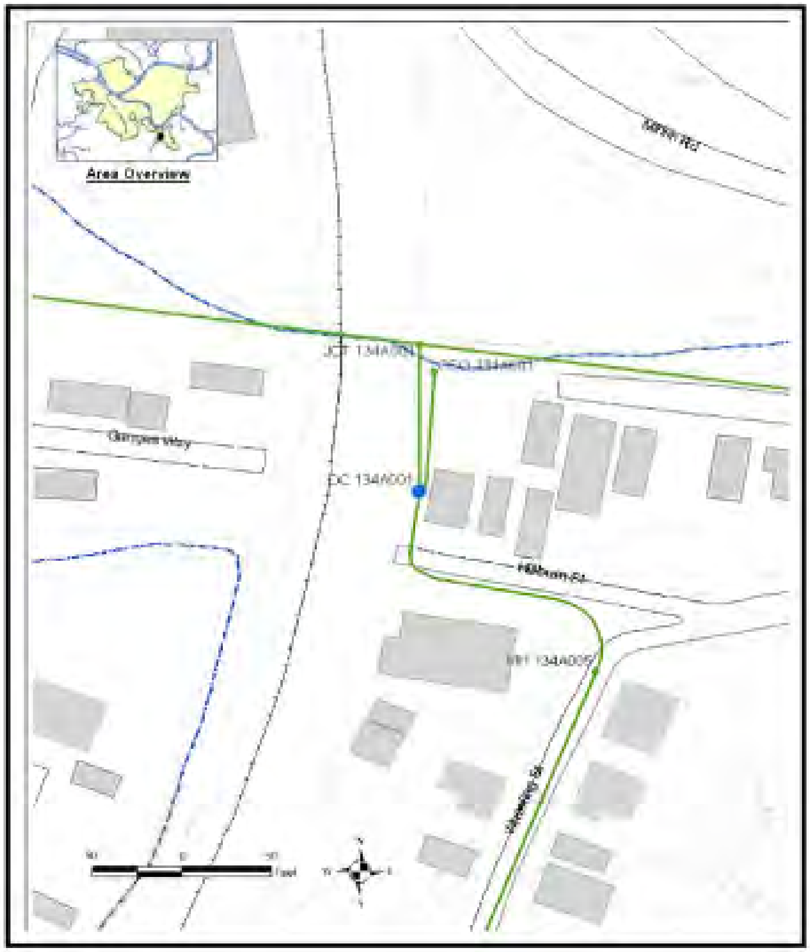
PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 134A001



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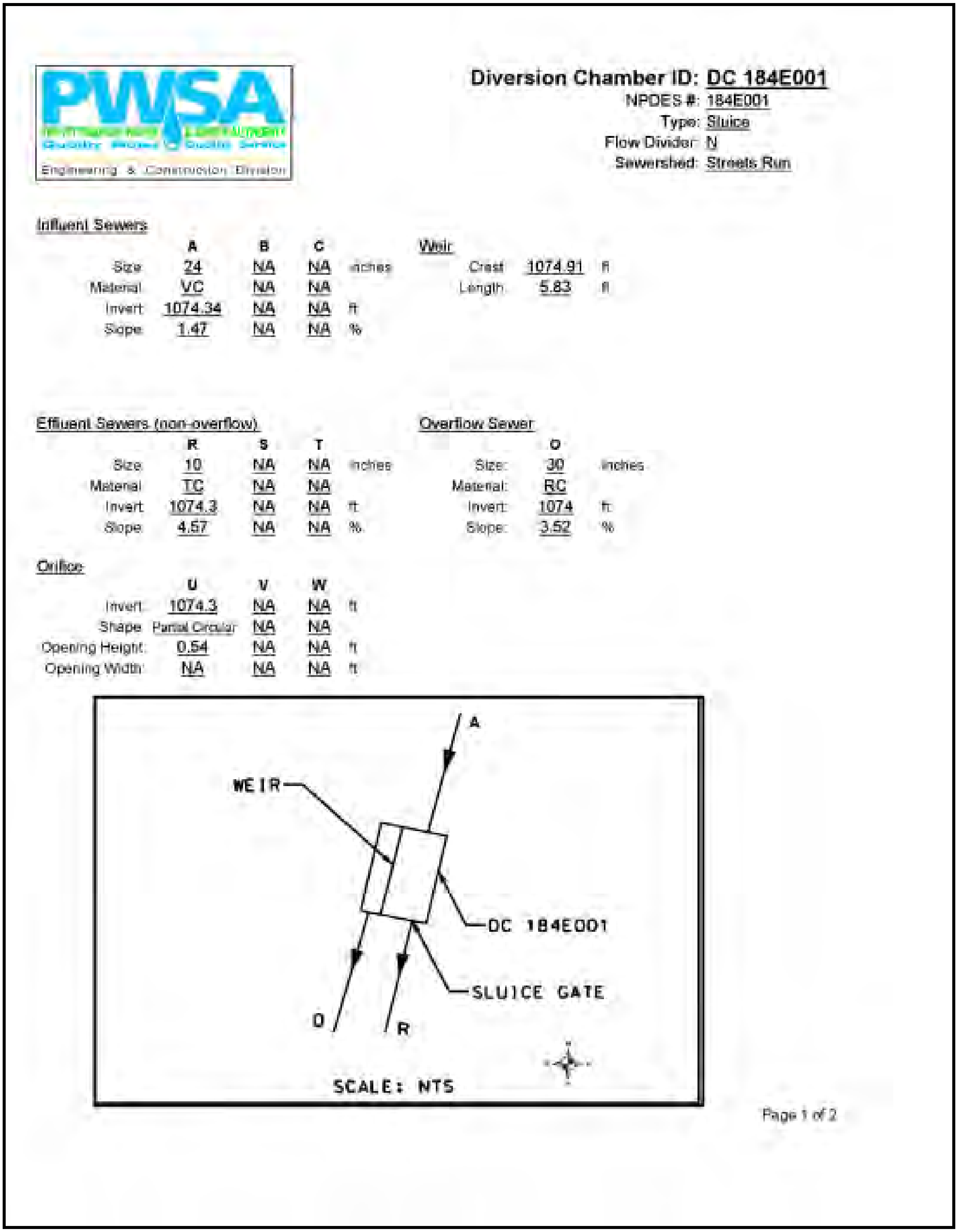


PWSA
Pittsburgh Water & Sewer Authority
Quality · Value · Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 184E001
NPDES #: 184E001
Type: Sluice
Flow Divider: N
Sewershed: Streets Run

Influent Sewers

	A	B	C	
Size	24	NA	NA	inches
Material	VC	NA	NA	
Invert	1074.34	NA	NA	ft
Slope	1.47	NA	NA	%

Weir

Crest	1074.91	ft
Length	5.83	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	10	NA	NA	inches
Material	TC	NA	NA	
Invert	1074.3	NA	NA	ft
Slope	4.57	NA	NA	%

Overflow Sewer

	O	
Size	30	inches
Material	RC	
Invert	1074	ft
Slope	3.52	%

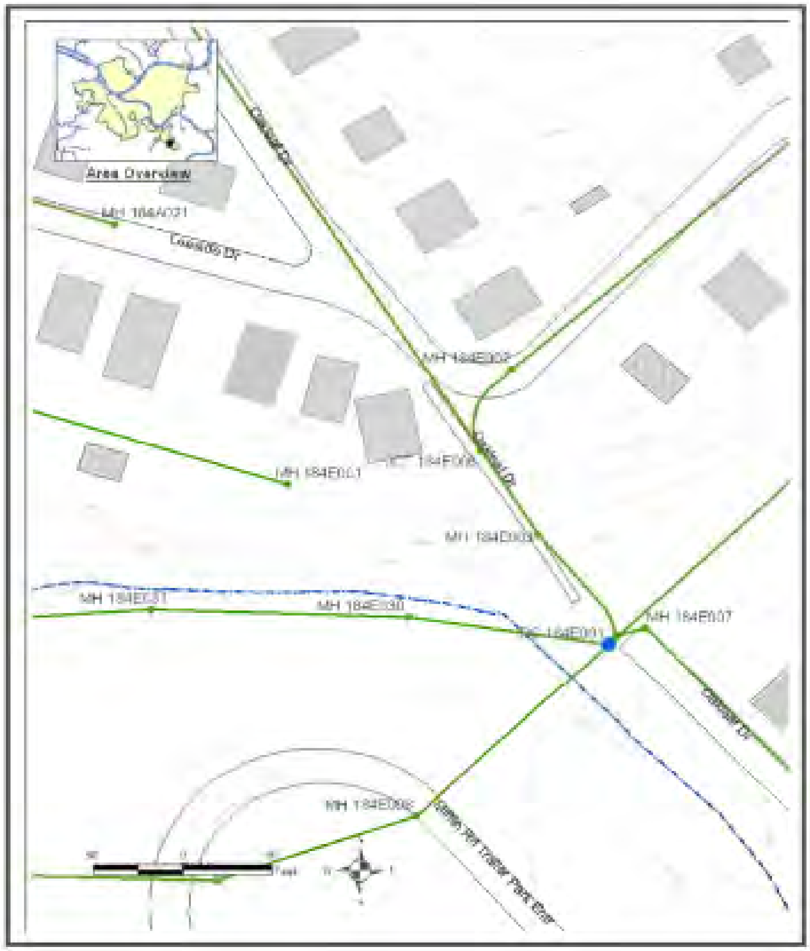
Orifice

	U	V	W	
Invert	1074.3	NA	NA	ft
Shape	Partial Circular	NA	NA	
Opening Height	0.54	NA	NA	ft
Opening Width	NA	NA	NA	ft

Page 1 of 2

THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 184E001



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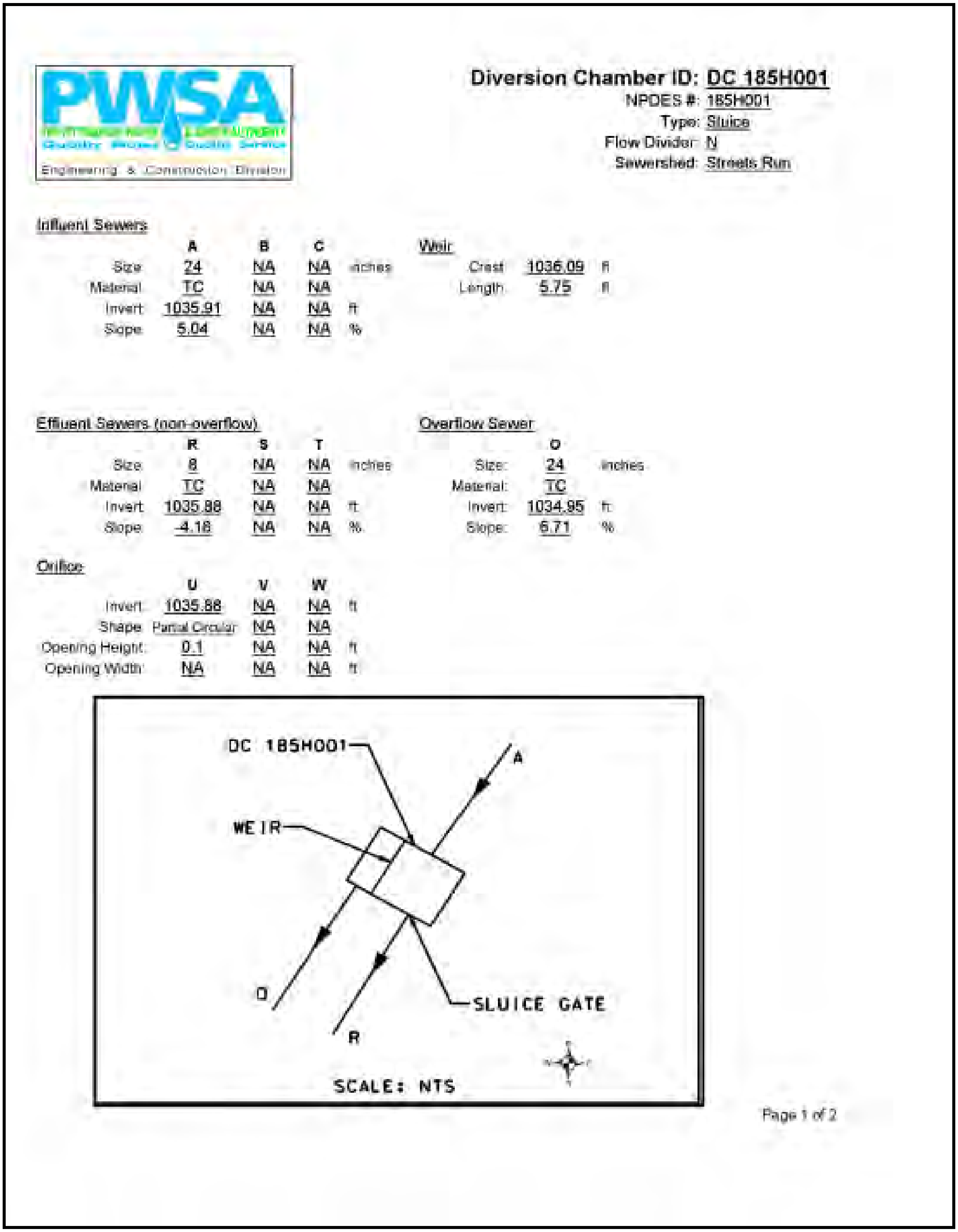


PWSA

Engineering & Construction Division

Diversion Chamber ID: DC 185H001

NPDES #: 185H001
Type: Sluice
Flow Divider: N
Sewershed: Streets Run

Influent Sewers

	A	B	C	
Size	24	NA	NA	inches
Material	TC	NA	NA	
Invert	1035.91	NA	NA	ft
Slope	5.04	NA	NA	%

Weir

Crest	1036.09	ft
Length	5.75	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	TC	NA	NA	
Invert	1035.88	NA	NA	ft
Slope	-4.18	NA	NA	%

Overflow Sewer

	O	
Size:	24	inches
Material:	TC	
Invert:	1034.95	ft
Slope:	6.71	%

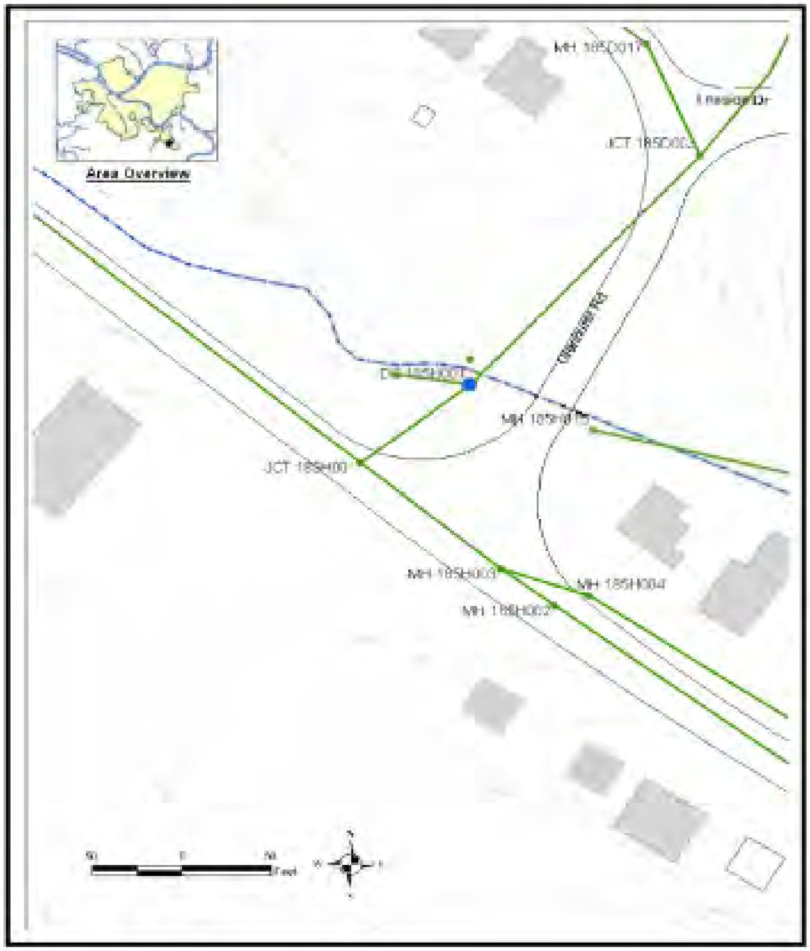
Orifice

	U	V	W	
Invert	1035.88	NA	NA	ft
Shape	Partial Circular	NA	NA	
Opening Height	0.1	NA	NA	ft
Opening Width	NA	NA	NA	ft

Page 1 of 2

Engineering & Construction Division

Diversion Chamber ID: DC 185H001



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2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC M-42: Streets Run through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Upper Monongahela Basin Planners (UM_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for M-42.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the *Hydraulic and Hydrologic Characterization Report (September, 2008)* and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. Eighteen (18) flow meters located within the M-42 sewershed were used in the RCS-FMP. Details on the eighteen (18) RCS-FMP flow monitors installed within the M-42 sewershed are found in Table M42-2-1.

TABLE M42-2-1: M-42 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Term[1]
M4200__-IM_-S-03_	Baldwin Borough	S
M4200__-IM_-S-07_	Baldwin Borough	S
M4200__-IM_-S-13_	Baldwin Borough	S
M4200__-MB_-L-02_	City of Pittsburgh	L
M4200__-MB_-L-05_	West Mifflin Borough	L
M4200__-MB_-L-06_	Baldwin Borough	L
M4200__-MB_-L-08_	Baldwin Borough	L
M4200__-MB_-L-09_	Baldwin Borough	L
M4200__-MB_-L-11_	Brentwood Borough	L
M4200__-MB_-L-14_	Whitehall Borough	L
M4200__-MB_-L-15_	Baldwin Borough	L
M4200__-MB_-L-16_	Baldwin Borough	L
M4200__-MB_-L-17_	City of Pittsburgh	L
M4200__-MM_-L-04_	Baldwin Borough	L
M4200__-MM_-L-10_	Brentwood Borough	L
M4200__-MM_-L-12_	West Miflin Borough	L
M4200__-OSC-M-18_	City of Pittsburgh	M
M4200__-POC-L-01_	City of Pittsburgh	L

[1]S=Short Term: 3-months to 6 months, M=Medium Term: 6 months to 9 months, L=Long Term: 1-year minimum to 21-month maximum.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

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[1] The flow monitor information in this Table M42-is from a file titled "Summary of Program Monitors by Name, Type and Dates.xls". This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled "Summary and Report of Flow Monitoring June 2009".

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).

- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.

- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.

- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the M-42 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the M-42 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.

- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The maximum, minimum, and average DWF and the GWI ratio for the, and GWI per inch-mile of sewer for each flow monitor within the M-42 sewershed are listed in Table M42-2-2. The GWI ratio is an estimated amount of the DWF that can be associated with GWI compared to the DWF peaking factor (i.e. Average Daily Maximum Flow vs. Average Daily Minimum Flow).

TABLE M42-2-2: M-42 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

POC	Average Daily Flow (mgd)			GWI Ratio (min/avg)
	Maximum	Minimum	Average	
M-42	6.5	3.1	5.0	69.7%

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table M42-2-3.

TABLE M42-2-3: M-42 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
M-42	5.40	5.48	1.5%

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[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Upper Monongahela Planning Basin – Table 4.3.
[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Upper Monongahela Planning Basin – Table 2-3

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event.

RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for M-42 are presented in Table M42-2-4.

TABLE M42-2-4: M-42 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
M-42	24.4	24.4	0.0%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not

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[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Upper Monongahela Planning Basin – Table 2-4

attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure M42-2-1a, M42-2-1b, M42-2-1c, M42-2-1d, and M42-2-1e present the computed hydraulic profiles of the existing Streets Run Interceptor and Main trunk sewers. The trunk sewers include Mifflin Road, Glass Run Road, Brentwood Road, and Lebanon Road trunk sewers, respectively. The profiles show the sewer system under projected 2-year design storm peak flow conditions. These figures illustrate how the trunk sewers operate under the current system configuration, including existing CSO diversion chamber settings. Extensive manhole surcharging, including manhole flooding, occurs along the lower portion of the Streets Run Interceptor Sewer. No manhole surcharging occurs along the Mifflin Road Trunk Sewer except at the lower end of the sewer. Surcharging/flooding at this location is due to backwater effects from the Streets Run Interceptor Sewer. Relatively minor manhole surcharging occurs at two locations in the upper reaches of the Glass Run Road Trunk Sewer. More extensive surcharging is indicated at the lower end of the sewer due to backwater effects from the Streets Run Trunk Sewer. Significant manhole surcharging, including manhole flooding occurs along the middle portion and upper end of the Brentwood Road Trunk Sewer. Also, the Lebanon Road trunk sewer functions acceptably.

Figure M42-2-2a, M42-2-2b, M42-2-2c, M42-2-2d, and M42-2-2e present the computed hydraulic profiles of the existing Streets Run Interceptor and Main trunk sewers. The trunk sewers include Mifflin Road, Glass Run Road, Brentwood Road, and Lebanon Road trunk sewers, respectively. The profiles show the sewer system under projected 5-year design storm peak flow conditions. These figures illustrate how the trunk sewers operate under the current system configuration, including existing CSO diversion chamber settings. Extensive manhole surcharging, including manhole flooding occurs at numerous locations along the Streets Run Interceptor Sewer. No manhole surcharging occurs along the Mifflin Road Trunk Sewer except at the lower end of the sewer. Surcharging/flooding at this location is due to backwater effects from the Streets Run Interceptor Sewer. Relatively minor manhole surcharging occurs at two locations in the upper reaches of the Glass Run Road Trunk Sewer. More extensive surcharging is indicated at the lower end of the sewer due to backwater effects from the Streets Run Trunk Sewer. Significant manhole surcharging, including manhole flooding occurs along the middle portion and upper end of the Brentwood Road Trunk Sewer. Also, the Lebanon Road trunk sewer functions acceptably.

Figure M42-2-3a, M42-2-3b, M42-2-3c, M42-2-3d, and M42-2-3e present the computed hydraulic profiles of the existing Streets Run Interceptor and Main trunk sewers. The trunk sewers include Mifflin Road, Glass Run Road, Brentwood Road, and Lebanon Road trunk sewers, respectively. The profiles show the sewer system under projected 10-year design storm peak flow conditions. These figures illustrate how the trunk sewers operate under the current system configuration, including existing CSO diversion chamber settings. Extensive manhole surcharging, including manhole flooding occurs along the length of the Streets Run Interceptor Sewer. No manhole surcharging occurs along the Mifflin Road Trunk Sewer except at the lower end of the sewer. Surcharging/flooding at this location is due to backwater effects from the Streets Run Interceptor Sewer. Relatively minor manhole surcharging occurs at two locations in the upper reaches of the Glass Run Road Trunk Sewer. More extensive surcharging is indicated at the lower end of the sewer due to backwater effects from the Streets Run Trunk Sewer. Significant manhole surcharging, including manhole flooding occurs along the middle portion and upper end of the Brentwood Road Trunk Sewer. Also, the Lebanon Road trunk sewer functions acceptably.

Computed flow hydrographs for each of the design storms at the M-42 POC are presented in Figure M42-2-4. It is noted that the peak flows reaching the POC are truncated due to extensive manhole surcharging and manhole flooding.

FIGURE M42-2-1A: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE- STREETS RUN INTERCEPTOR

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

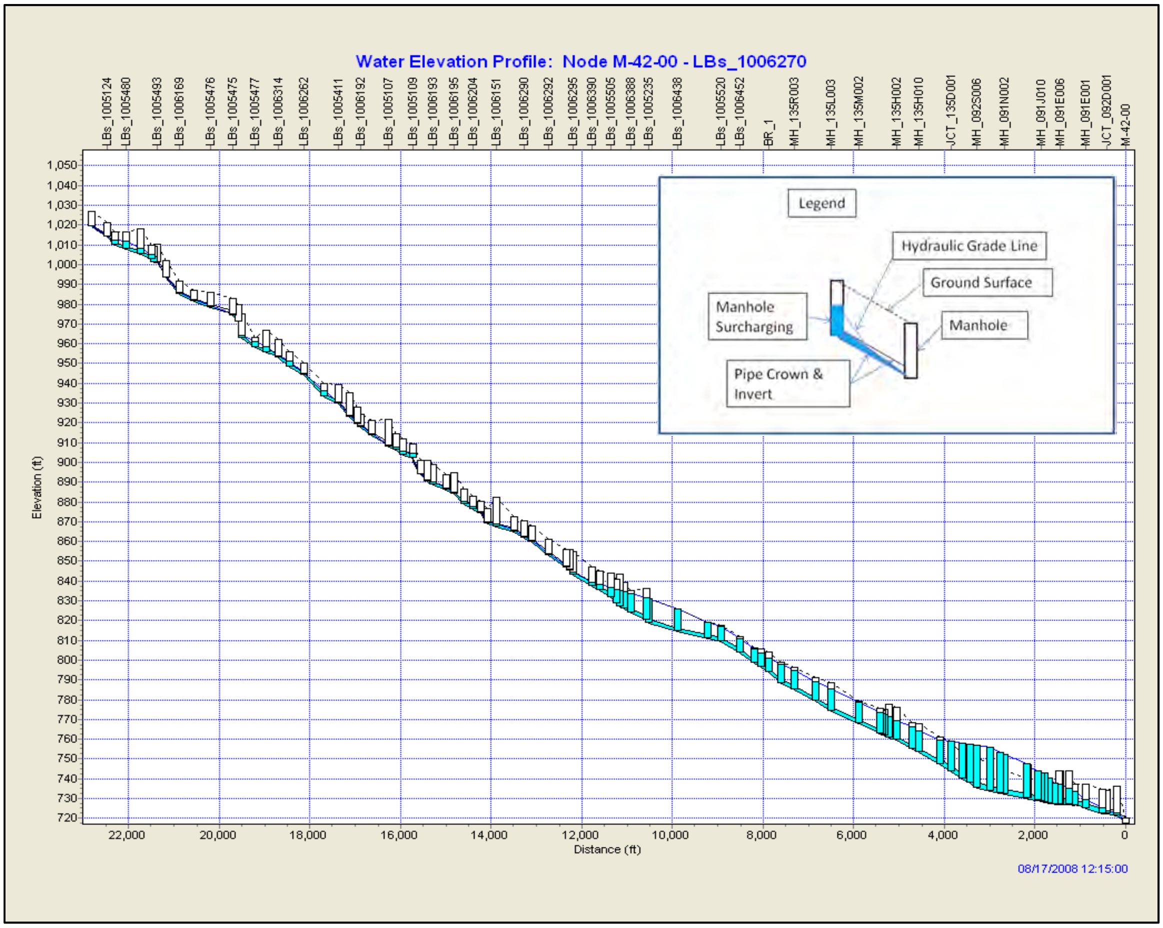


FIGURE M42-2-1B: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-MIFFLIN ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

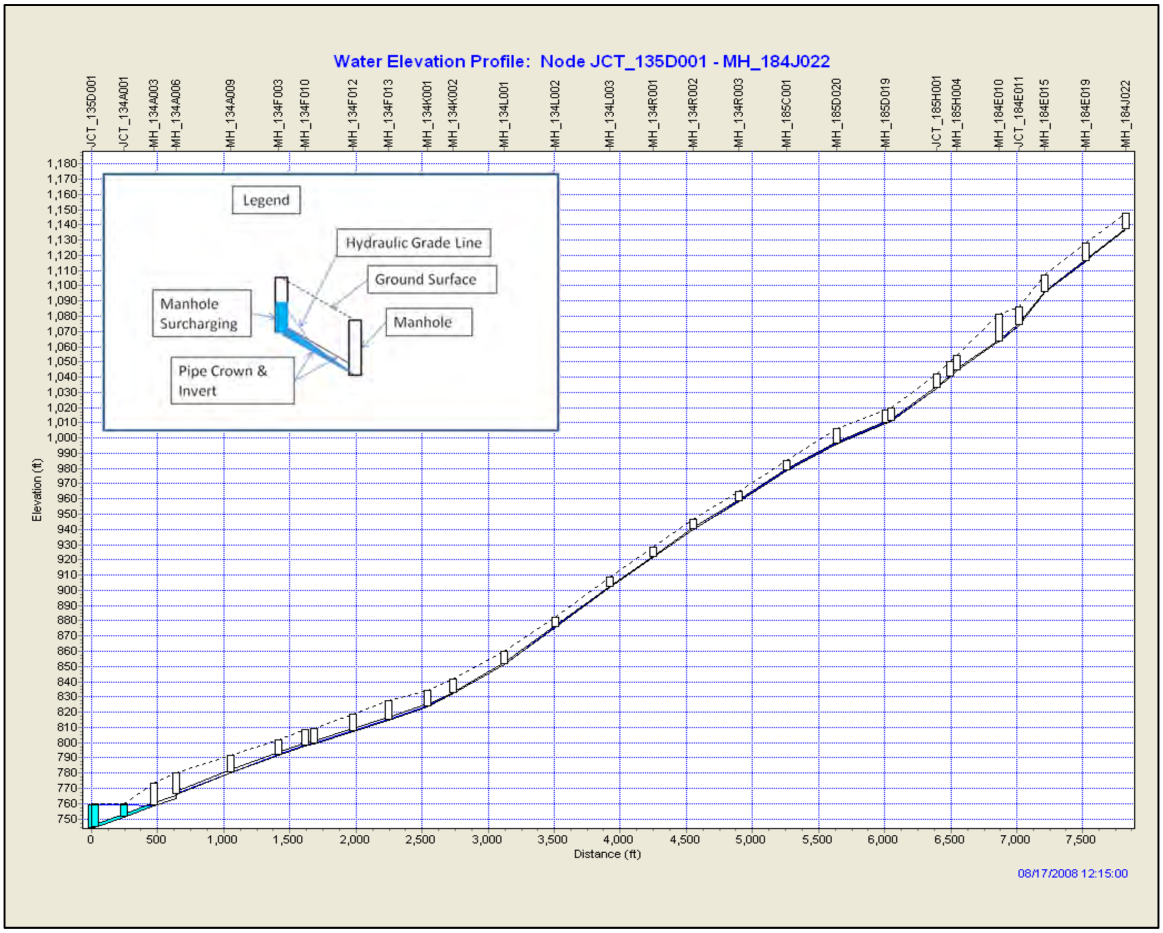


FIGURE M42-2-1C: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-GLASS RUN ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

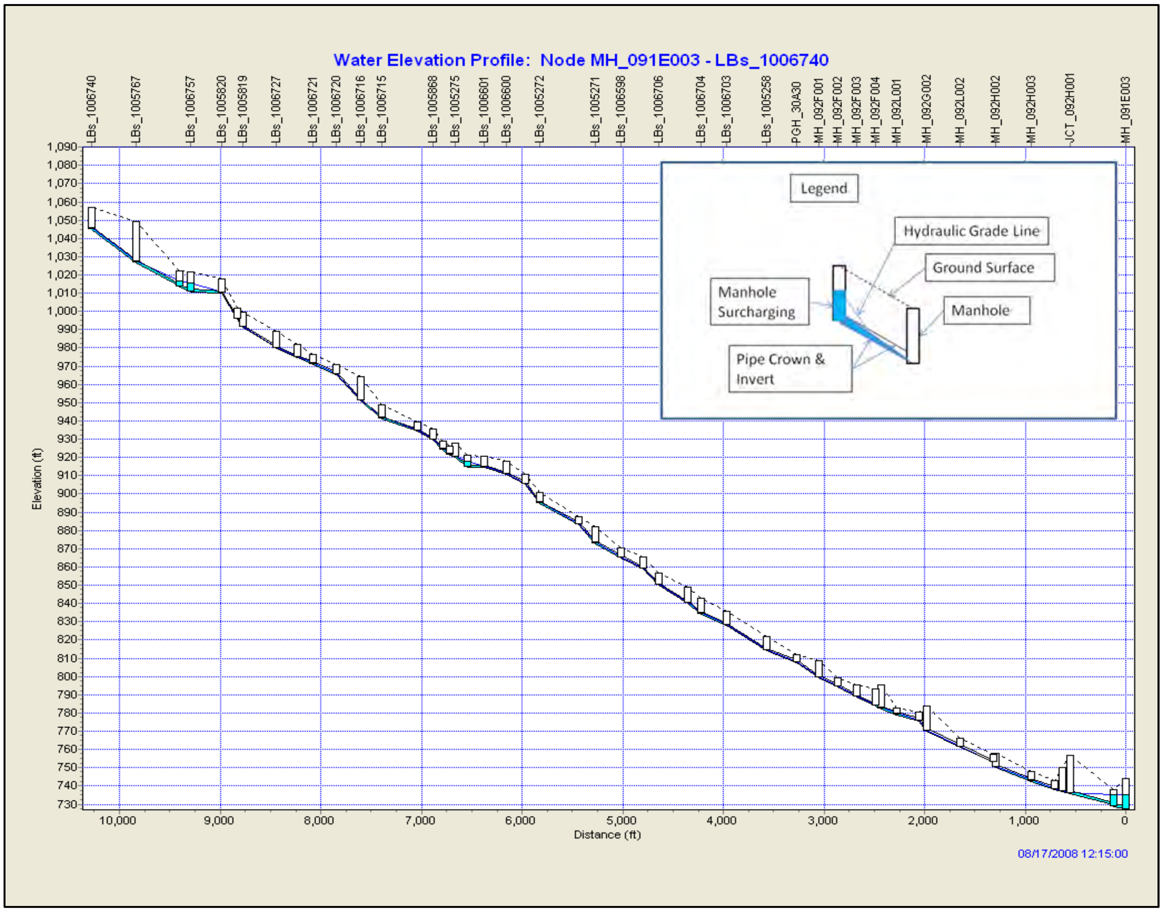


FIGURE M42-2-1D: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-BRENTWOOD ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

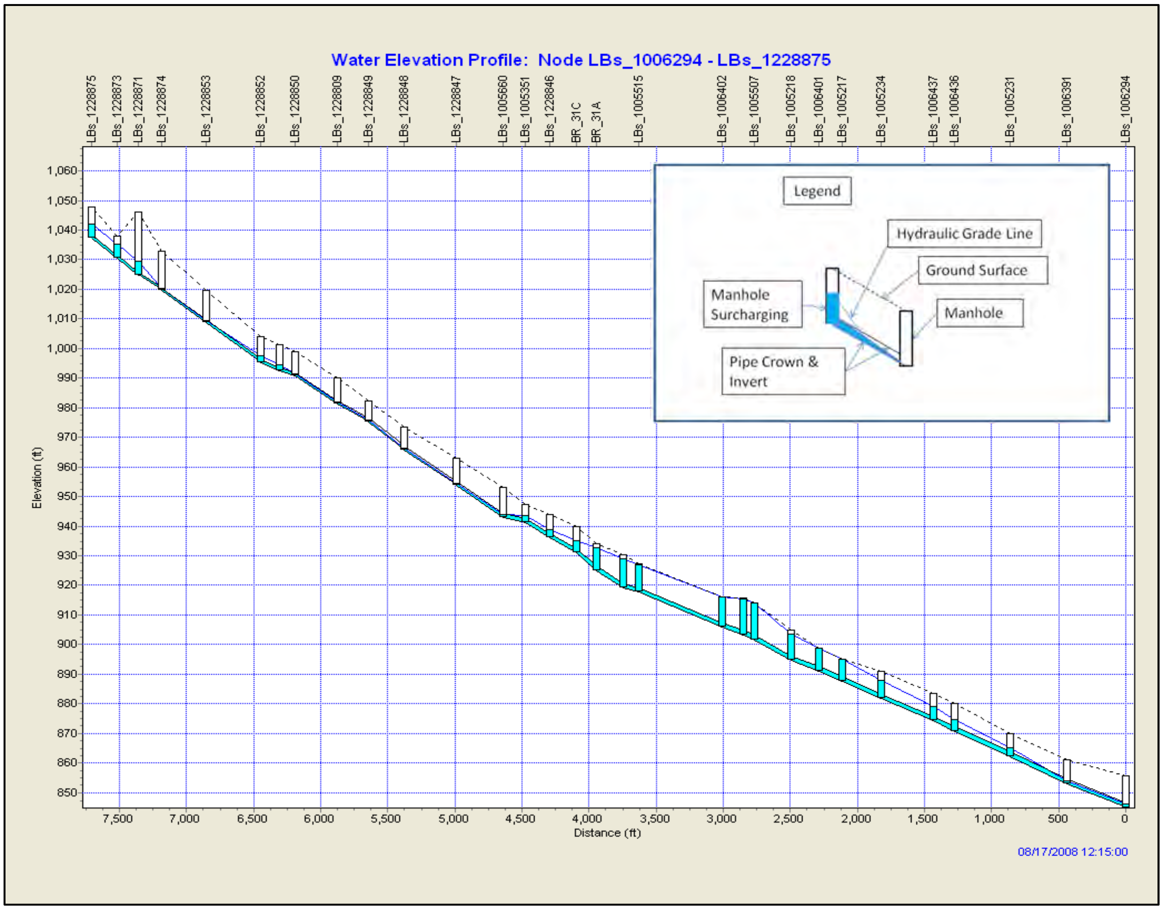


FIGURE M42-2-1E: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-LEBANON ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

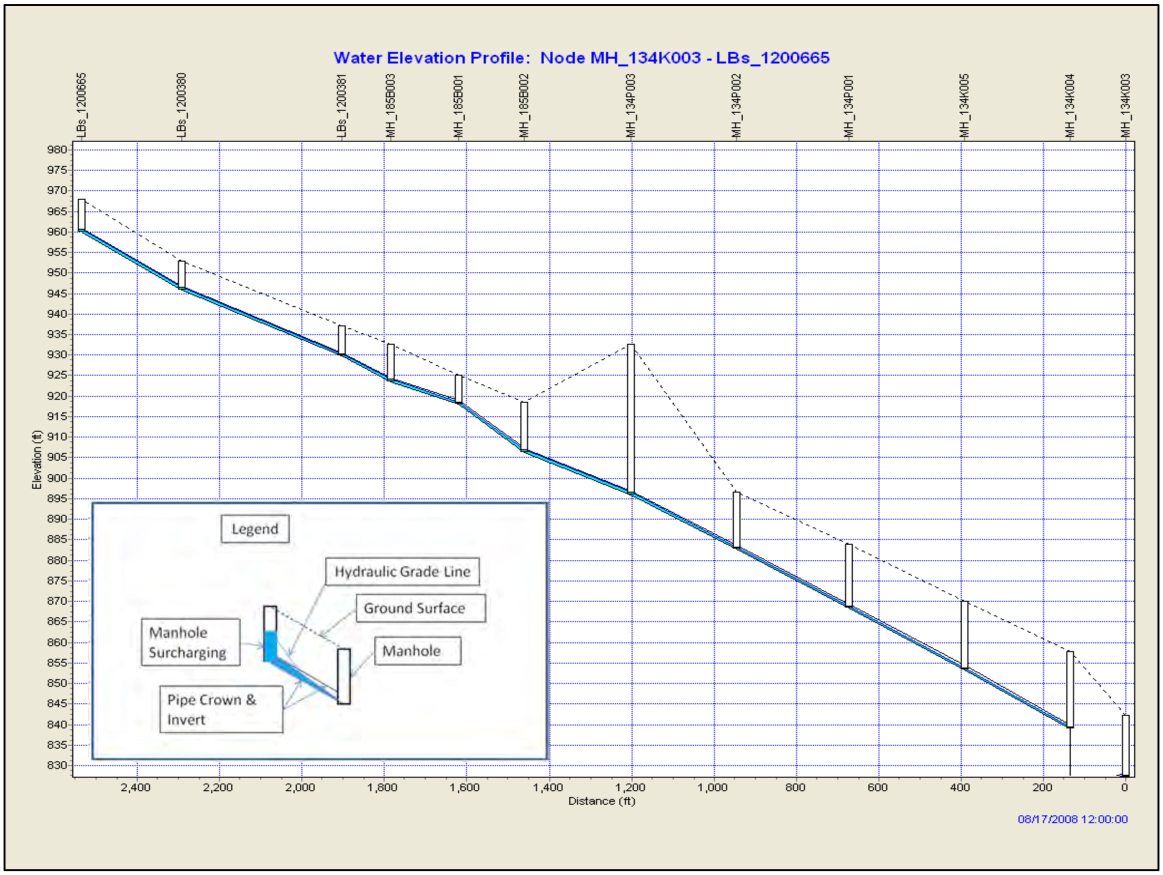


FIGURE M42-2-2A: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-STREETS RUN INTERCEPTOR

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

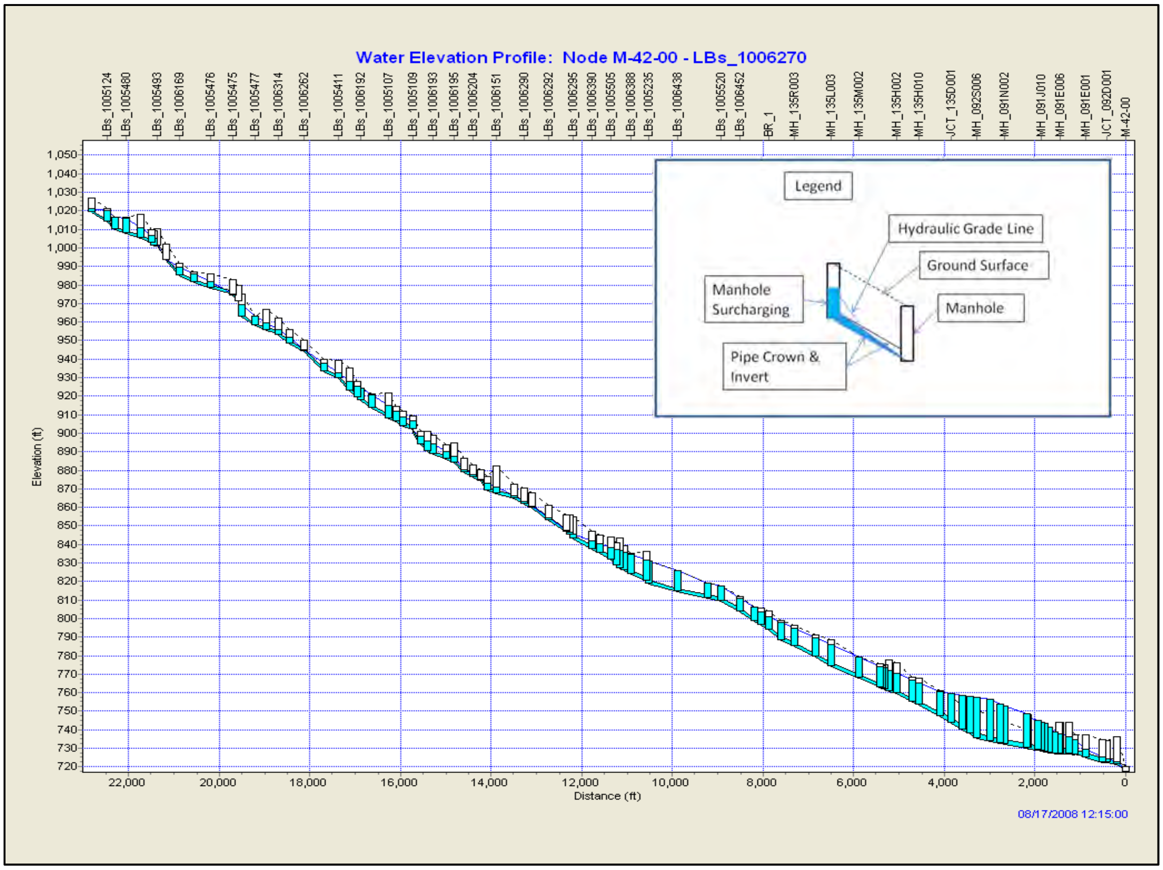


FIGURE M42-2-2B: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-MIFFLIN ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

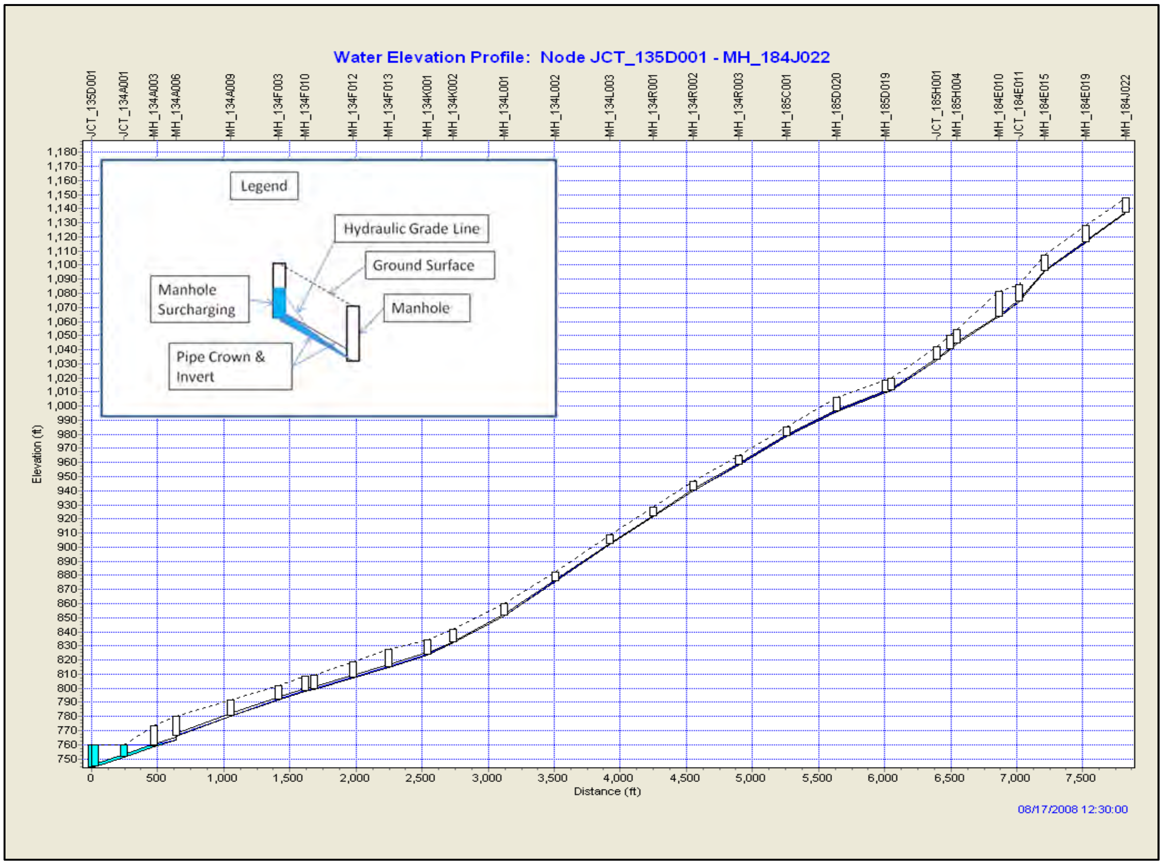


FIGURE M42-2-2C: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-GLASS RUN ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

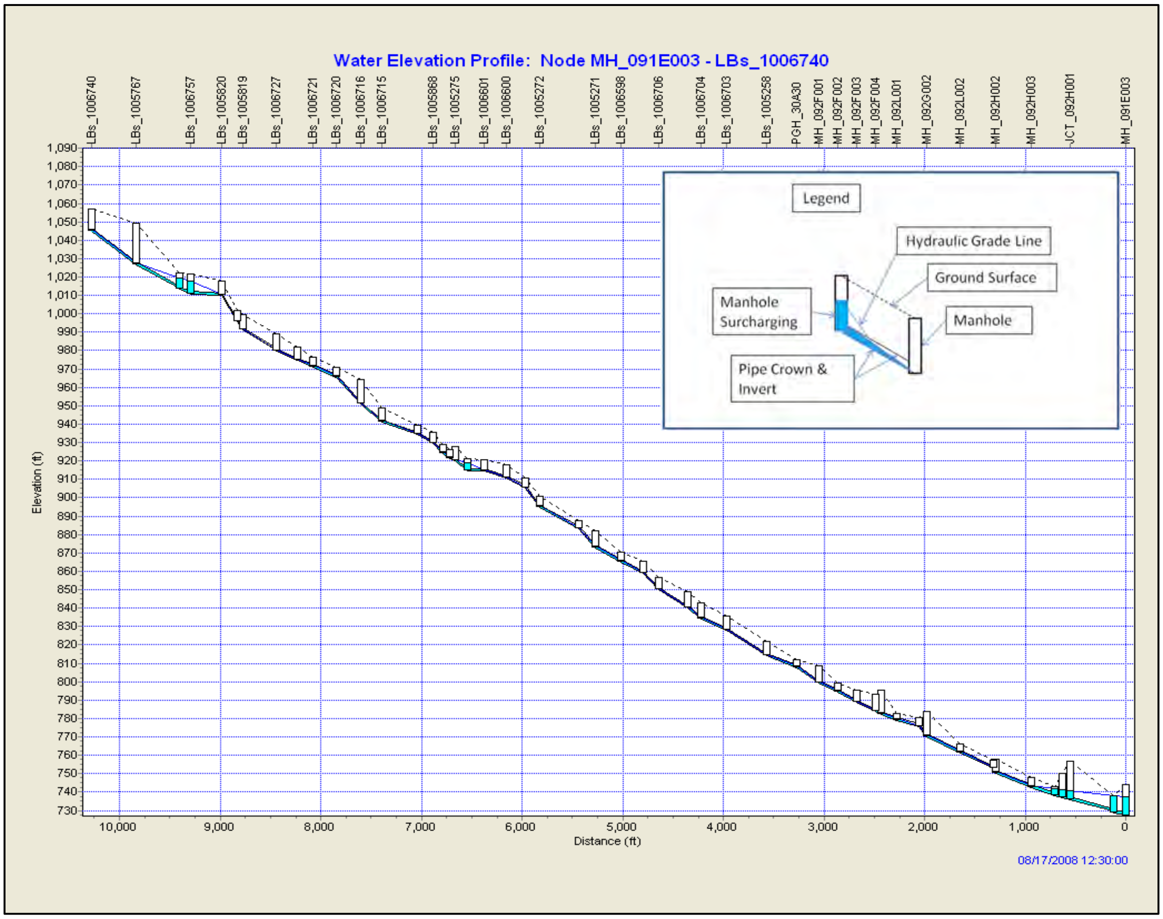


FIGURE M42-2-2D: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-BRENTWOOD ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

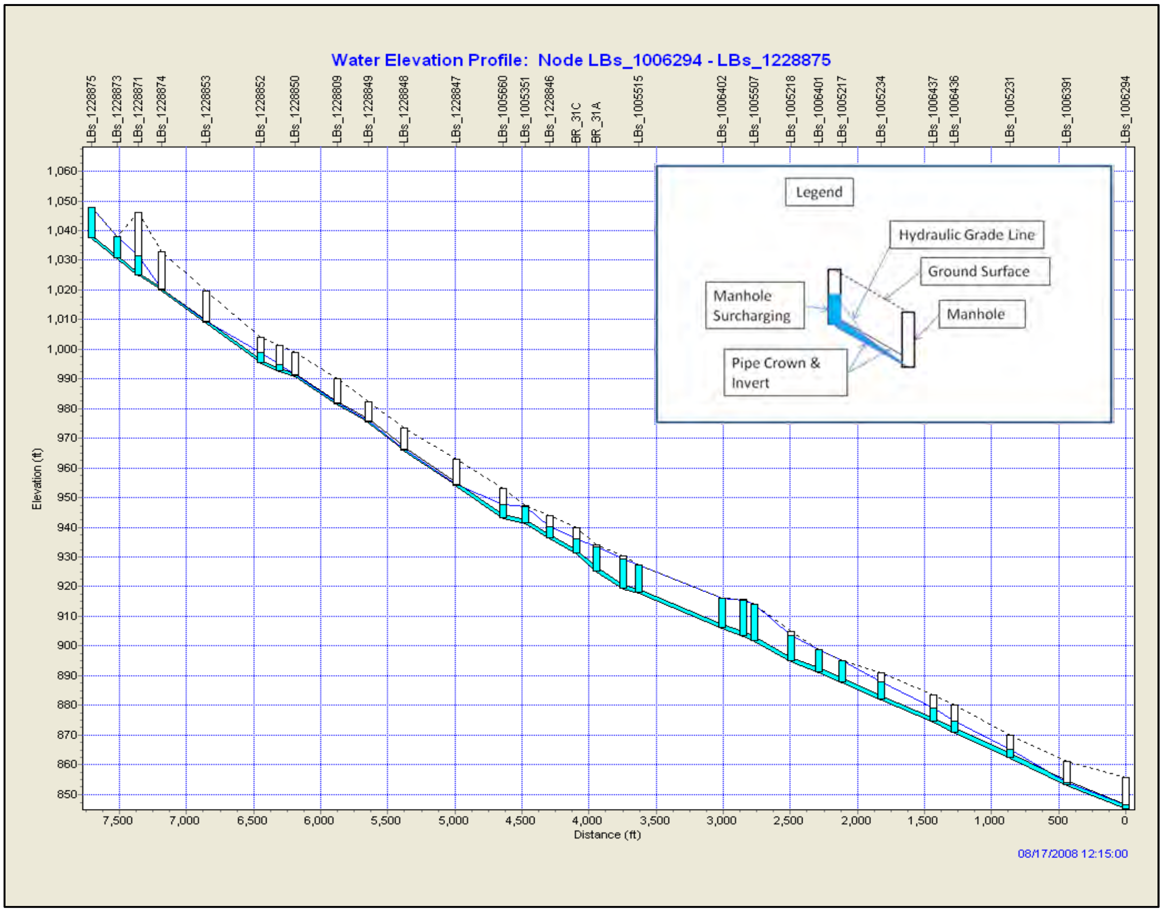


FIGURE M42-2-2E: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-LEBANON ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

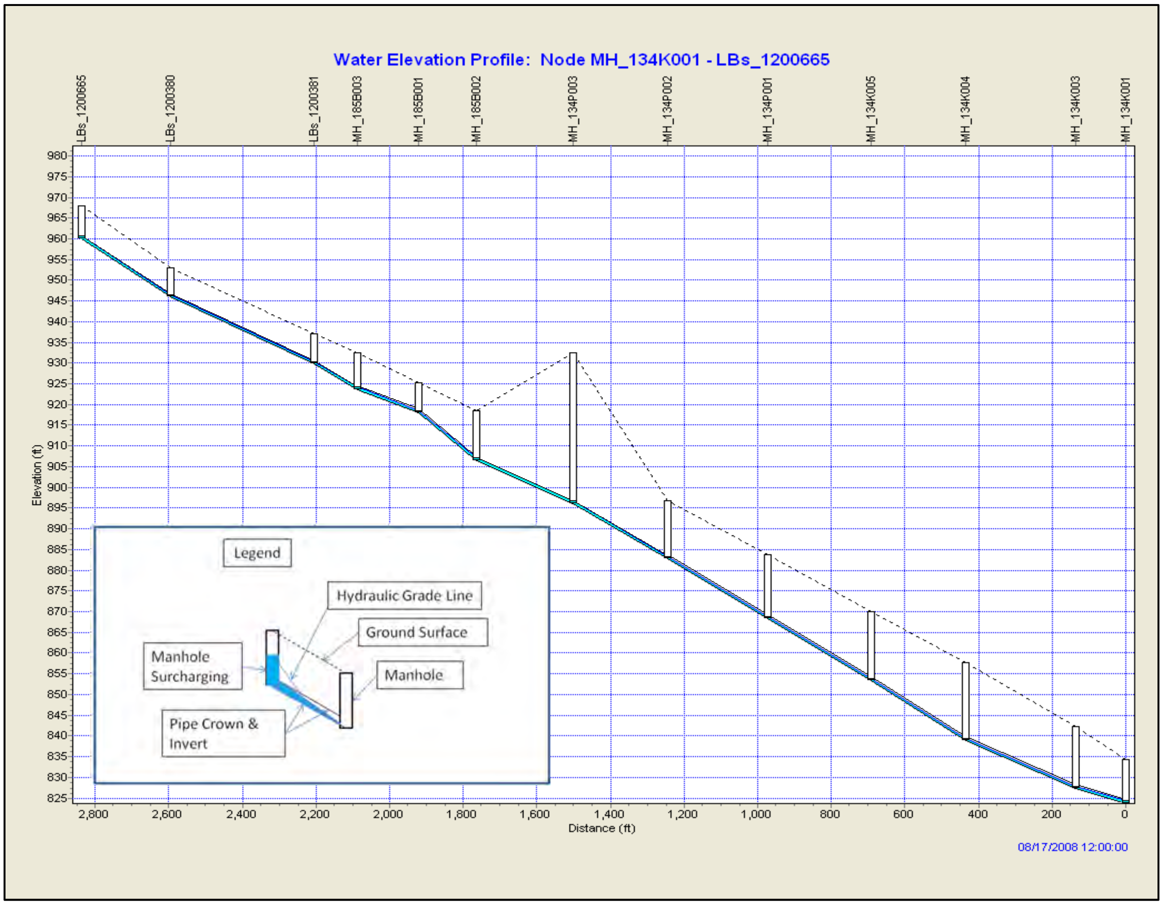


FIGURE M42-2-3A: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-STREETS RUN INTERCEPTOR

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

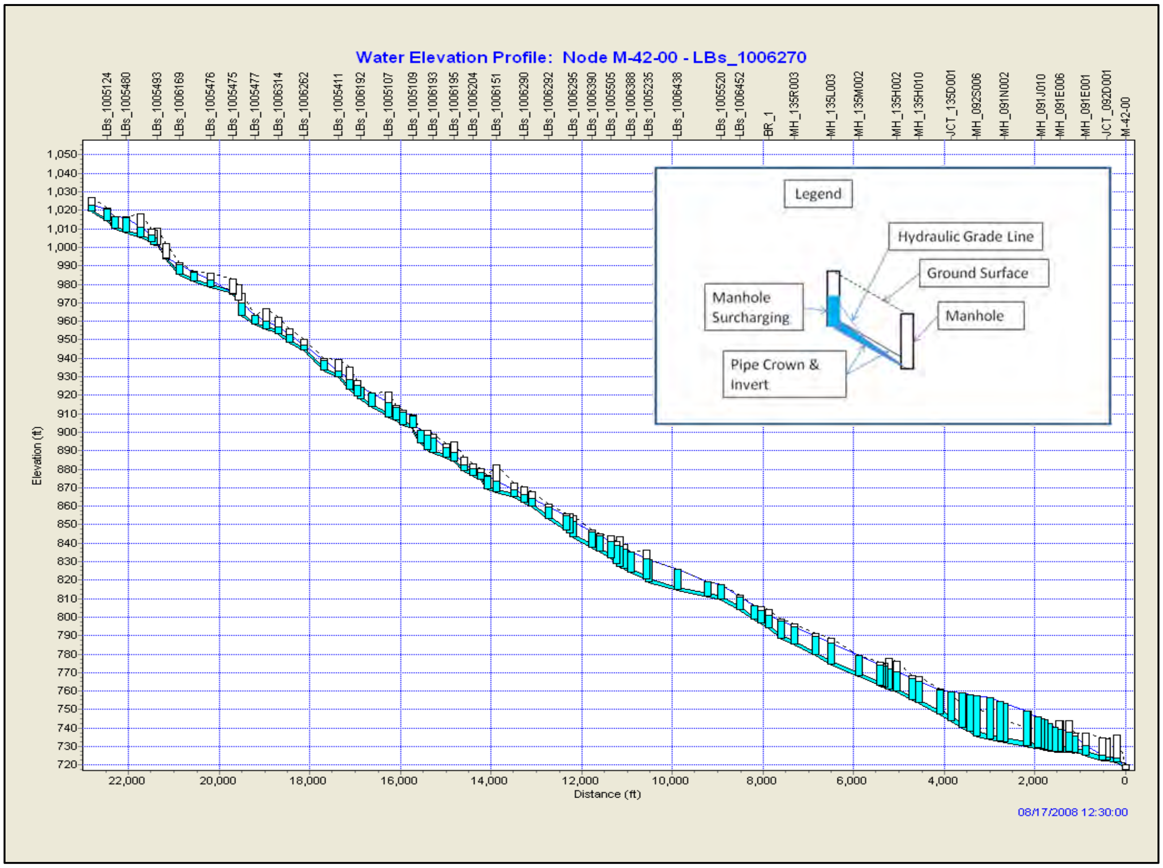


FIGURE M42-2-3B: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-MIFFLIN ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

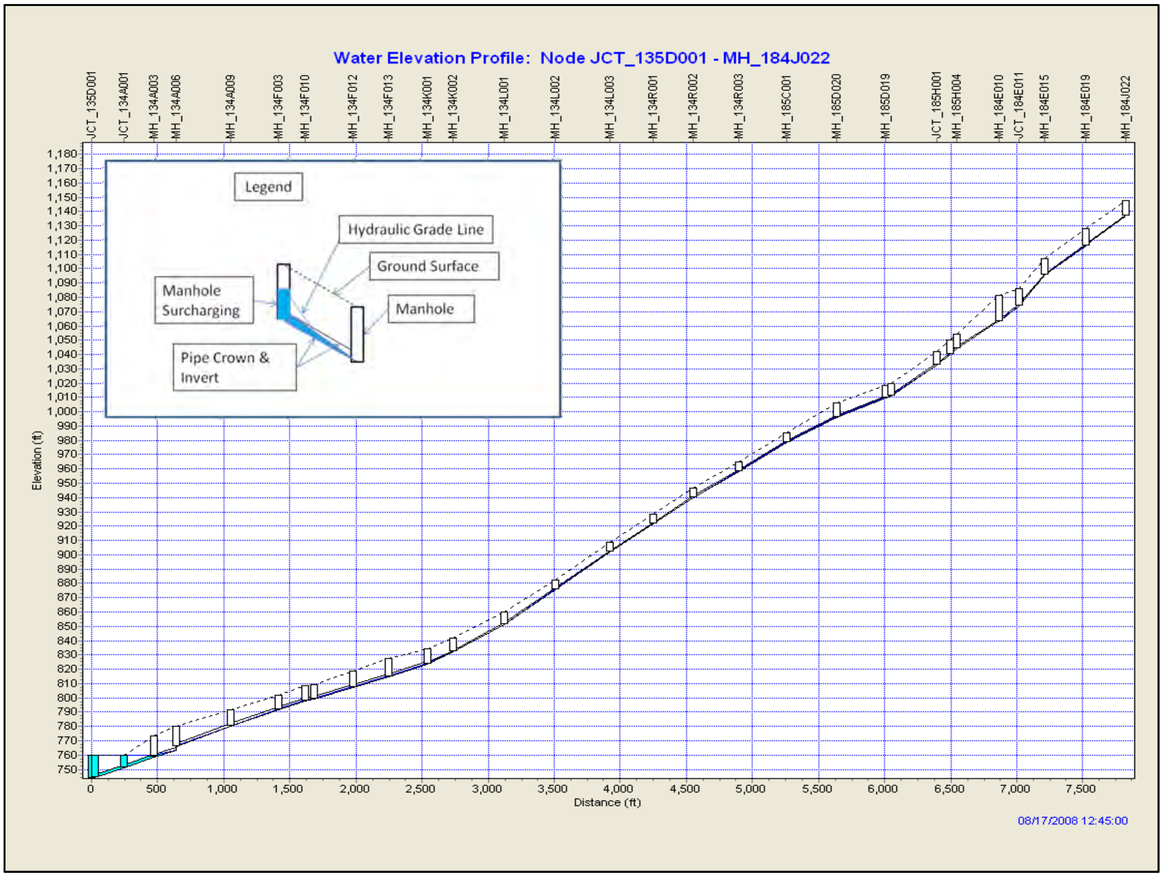


FIGURE M42-2-3C: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-GLASS RUN ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

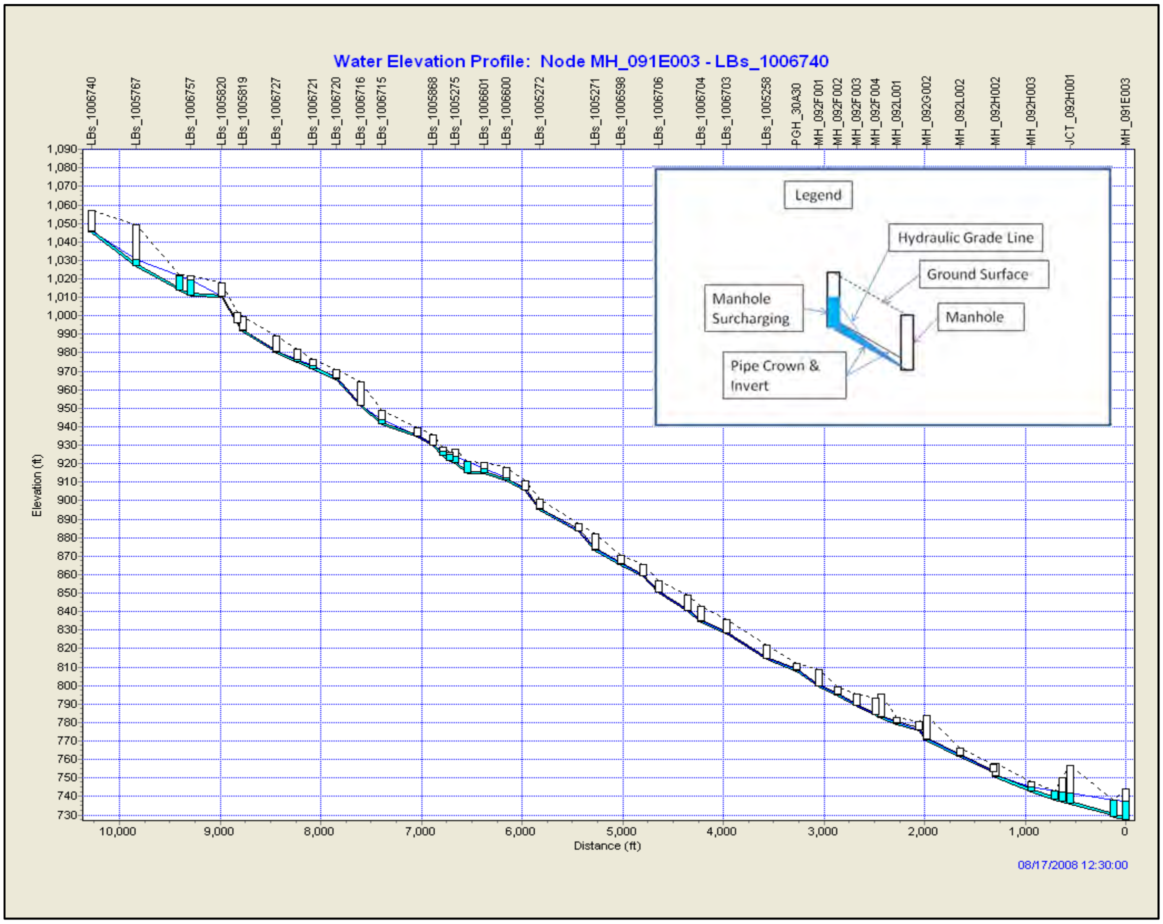


FIGURE M42-2-3D: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-BRENTWOOD ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

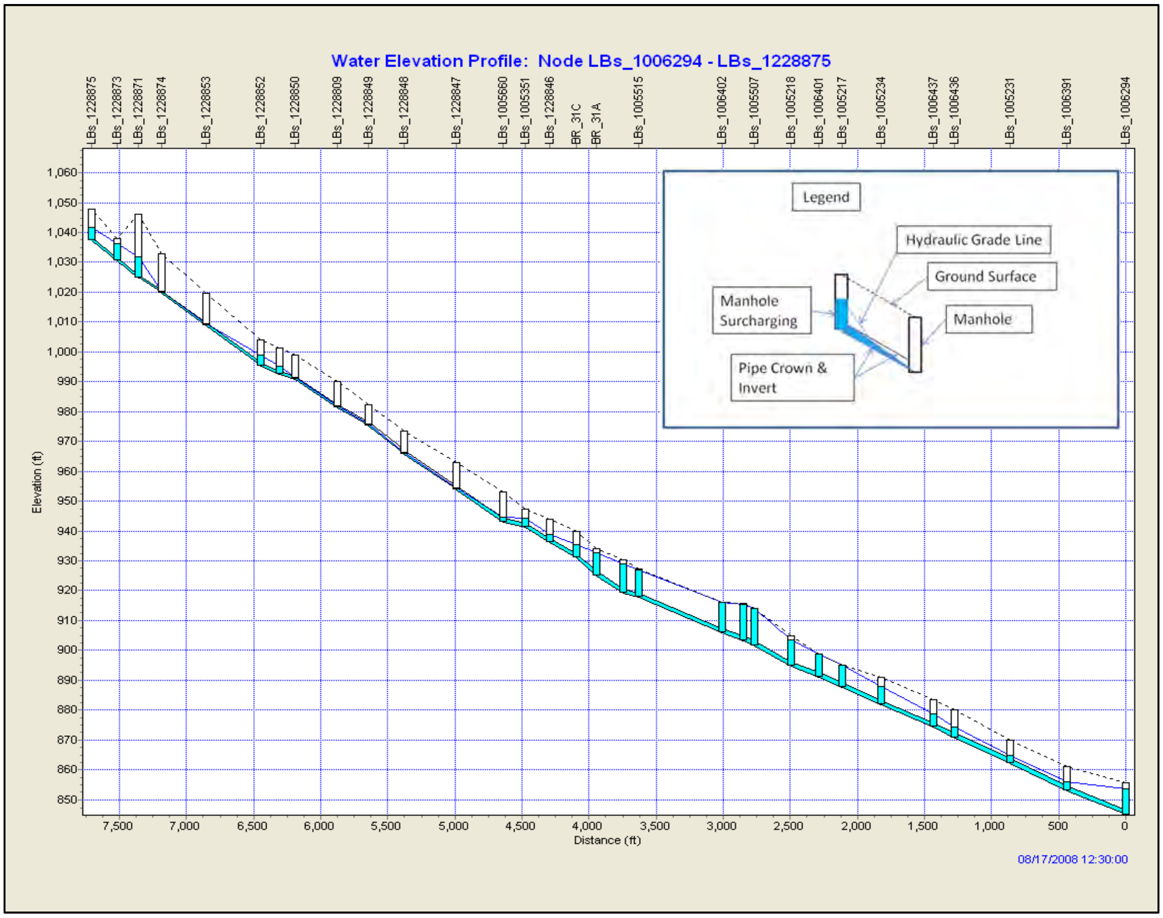


FIGURE M42-2-3E: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-LEBANON ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

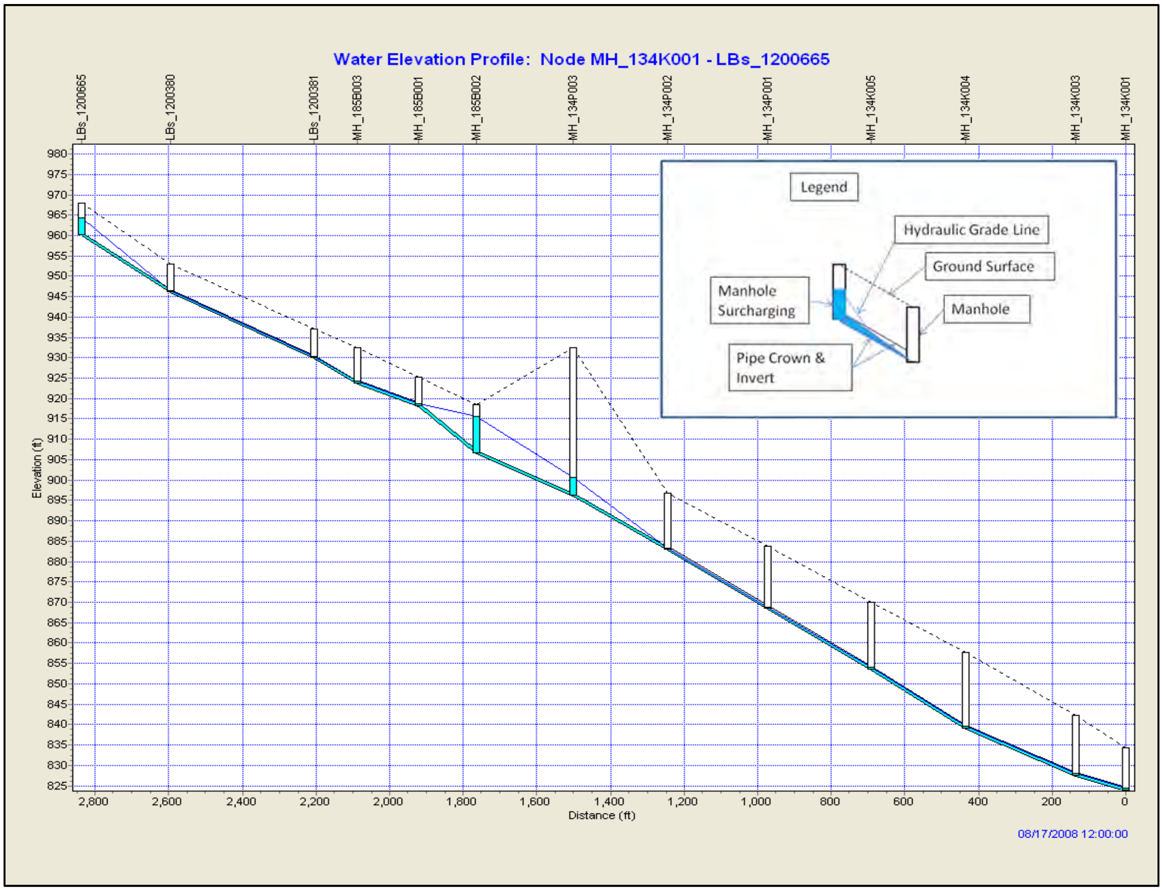
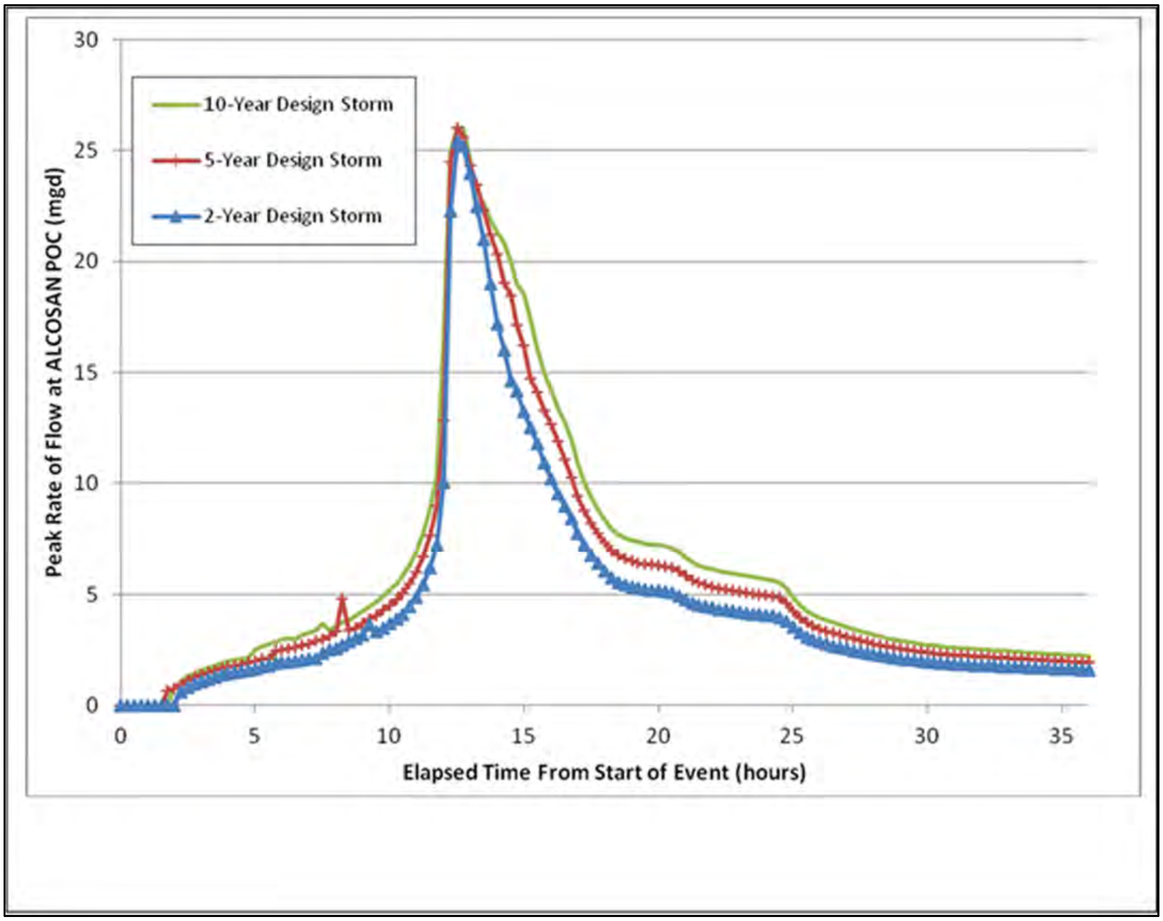


FIGURE M42-2-4: M-42 SEWERSHED PEAK FLOW RATES TO THE POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

Table M42-2-5 presents a summary of the identified chronic basement flooding locations within the PWSA portion of the Streets Run sewershed. Most of the neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. However, per a response letter to 3RWW to a request for information, Whitehall Borough indicated that they do not have any basement flooding in M-42. Via a similar letter submitted by Brentwood Borough, Brentwood indicated they also do not have any basement flooding in M-42.

The data presented in Table M42-2-5 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE M42-2-5: M-42 CHRONIC BASEMENT BACKUP LOCATIONS (PWSA SYSTEM)[5]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
5722 Cox Ave	2	2008
1222 Rodgers St	2	2010
1457 Leaside Dr	2	2009
5117 Glenhurst Rd	2	2006
157 Spencer Ave	2	2010

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the M-42 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures M42-2-5a thru M42-1-5e and M42-2-6a thru M42-1-6e. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figures shows that under this range of operating conditions, the existing trunk sewer system does not have sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding. These results validate the findings and recommendations of the Draft Feasibility Study that anticipated the need to construct a consolidation/relief sewer to supplement the capacity of the existing trunk sewer system.

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[5] Information from analysis of PWSA SAP system

FIGURE M42-2-5A: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE- STREETS RUN INTERCEPTOR

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

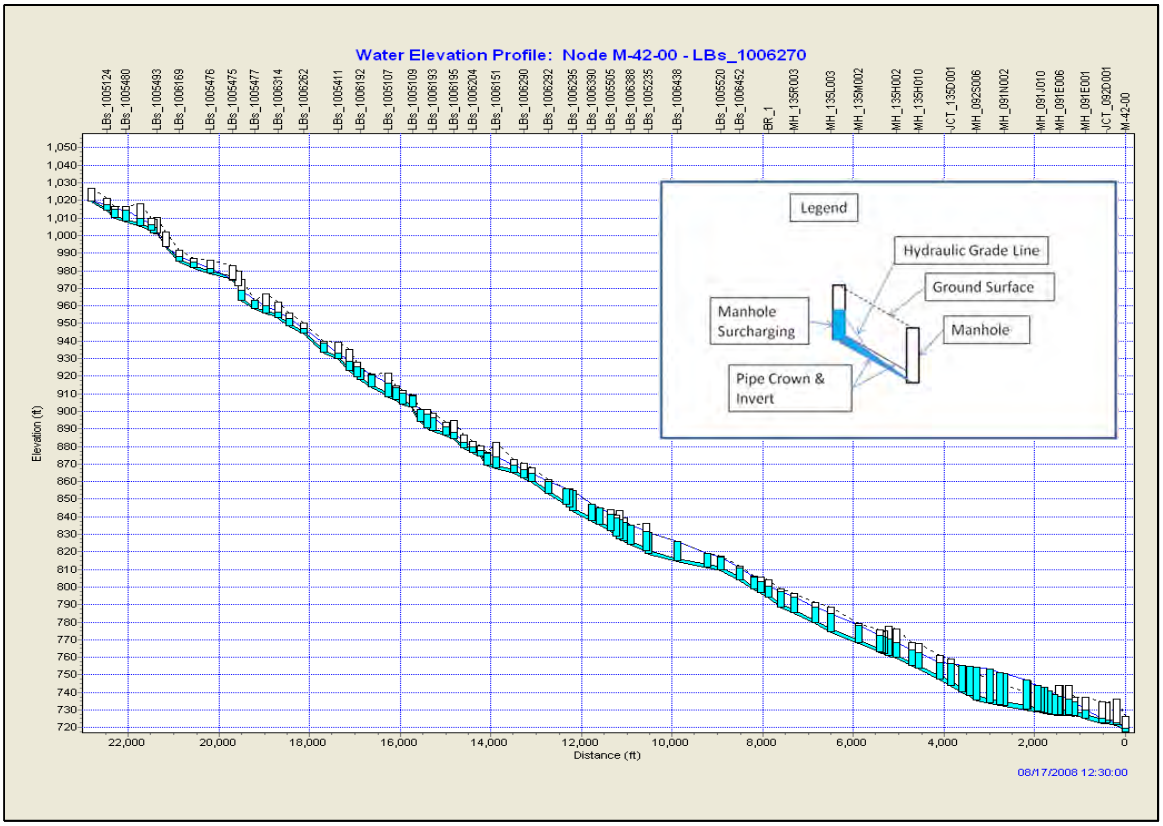


FIGURE M42-2-5B: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-MIFFLIN ROAD TRUNK SEWER

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

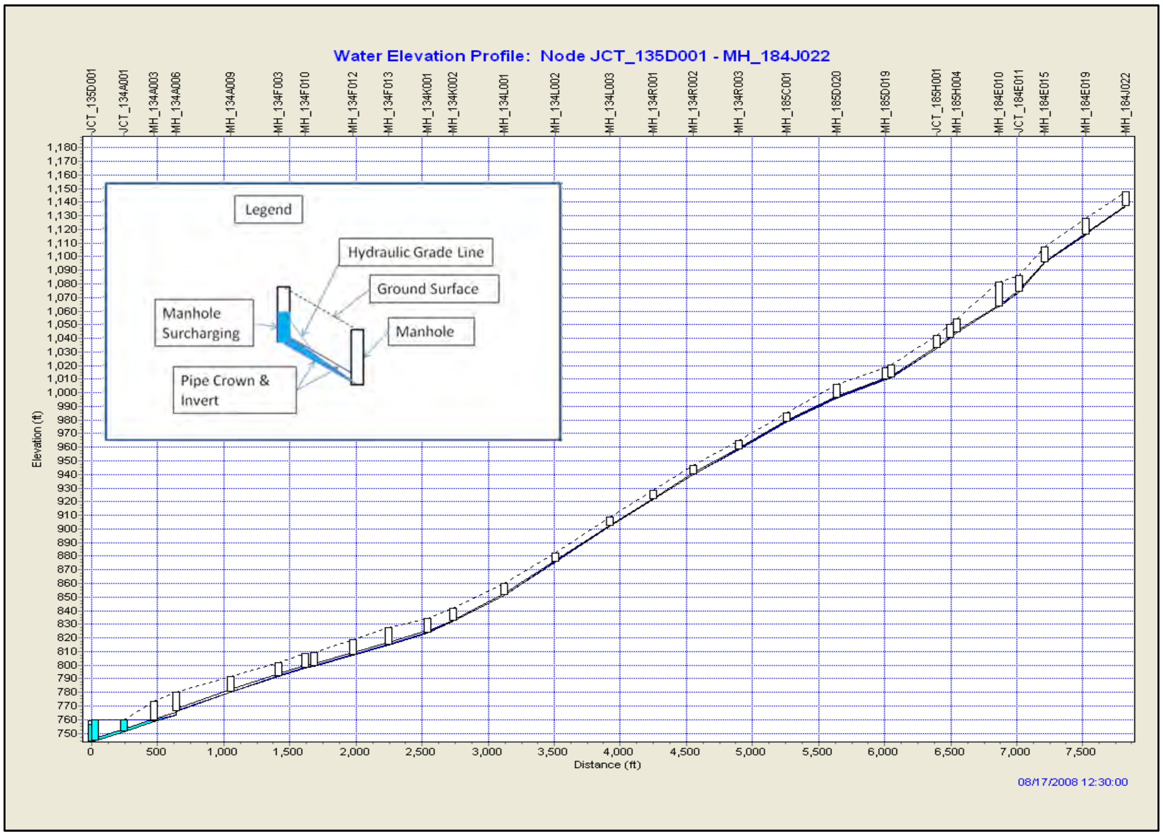


FIGURE M42-2-5C: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-GLASS ROAD TRUNK SEWER

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

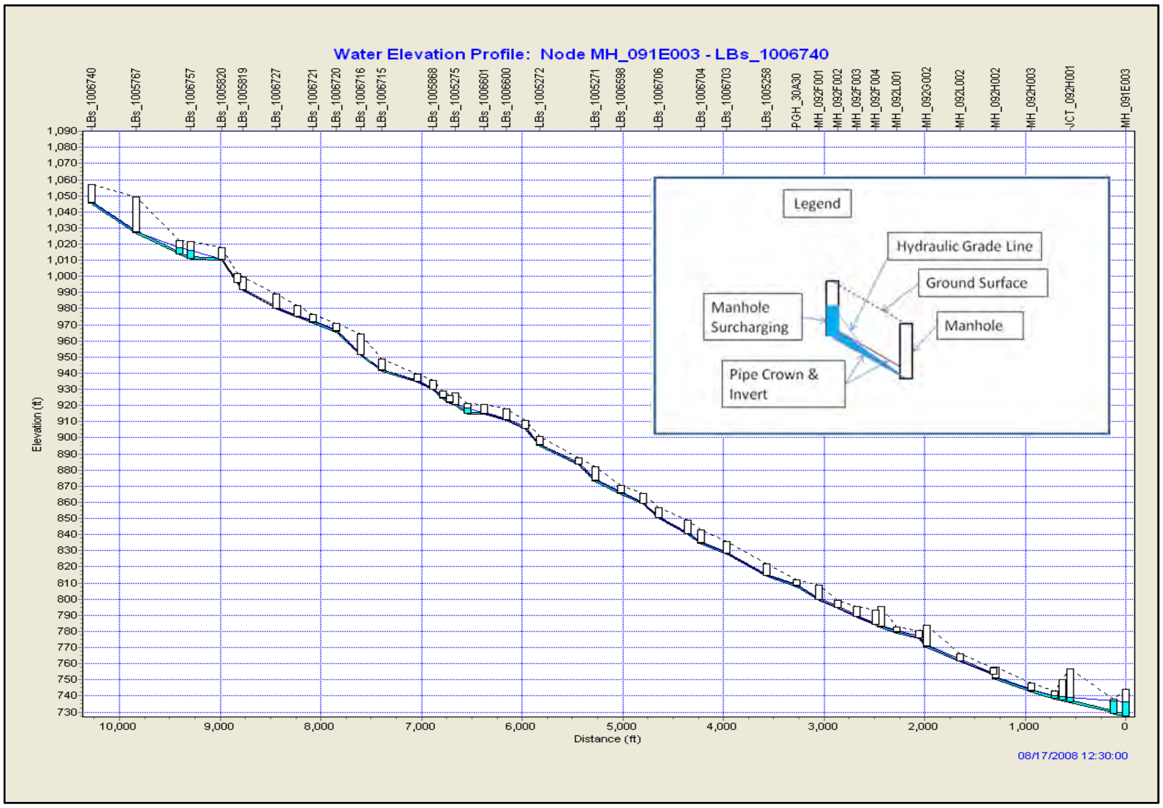


FIGURE M42-2-5D: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-BRENTWOOD ROAD TRUNK SEWER

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

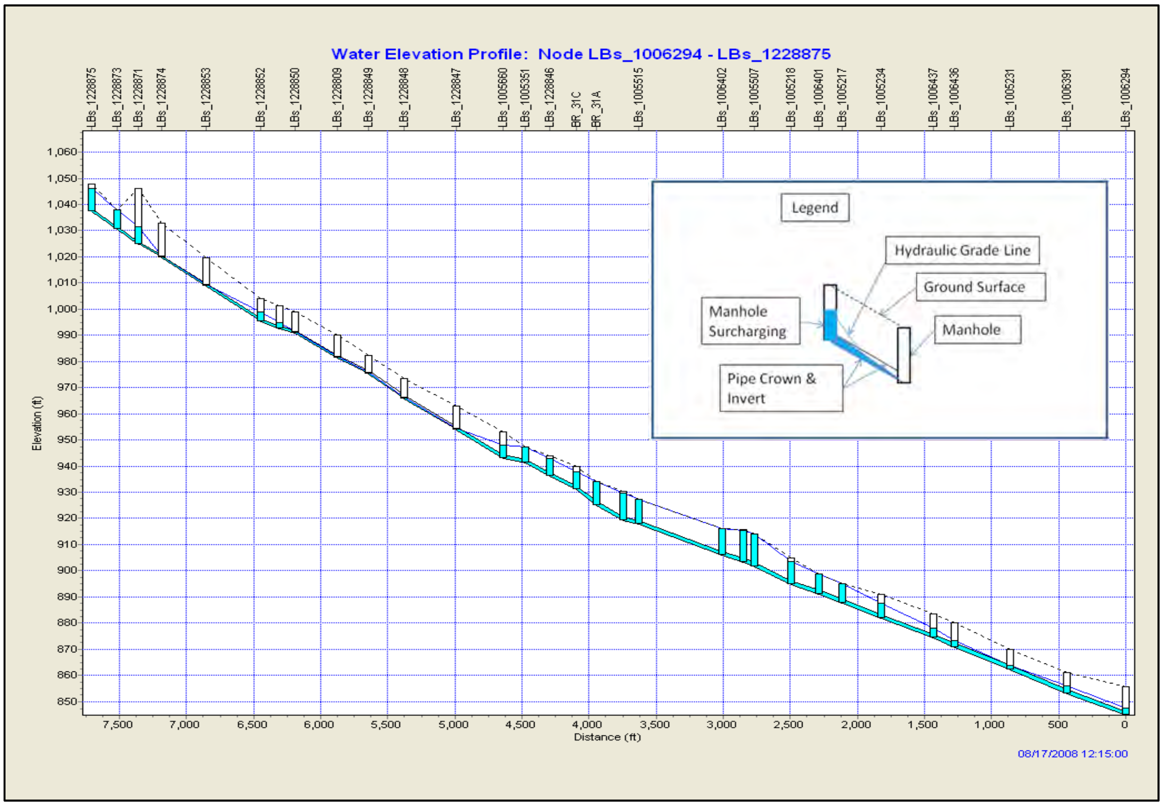


FIGURE M42-2-5E: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-LEBANON ROAD TRUNK SEWER

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

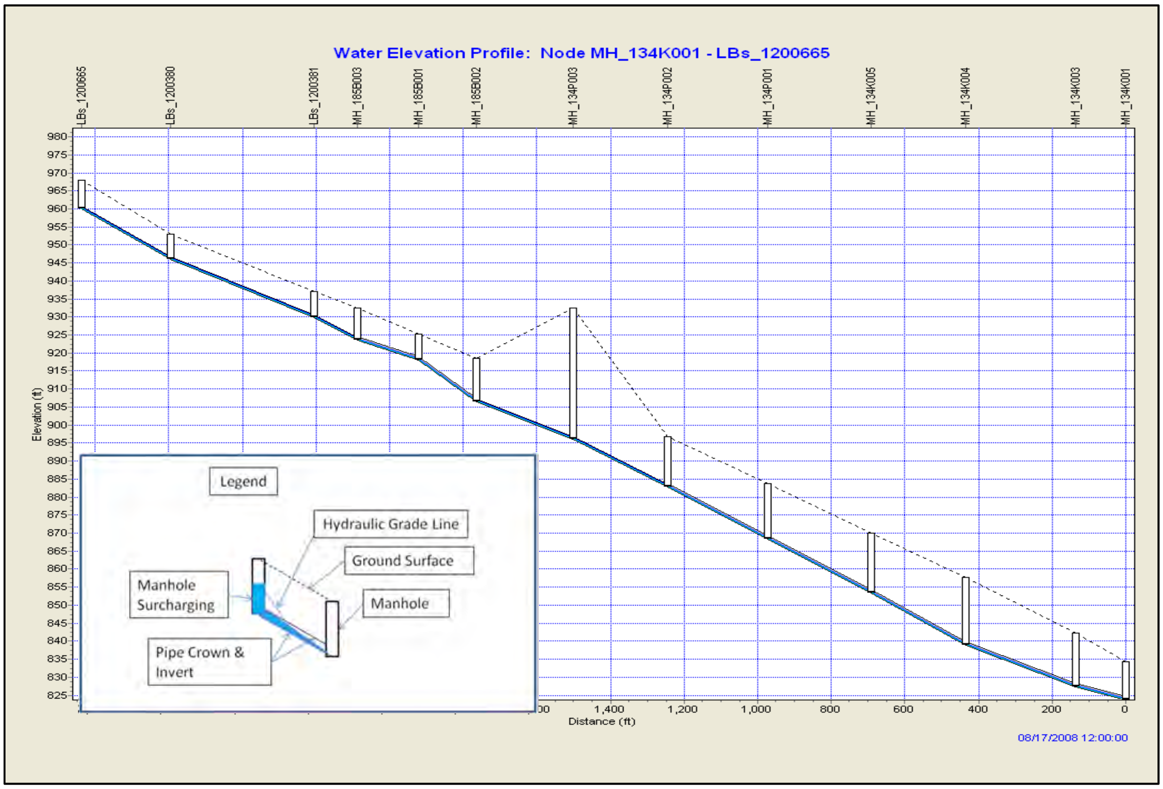


FIGURE M42-2-6A: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-STREETS RUN INTERCEPTOR

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

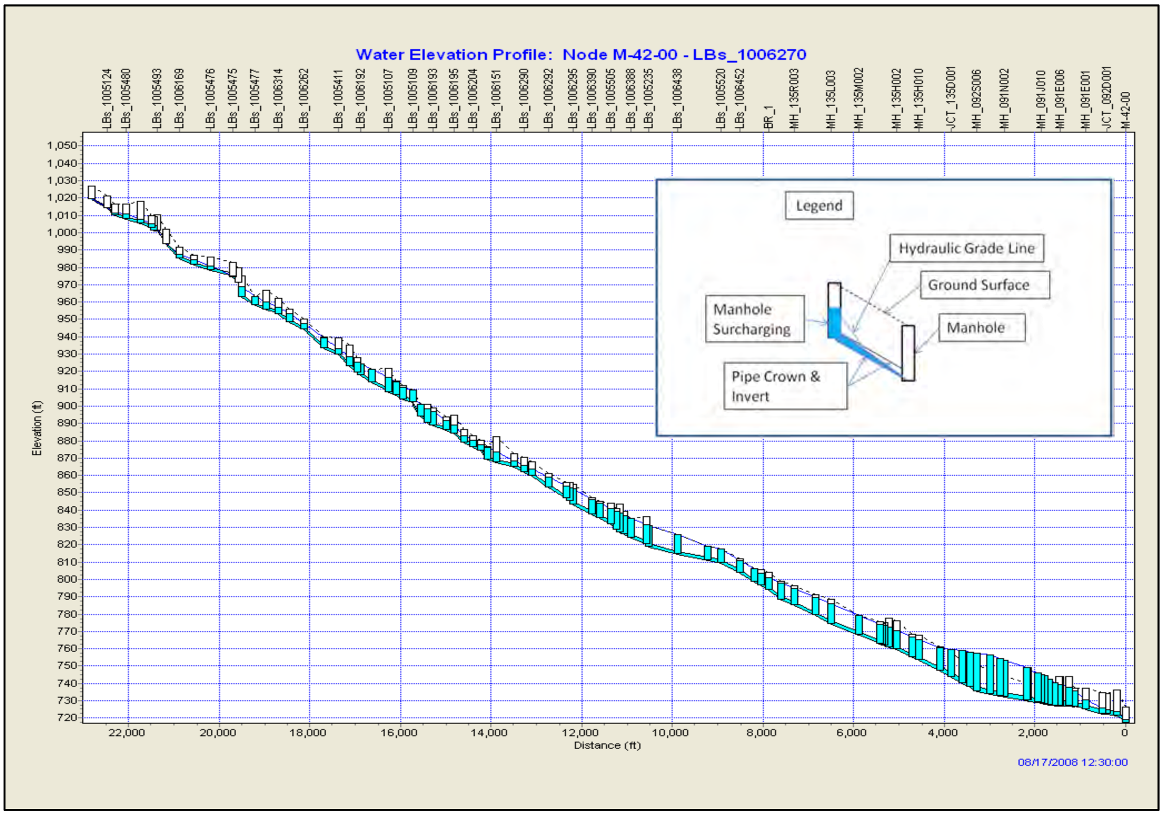


FIGURE M42-2-6B: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-MIFFLIN ROAD TRUNK SEWER

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

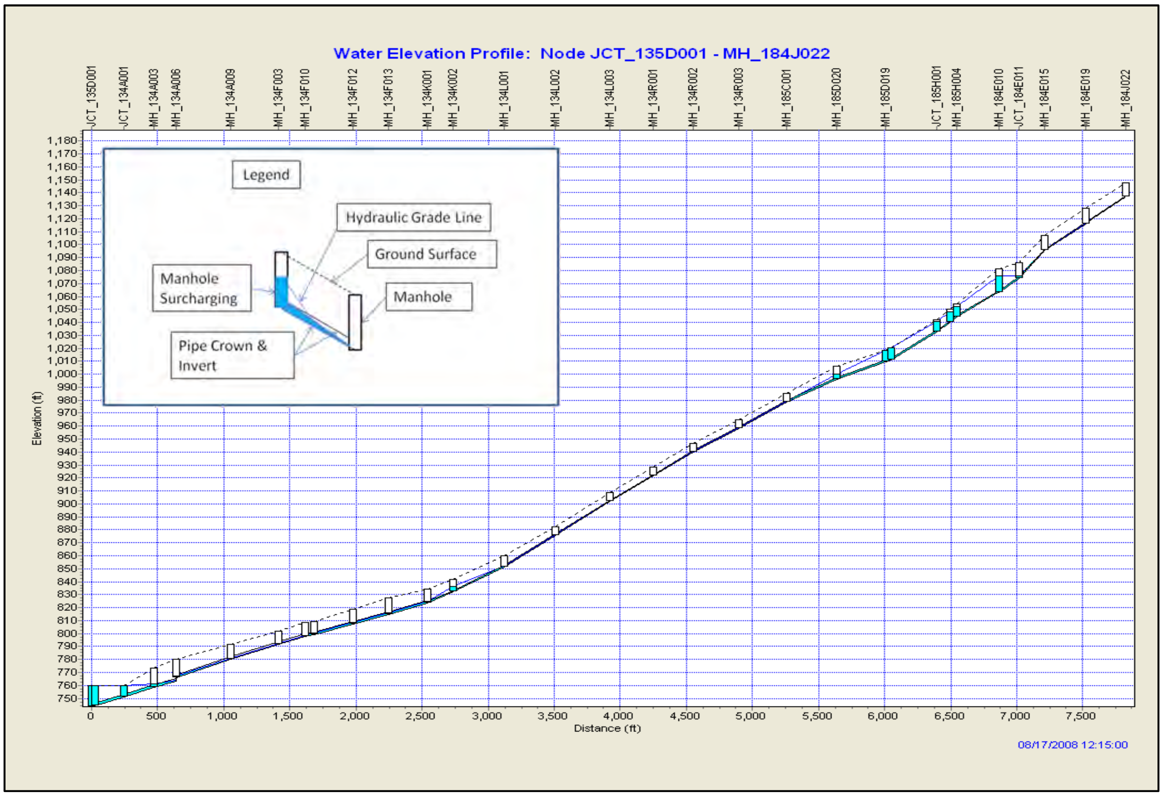


FIGURE M42-2-6C: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-GLASS ROAD TRUNK SEWER

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

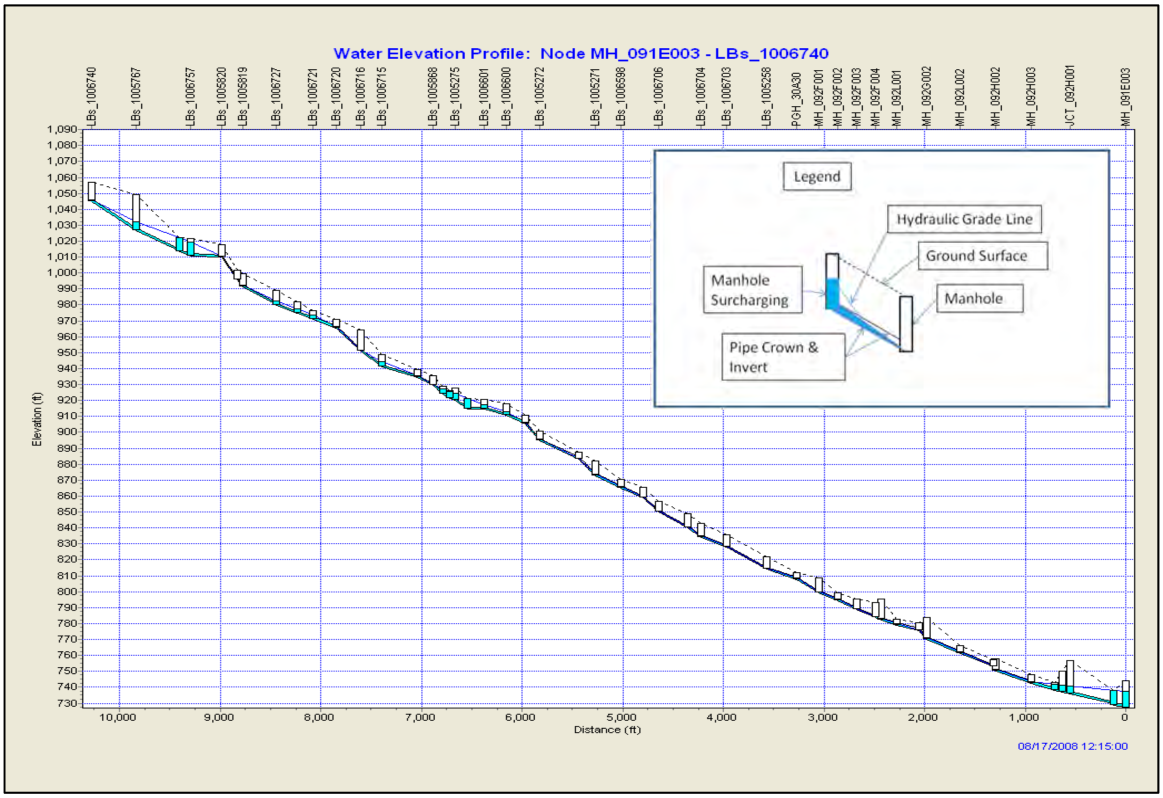


FIGURE M42-2-6D: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-BRENTWOOD ROAD TRUNK SEWER

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

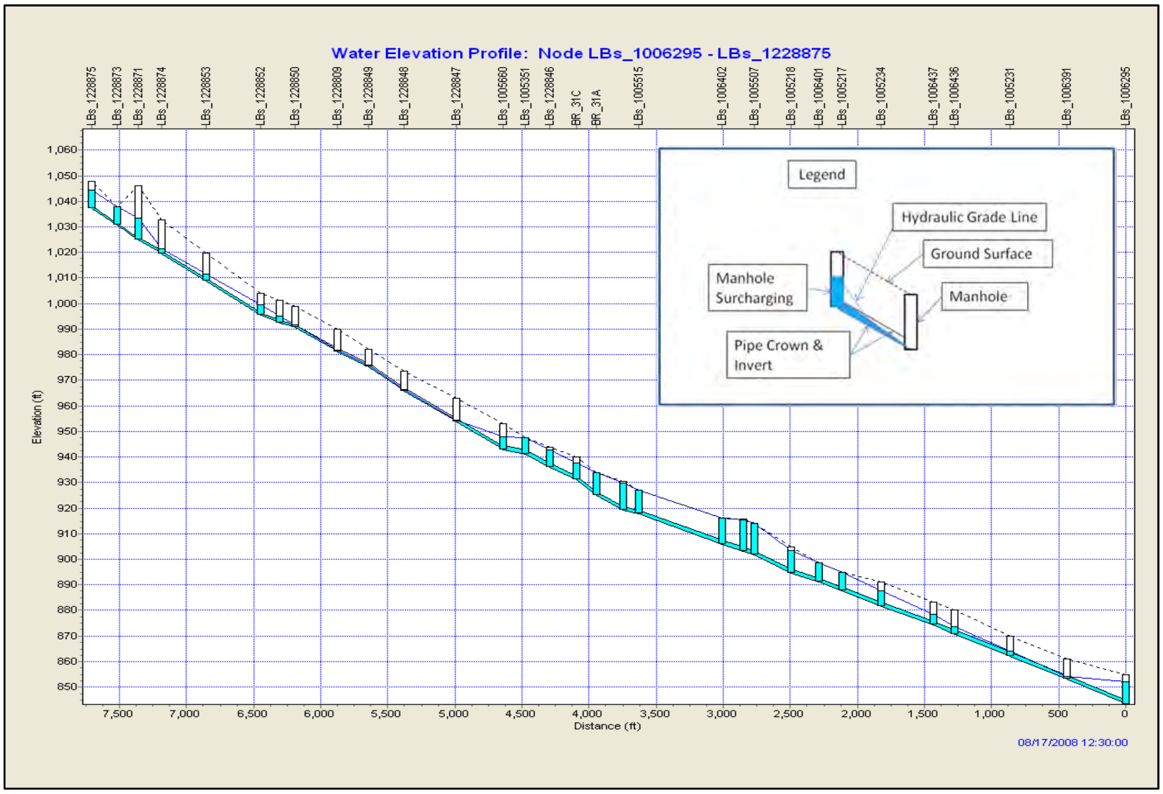
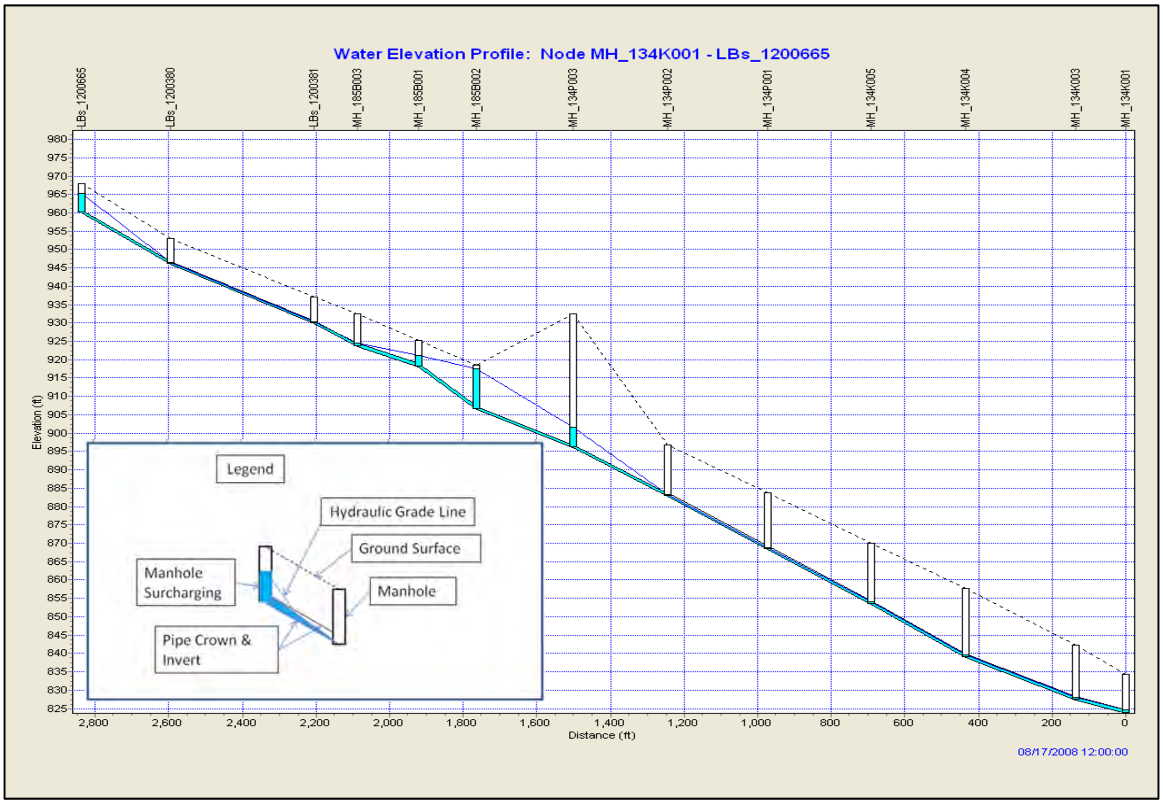


FIGURE M42-2-6E: M-42 SEWERSHED MAIN TRUNK SEWER PROFILE-LEBANON ROAD TRUNK SEWER

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 in this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the M-42 sewer system performed by PWSA produced the following computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table M42-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the M-42: Streets Run sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

> which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. Three (3) of these outfalls are found within the M-42 or Streets Run Sewershed, as shown in Table M42-3-1.

TABLE M42-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE M-42: STREETS RUN SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF134A001	UM	M-42	Streets Run	WWF[1]	N	Y
OF185H001	UM	M-42	Streets Run	WWF	N	Y
OF184E001	UM	M-42	Streets Run	WWF	N	Y

As shown in the table, these three (3) PWSA owned outfalls discharges into Streets Run. This receiving water is classified as warm water fishery (WWF) and currently does not meet its assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is

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[1] Warm Water Fishery

calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.

- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical

characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving water for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the M-34 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO

controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a “typical year” storm. For the M-42 sewershed, Table M42-3-2 lists the untreated CSO statistics that were computed for each control level.

TABLE M42-3-2: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE M-42 STREETS SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC184E001	0	0	4	0.36	8	1.27
DC185H001	0	0	4	0.74	8	1.16
DC134A001	0	0	3	0.08	10	0.30
Total Volume		**0**		**1.18**		**2.73**

As will be described later in this report, the M-42 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year and 10-year return frequency events).

A range of design storms (2-yr, 5-yr, and 10-yr) were evaluated for transport of flows. PWSA plans to use the 4-yr storm which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

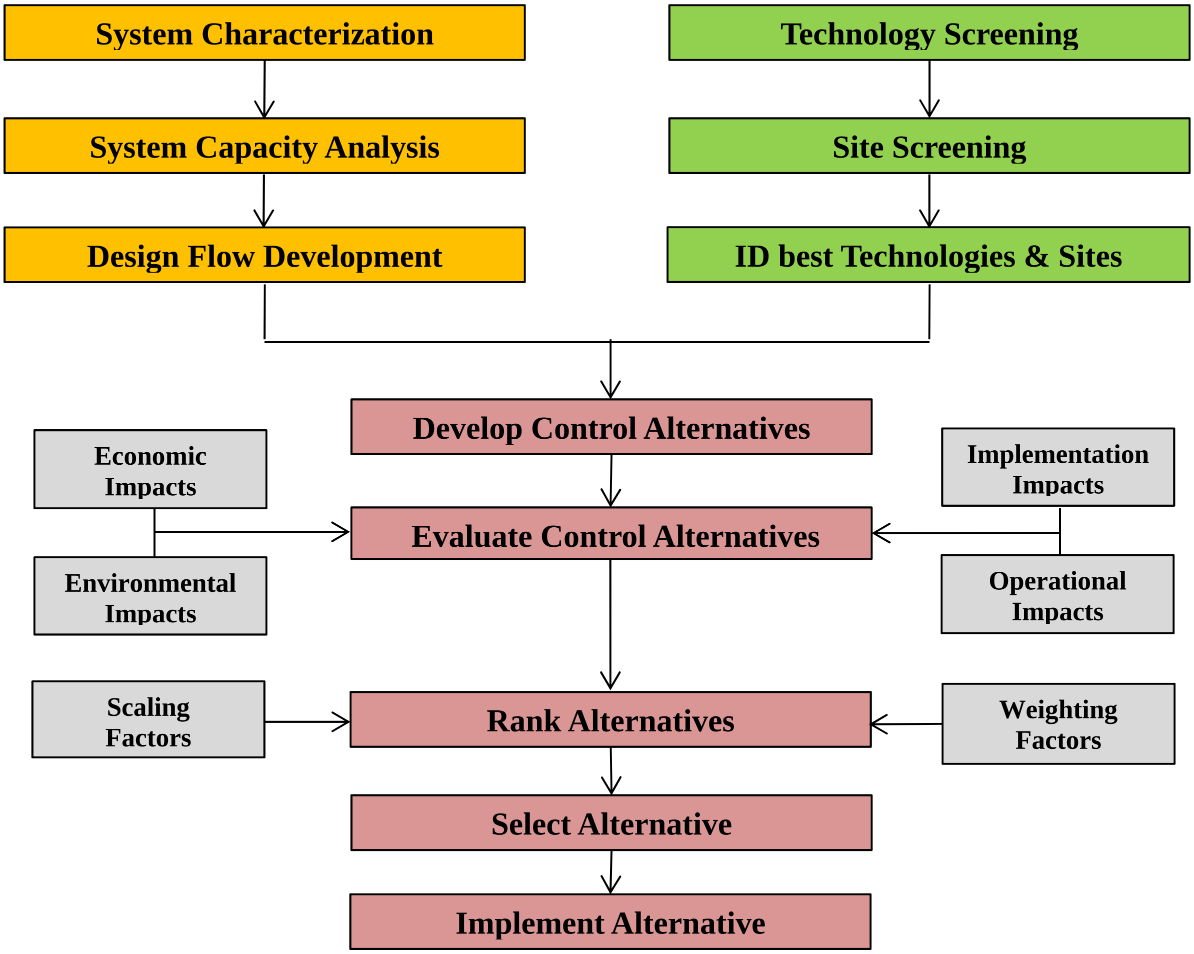
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure 4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE 4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered "feasible" for use in the M-42 sewershed are shown below in Table 4-1.

TABLE 4-1: M-42 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house

the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies was identified for the M-42 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table 4-2.

Contributing flows from the municipalities that are tributary to the M-42 sewershed, which include Baldwin Borough and Mt. Oliver Borough, were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as waterways.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning “Objective Scores” to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

TABLE 4-2: M-42 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 134A001	CS4 134A001: Sewer separation	Complete sewer separation of tributary area.
	S2-134A001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-134A001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-134A001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-134A001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-134A001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-134A001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 184E001 AND 185H001	CS4-184E001 AND 185H001: Sewer Separation	Complete sewer separation of tributary area.
	S2-184E001 AND 185H001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-184E001 AND 185H001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-184E001 AND 185H001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-184E001 AND 185H001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-184E001 AND 185H001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-184E001 AND 185H001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 091AM42	CS4-091AM42: Sewer Separation	Complete sewer separation of tributary area.
	S2-091AM42: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-091AM42: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-091AM42: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-091AM42: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-091AM42: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-091AM42: Screening and Disinfection	A stand-alone screening and disinfection facility.

CSO(s)	Control Alternative(s)	Description
Regional Controls – M-42: Streets Run Controls		
Outfall 091AM42, 134A001, 184E001 and 185H001	CS4- Streets Run: Sewer Separation	Complete sewer separation of tributary area.
	S2- Streets Run: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4- Streets Run: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1- Streets Run: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2- Streets Run: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3- Streets Run: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4- Streets Run: Screening and Disinfection	A stand-alone screening and disinfection facility.
None	NA	NA
Sub-system Controls – Monongahela - Ohio Controls		
Outfalls 134A001, 184E001 AND 185H001, 030N001, and 032P001	MO-1: Tunnel Storage[2]	A 2.4 mile long tunnel collecting flow from M-28 to O-25 The Becks Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • M-42 - Surface Storage • 030N001 – Sewer Separation • 184E001 AND 185H001 – Sub-Surface Storage
	MO-2: Tunnel Storage[2]	A 2.9 mile long tunnel collecting flow from M-29 to O-25 The Becks Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • M-42 - Surface Storage • 030N001 – Sewer Separation • 184E001 AND 185H001 – Sub-Surface Storage
	MO-3: Tunnel Storage[2]	A 5.4 mile long tunnel collecting flow from M-40 to O-25. The 030N001 and 184E001 AND 185H001 outfalls will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 030N001 – Sewer Separation • 184E001 AND 185H001 – Sub-Surface Storage

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

CSO(s)	Control Alternative(s)	Description
	MO-4: Tunnel Storage[2]	A 6.1 mile long tunnel collecting flow from M-42 to O-25 The 030N001 and 184E001 AND 185H001 outfalls will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 030N001 – Sewer Separation • 184E001 AND 185H001 – Sub-Surface Storage
	MO-5: Tunnel Storage[2]	A 7.5 mile long tunnel collecting flow from M-47 to O-25 The 030N001 and 184E001 AND 185H001 outfalls will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 030N001 – Sewer Separation • 184E001 AND 185H001 – Sub-Surface Storage
	MO-6: Tunnel Storage[2]	A 5.0 mile long tunnel collecting flow from M-29 to O-25 and M-47. The Becks Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • M-42 - Surface Storage • 030N001 – Sewer Separation • 184E001 AND 185H001 – Sub-Surface Storage

As described in later paragraphs, these criteria were used to “score” each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN’s Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

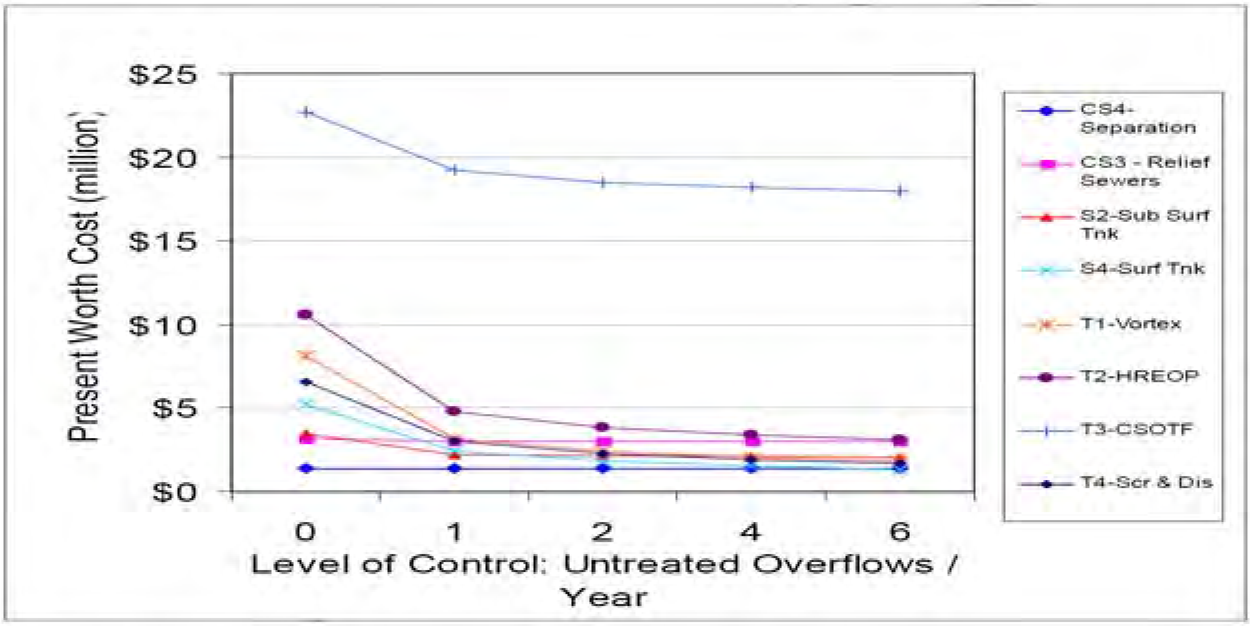
PWSA utilized ACT Version 2.1; a summary of the PWSA’s use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA’s cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

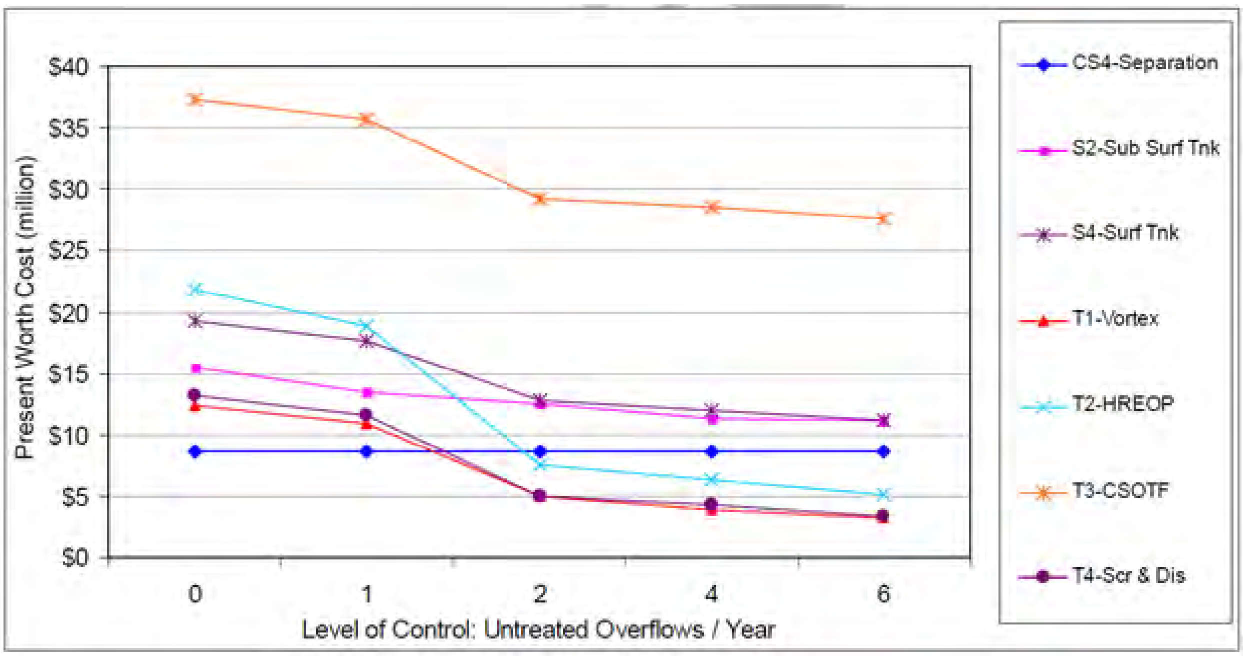
Outfall 134A001: Cost estimates were produced for outfall-specific control alternatives CS4 134A001: Sewer separation, S2-134A001: Sub-Surface Storage, S4-134A001: Surface Storage, T1-134A001: Suspended Solids Control, T2-134A001: High Rate End of Pipe Treatment, T3-134A001: CSO Treatment Facility, and T4-134A001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2a illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2A: OUTFALL 134A001 ALTERNATIVE COSTS



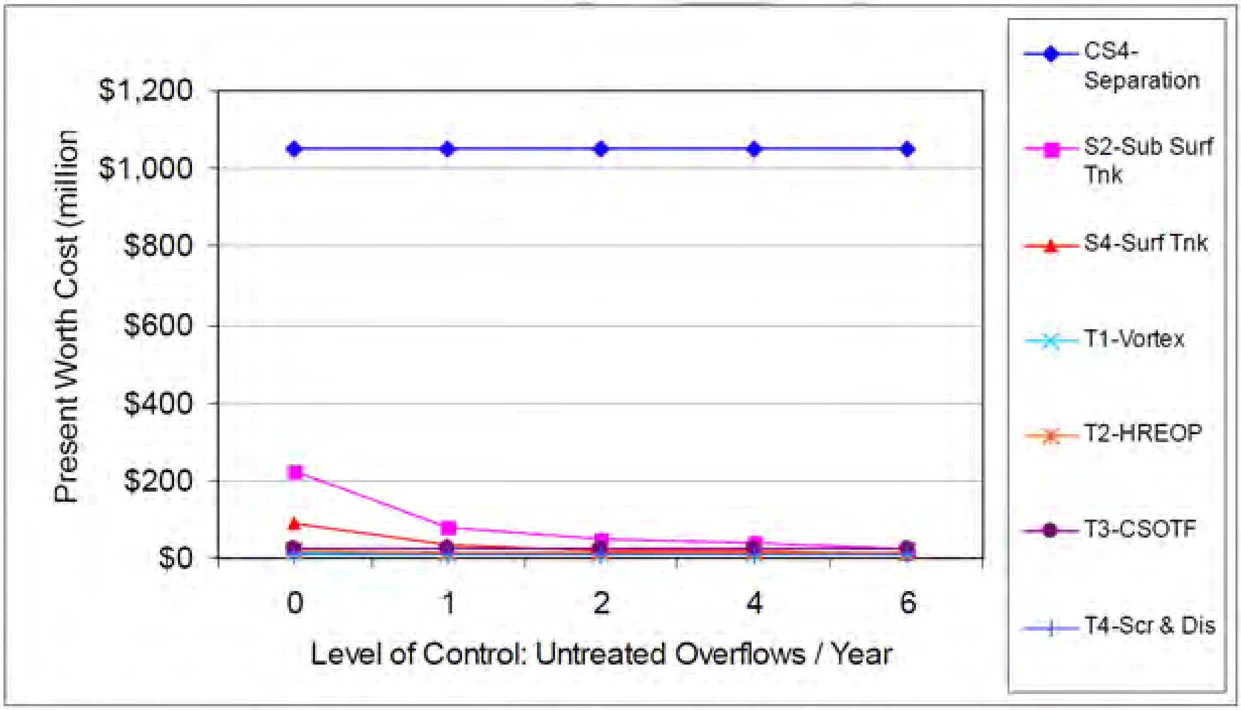
Outfalls 184E001 AND 185H001: Cost estimates were produced for outfall-specific control alternatives CS4-184E001 AND 185H001: Sewer separation, S2-184E001 AND 185H001: Sub-Surface Storage, S4-184E001 AND 185H001: Surface Storage, T1-184E001 AND 185H001: Suspended Solids Control, T2-184E001 AND 185H001: High Rate End of Pipe Treatment, T3-184E001 AND 185H001: CSO Treatment Facility, and T4-184E001 AND 185H001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2b illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2B: OUTFALLS 184E001 AND 185H001 ALTERNATIVE COSTS



Outfall 091AM42: Cost estimates were produced for outfall-specific control alternatives CS4 091AM42: Sewer separation, S2-091AM42: Sub-Surface Storage, S4-091AM42: Surface Storage, T1-091AM42: Suspended Solids Control, T2-091AM42: High Rate End of Pipe Treatment, T3-091AM42: CSO Treatment Facility, and T4-091AM42: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2c illustrates the ranges of estimated present worth costs for these alternatives.

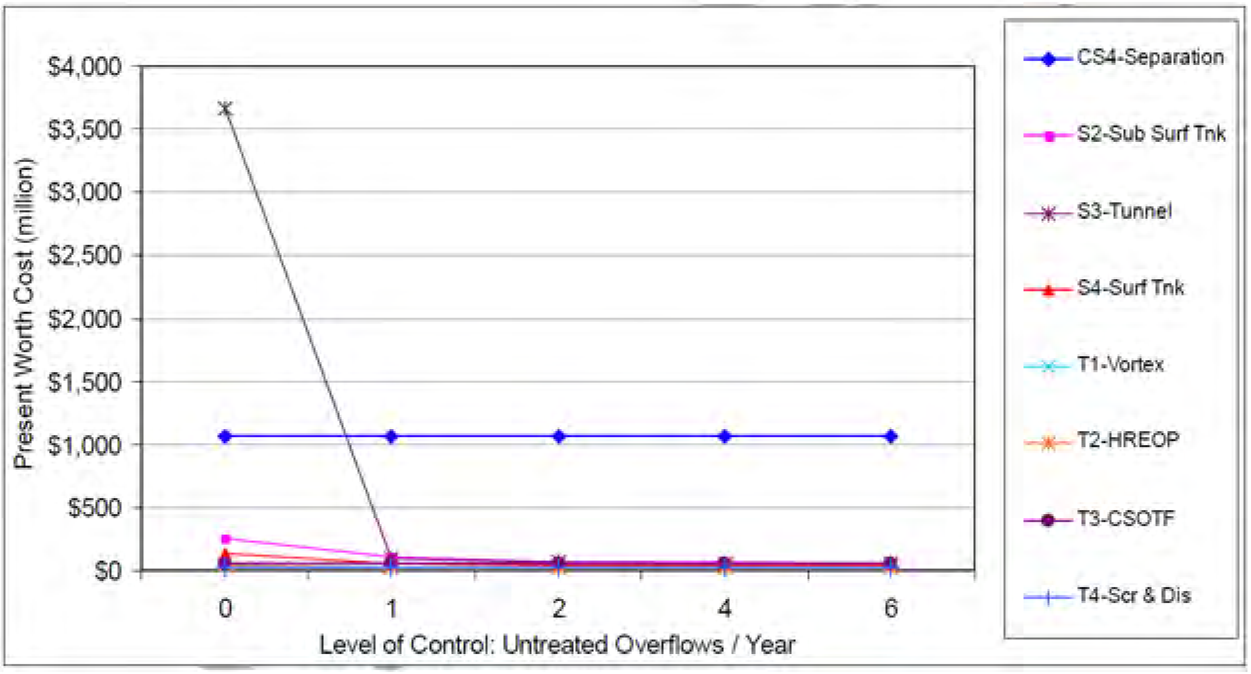
FIGURE 4-2C: OUTFALLS 091AM42 ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

Cost estimates were produced for regional control alternatives developed for the Streets Run region. Figure 4-3 illustrates the estimated costs for these alternatives. It is important to note that Alternative S3-Tunnel includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-3: STREETS RUN ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Monongahela- Ohio sub-system. Table 4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Monongahela- Ohio subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between “complete” sub-system alternatives. It remains PWSA’s assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE 4-3: MONONGAHELA OHIO SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
MO-1	478.2	4.4	529.3
MO-2	441.4	4.2	489.2
MO-3	420.7	3.9	464.9
MO-4	435.0	4.0	479.8
MO-5	458.5	4.2	505.8
MO-6	438.4	4.2	486.9

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining "Objective Scores" relative to each evaluation criteria.
- Applying "scaling" and "weighting" factors.
- Determining "Weighted Objective Scores" relative to each evaluation criteria.
- Ranking each alternative based on the sum of its "Weighted Objective Scores".

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table 4-4.

TABLE 4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

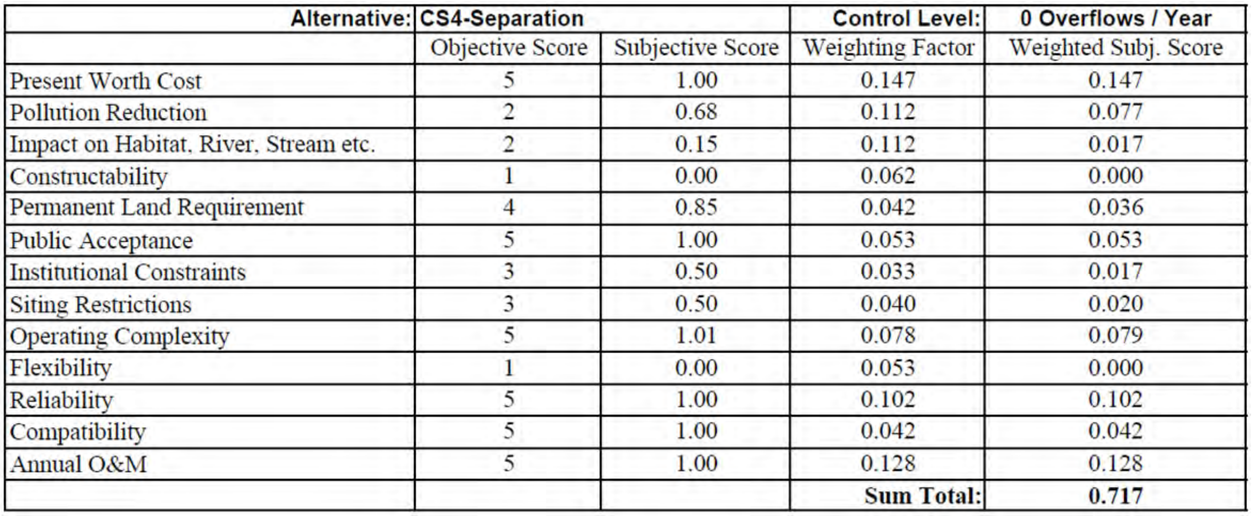
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in Table 4-5.

TABLE 4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 134A001: Sewer Separation,* at a level of control equal to 4 events per year, is shown below in Table 4-6.

TABLE 4-6: WEIGHTED SUBJECTIVE SCORING - CS4 134A001: SEWER SEPARATION



Alternative:	**CS4-Separation**		**Control Level:**	**0 Overflows / Year**
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	5	1.00	0.147	0.147
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.112	0.017
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	3	0.50	0.033	0.017
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.717**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008)*. Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 134A001: The results of the control alternative evaluation process are shown in Figure 4-4a. For control levels 0 through 6, it is recommended that Alternative CS4- 134A001: Sewer Separation be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses.

Outfalls 184E001 AND 185H001: The results of the control alternative evaluation process are shown in Figure 4-4b. For control levels 0 and 1, it is recommended that

Alternative CS4- 184E001 and 185H001: Sewer Separation be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses. For control levels 2 through 6, it is recommended that Alternative T4-184E001 and 185H001: Suspended Solids Control be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses.

Outfall 091AM42: The results of the control alternative evaluation process are shown in Figure 4-4c. For control levels 0 through 4, it is recommended that *Alternative T4-091AM42: Screening and Disinfection* be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses. For control level 6, it is recommended that *Alternative S4-091AM42: Surface Storage* be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses.

FIGURE 4-4A: ALTERNATIVE SCORING - OUTFALL 134A001

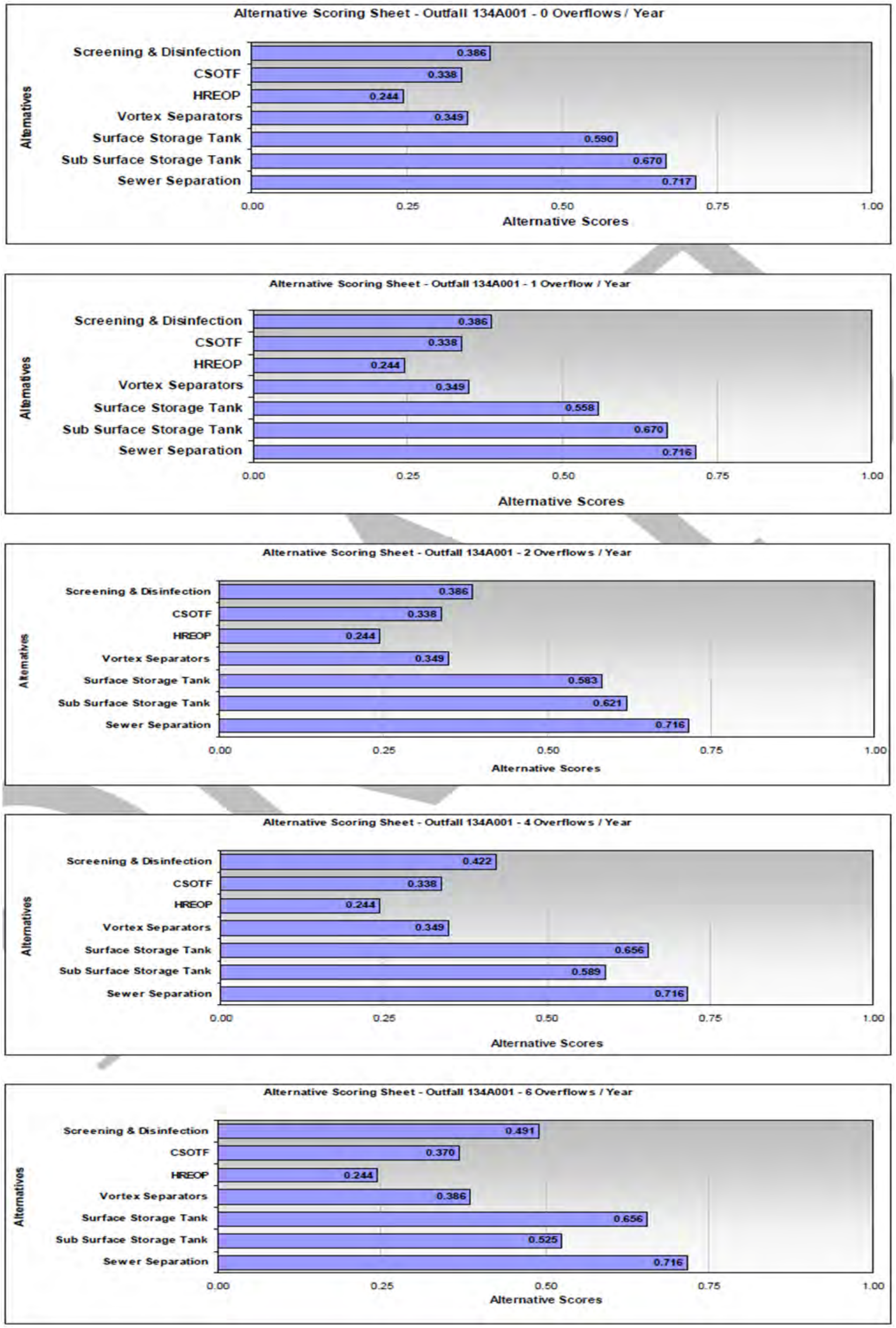


FIGURE 4-4B: ALTERNATIVE SCORING - OUTFALLS 184E001 AND 185H001

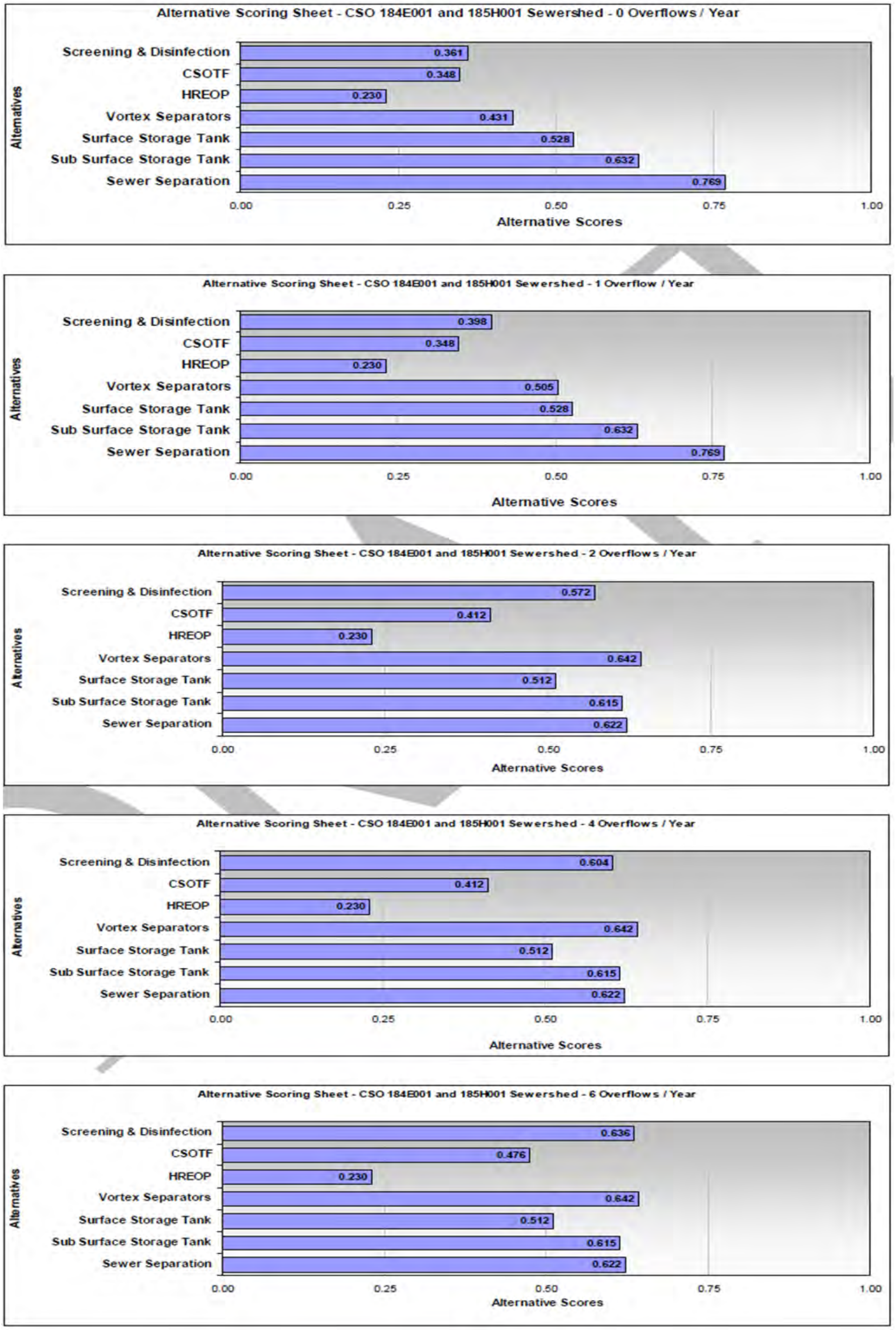
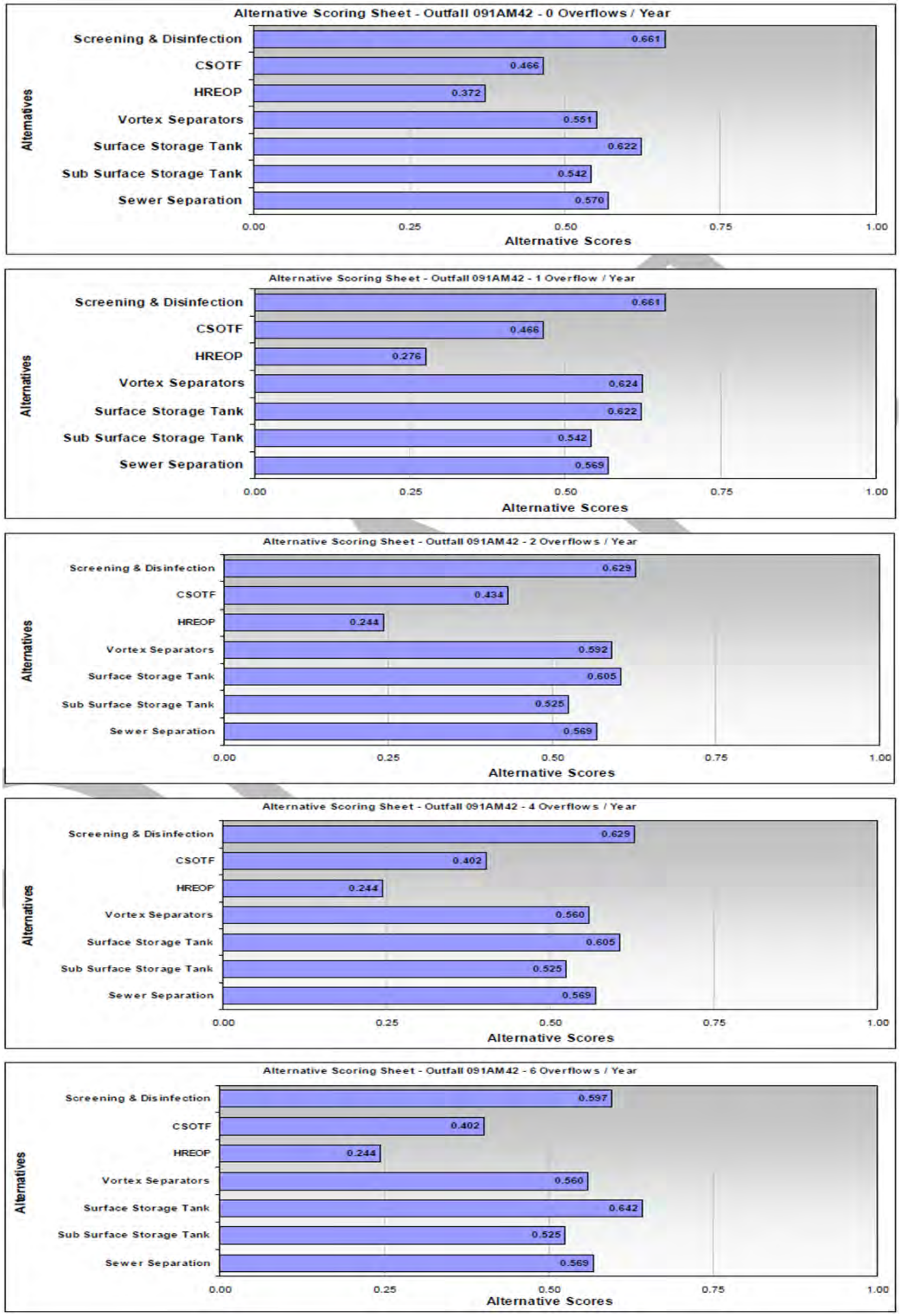


FIGURE 4-4C: ALTERNATIVE SCORING - OUTFALL 091AM42



4.4.2 Regional Control Alternatives

Streets Run: The results of the regional control alternative evaluation process are shown below in Figure 4-5. *F*or control levels 0 through 6 it is recommended that Alternative T4- Streets Run: Screening and Disinfection be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses.

4.4.3 Sub-System Control Alternatives

Monongahela - Ohio. The results of the sub-system control alternative evaluation process are shown below in Figure 4-6. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative MO-5: Tunnel Storage* be carried forward as the Monongahela - Ohio component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative MO-5: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative MO-5* included only those components required to deliver flows to the M-42 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the M-42 POC would become the responsibility of ALCOSAN.

FIGURE 4-5: ALTERNATIVE SCORING - STREETS RUN REGION

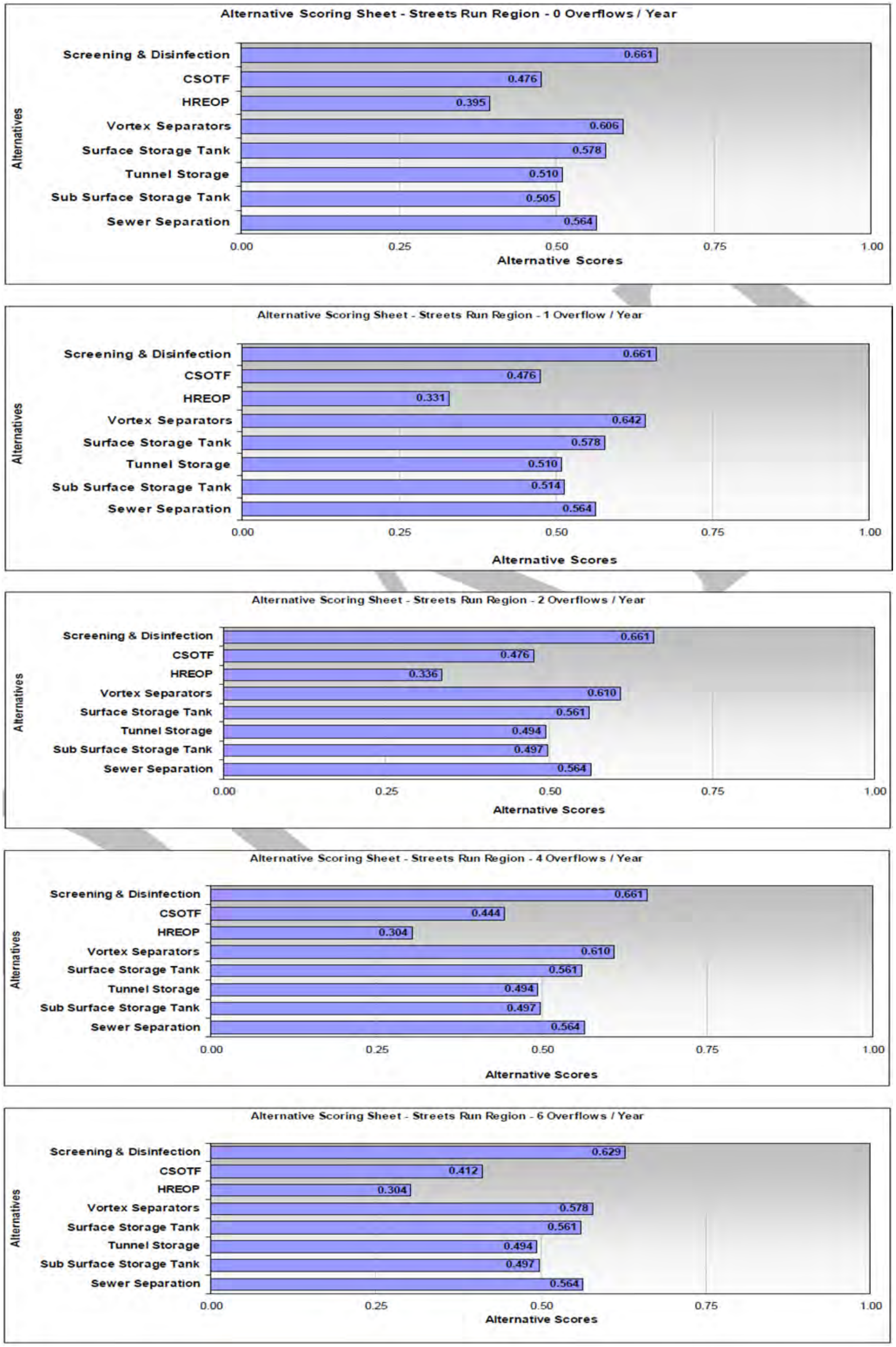
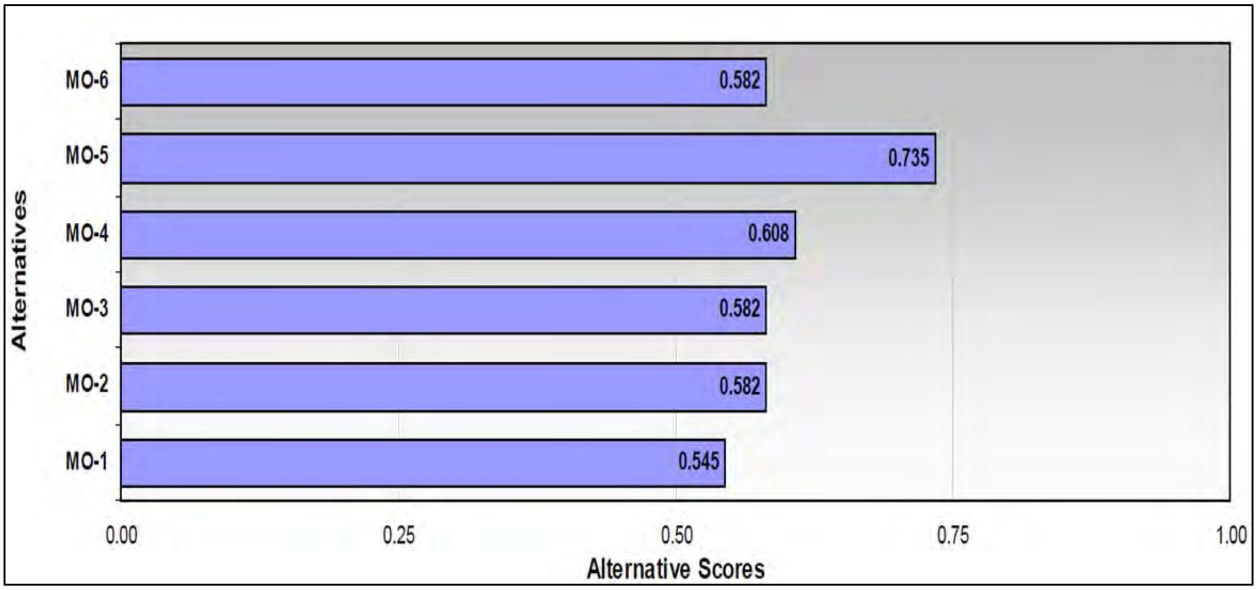


FIGURE 4-6: ALTERNATIVE SCORING – MONONGAHELA OHIO SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Streets Run sewershed would best be accomplished by implementing *Alternative MO-5: Tunnel Storage*. Within the M-42 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the three PWSA permitted CSOs to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the M-42 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative MO-5* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-M34-C-0*, *POC-M34-C-4* and *POC-M34-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **M34 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.

- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the M-42 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the M-42 sewershed is four untreated overflows per year. The recommended control alternative for the M-42 Streets Run sewershed has been designated as POC-M42-C-4. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **M42** The M-42 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **4** The selected level of control is four untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of four (4) untreated overflows per year, the required consolidation / conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-M42-C-4 are summarized in Table M42-5-1.

TABLE M42-5-1: ALTERNATIVE POC-M42-C-4 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
M-42	DC134A001	134A001	C*	4
	DC184E001	184E001		
	DC185H001	185H001		

*To be achieved via additional conveyance piping and regulator modifications.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, any anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, any stream removal projects that may be included, its integration with ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-M42-C-0 and/or POC-M42-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. The Draft Feasibility Study determined that the optimal method of increasing the level of control of CSO overflows in the Streets Run Sewershed is to adjust the diversion structure controls to reduce the amount of wet weather flows that are diverted from the system as necessary to achieve the target levels of control. Wastewater not diverted from the system will be conveyed to the ALCOSAN point of connection. To accomplish this, the PWSA and/or their tributary municipalities must:

- Modify existing diversion structures to achieve desired level(s) of control.
- Construct additional consolidation piping to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

For each of the three diversion structures in the M-42 sewershed, the H&H model was employed to identify the type and extent of modifications required to achieve four overflows during the typical year.

The Draft Feasibility Study and subsequent analyses have determined that the optimal method of increasing the level of control of CSO overflows in the Streets Run Sewershed is to reduce the number of overflows and convey the additional wastewater to the ALCOSAN point of connection. This would be accomplished by modifying the existing diversion chambers to increase peak rate of flow to the conveyance system to the extent necessary to reduce the number of typical year overflows to the desired level. The required modifications to the flow diversion settings are determined by the current typical year overflow statistics.

The required modifications to the flow diversion settings were determined by the current typical year overflow statistics. Table M42-5-2 presents the required changes to each tributary area and CSO diversion chamber that are required to achieve the 0, 4, and 10-overflows per typical year levels of control. As is indicated in Table M42-5-2, some of the diversion structures currently produce fewer than the control level number of overflows during the typical year. In those cases, sewer separation would not be required and changes to the diversion chamber settings would not be made so as not to increase the current frequency of CSO discharges. The upstream municipalities the Borough of Baldwin, Borough of Brentwood, Borough of Pleasant Hills, Borough of West Mifflin and the Borough of Whitehall do not report plans to take any actions to their tributary sewer system that will result in reductions in the projected flows.

TABLE M42-5-2: POC-M42-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC184E001	Diversion structure replacement*	14.2	6.5	1.0
DC185H001	Diversion structure replacement*	14.3	3.2	0.8
DC134A001	Diversion structure replacement*	6.0	3.3	1.0

*The installation of screening is planned for all PWSA diversion structures.

As can be seen from the table, new consolidation piping to convey flows at the four OF/yr level of control must be designed to carry flows ranging from 6 to 14 mgd.

5.1.2 Consolidation Piping

The H&H model was employed to identify the capacity improvements necessary to consolidate and convey increased flows from the three existing diversion structures to the M-42 POC. The modeling was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer system, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the M-42 POC without significant manhole surcharging and flooding. These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008)* that anticipated the construction of consolidation / relief sewers to supplement the capacity of the existing trunk sewer system.

It was anticipated that the required increase in conveyance capacity would be achieved by constructing parallel relief sewers designed to convey flows associated with four overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Note that the upstream municipalities the Borough of Baldwin, Borough of Brentwood, Borough of Pleasant Hills, Borough of West Mifflin and the Borough of Whitehall have not reported any plans to modify their systems to reduce their tributary flows.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table M42-5-3 and in Figure M42-5-1.

TABLE M42-5-3: POC-M42-C-4 CONSOLIDATION PIPING

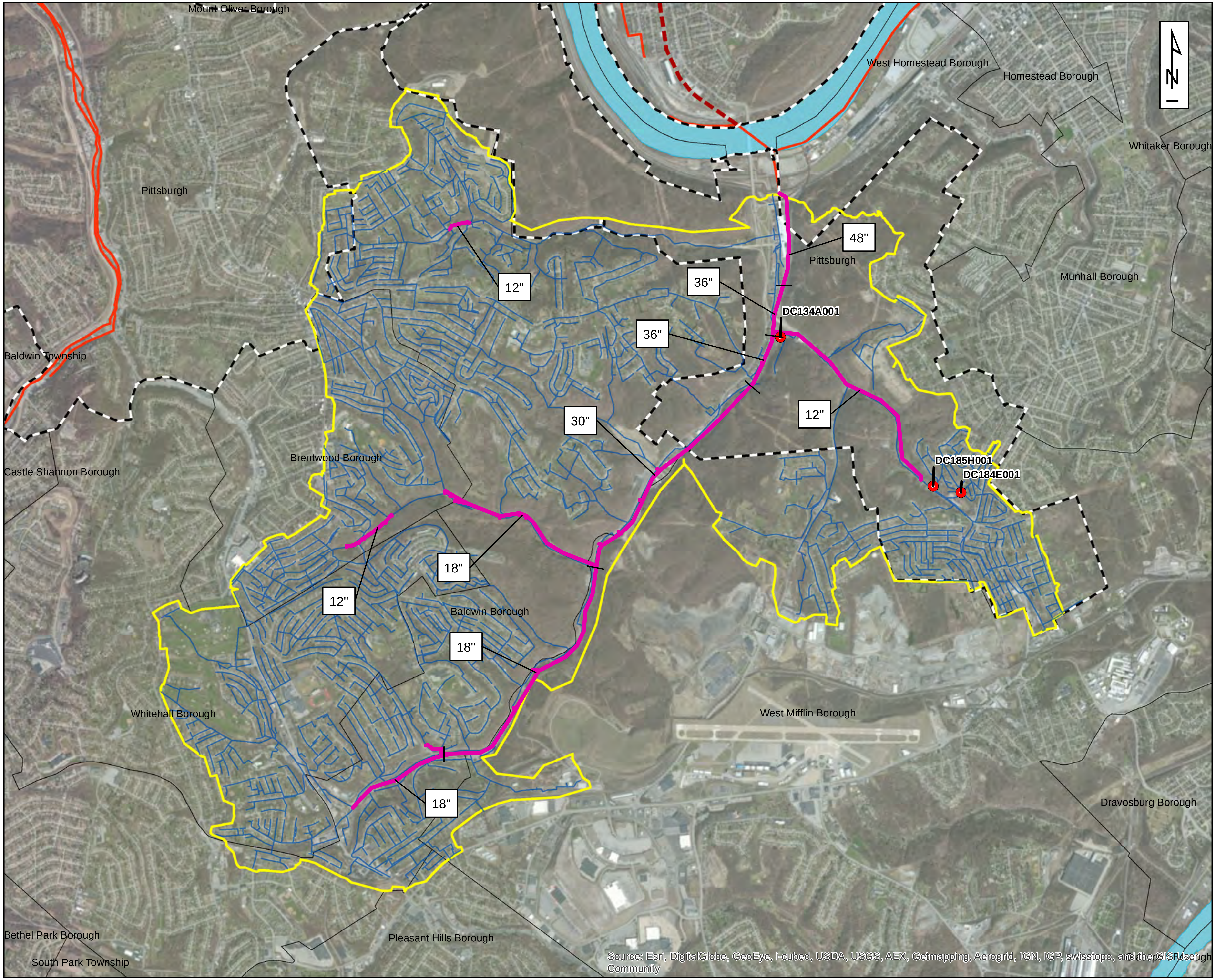
Diameter (in)	Length (ft)
12	12,936
18	12,221
30	7,220
36	2,085
48	2,659

*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

5.1.3 Future Untreated CSO Volumes

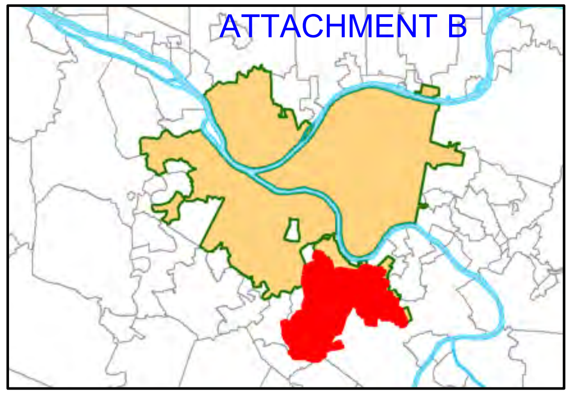
Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table M42-5-

4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 4.4 MG in the typical year.



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

- ● PWSA Diversion Structure Modification
- ▬ Relief/Consolidation Sewers
- — Collector Sewer
- 🟨 M-42 Sewer Boundary
- ▭ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ▬ Deep Tunnel
- — Shallow Cut

2,500 1,250 0 2,500 Feet

Figure M42-5-1: POC M42-C-4 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

TABLE M42-5-4: M-42 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-C25-C-0	128.6	172.9	302.3	7.9	9.9	12.9
POC-C25-C-4	78.7	92.4	118.4	7.0	7.8	9.6
POC-C25-C-10	46.4	48.4	53.2	5.7	6.7	7.7

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The combination of regulator modifications and additional consolidation piping will result in increased flow rates and volumes to the M-42 POC. Peak flow rates to the M-42 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-M42-C-0, POC-M42-C-4 and POC-M42-C-10 are presented in Figure M42-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the M-42 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table M42-5-5.

FIGURE M42-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE M-42 POC

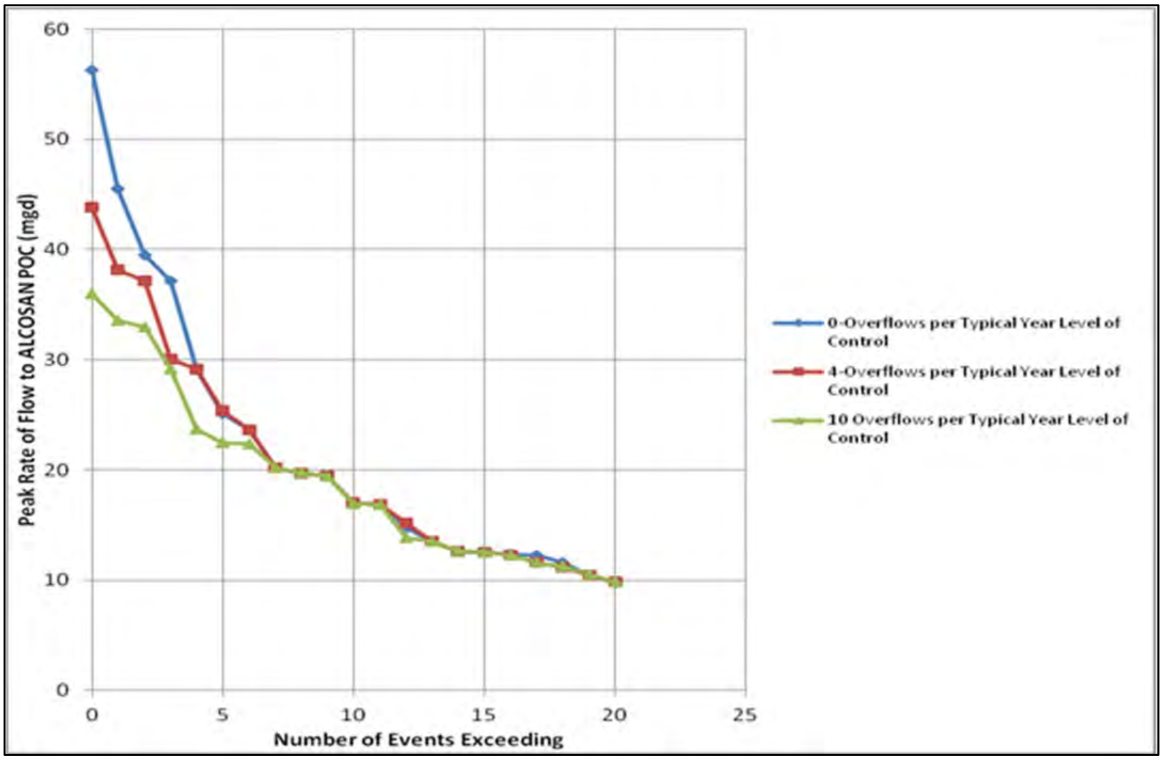


TABLE 5-5: M-42 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-M42-C-0	57.0	63.9	91.0	12.9	14.4	16.5
POC-M42-C-4	53.7	61.4	68.4	12.8	14.3	15.5
POC-M42-C-10	48.3	58.4	64.1	12.5	14.0	15.2

5.1.5 Recommended Control Alternative Integration

In the spring of 2013, 3 Rivers Wet Weather facilitated a series of meetings between the PWSA and the municipalities tributary to this sewershed. All associated parties in the POC sewershed have participated in these planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements.

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. MOU updates can be found in Addendum M42-6-1.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-M42C-4 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through the construction of parallel relief sewers designed to convey flows associated with four overflows per typical year, under 2-year design storm conditions (4 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the M-42 sewershed, both before and after implementation of the recommended alternative:

- Peak flow hydraulic grade line (HGL) of the trunk sewer system

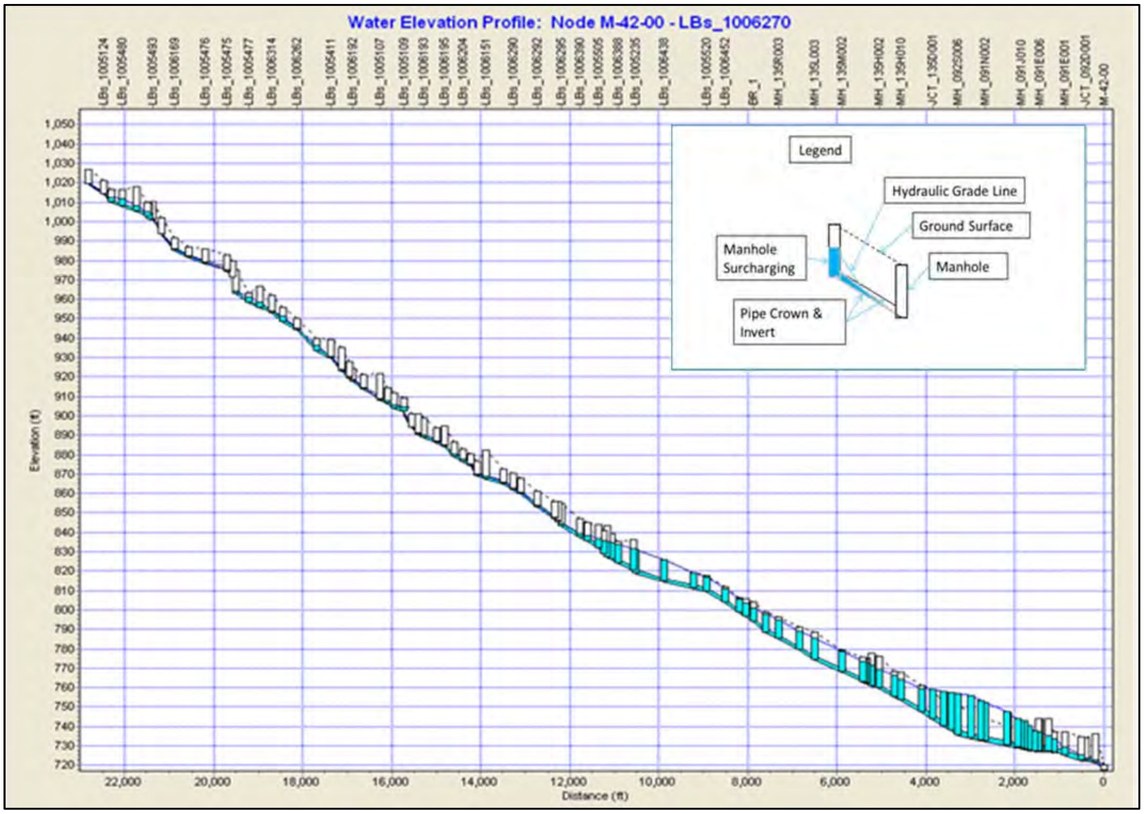
- 2046 peak flows and volumes to the M-42 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figures 3a, 3b, 3c, 3d, and 3e from that report presented profiles of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. These figures are reproduced below as Figure M42-5-3a, M42-5-3b, M42-5-3c, M42-5-3d, and Figure M42-5-3e. Under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging and manhole flooding occurs along the length of the trunk sewer.

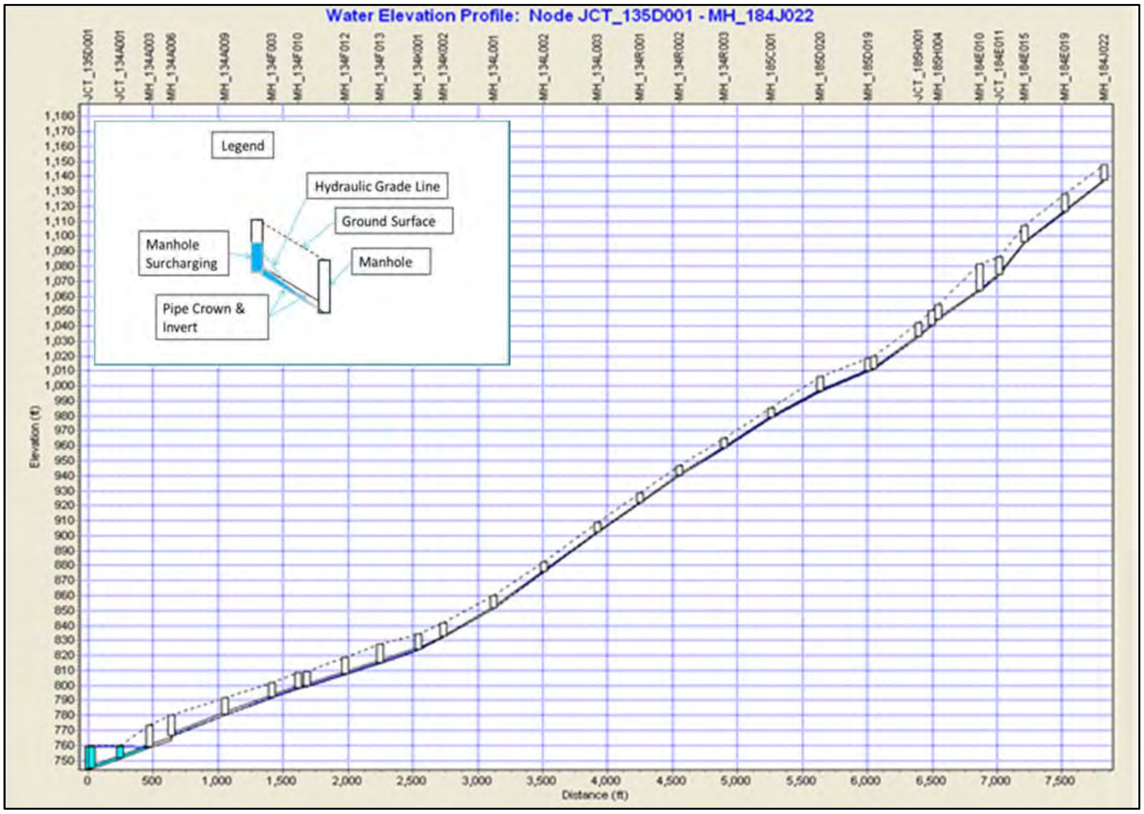
The HGL along the main trunk sewer following implementation of alternative POC-M42-C-4 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with four overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, modification of the diversion structures combined with additional conveyance capacity (4 OF/yr; 2-yr storm) will satisfactorily reduce manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE M42-5-3A: M-42 UPPER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



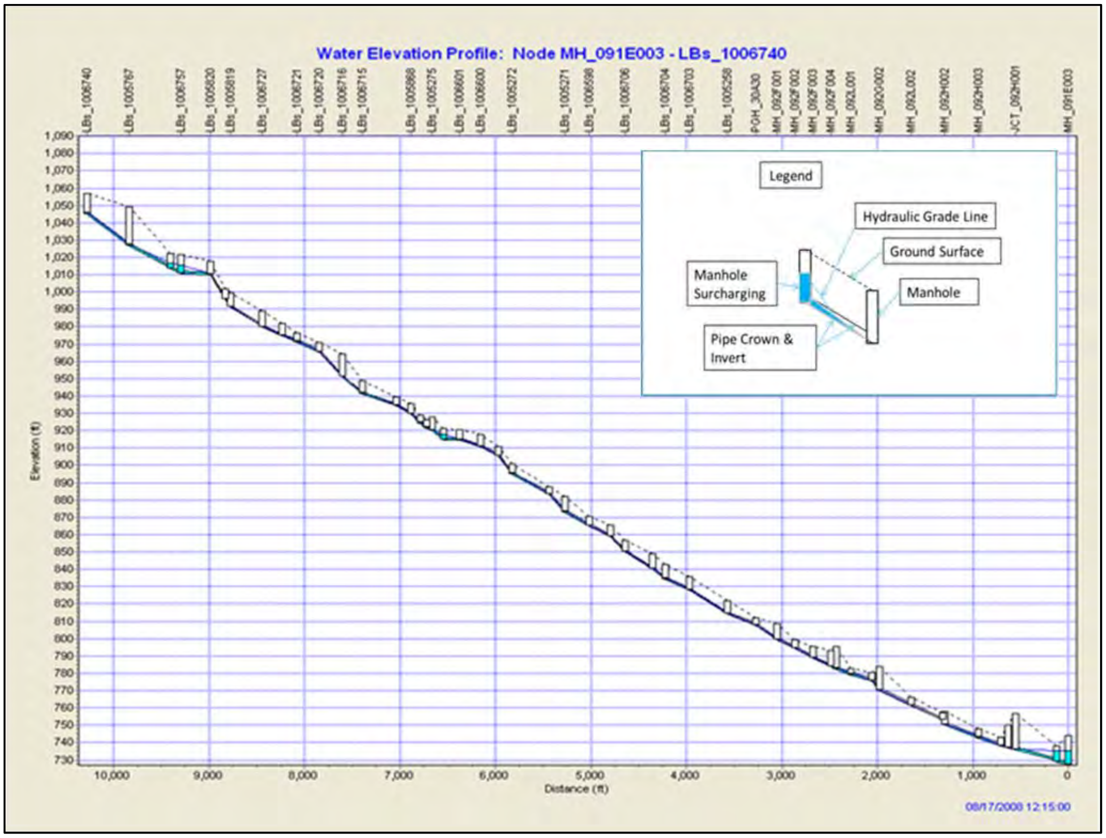
As is indicated in Figure M42-5-3a, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along the lower portion of the Streets Run Interceptor Sewer.

FIGURE M42-5-3B: M-42 LOWER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



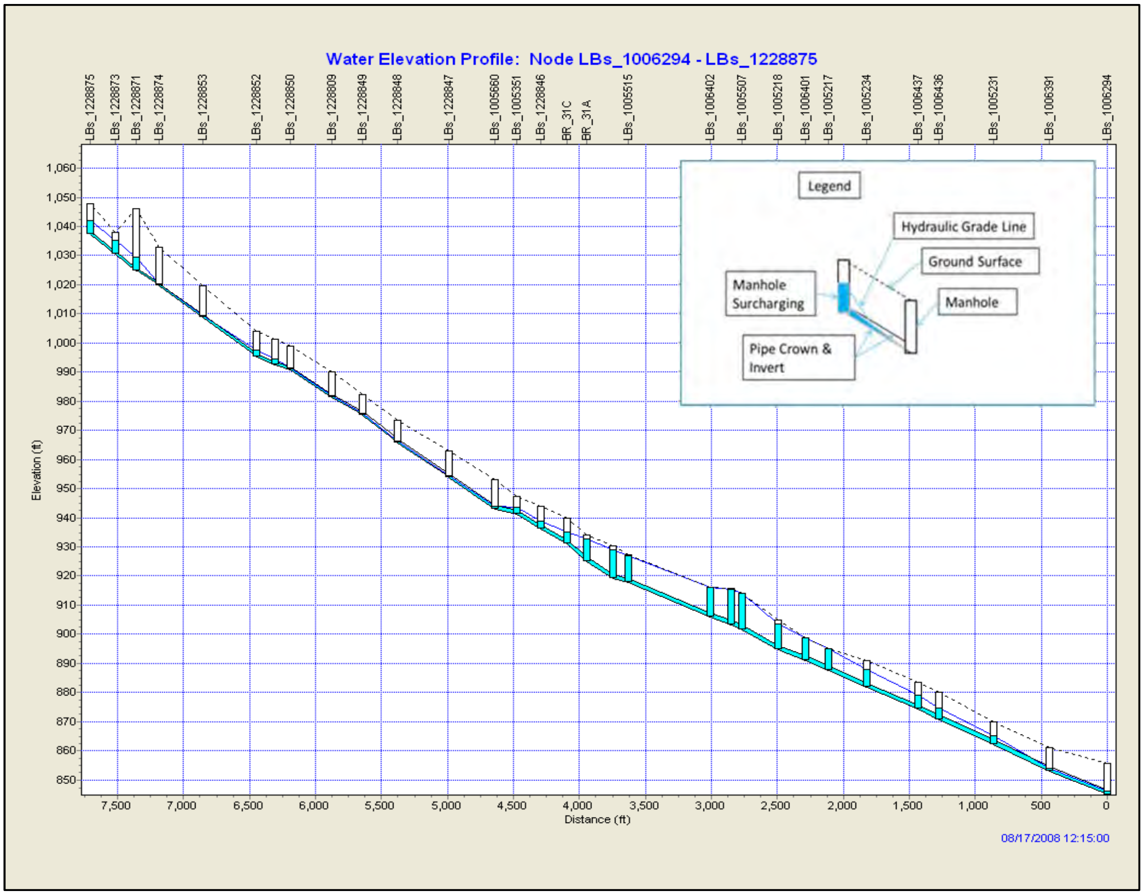
As is indicated in Figure M42-5-3b, under the current system configuration, including existing CSO diversion chamber settings, no manhole surcharging occurs along the Mifflin Road Trunk Sewer except at the lower end of the sewer. Surcharging/flooding at this location is due to backwater effects from the Streets Run Interceptor Sewer.

FIGURE M42-5-3C: M-42 WAGNER STREET TRUNK SEWER HGL (EXISTING CONDITIONS)



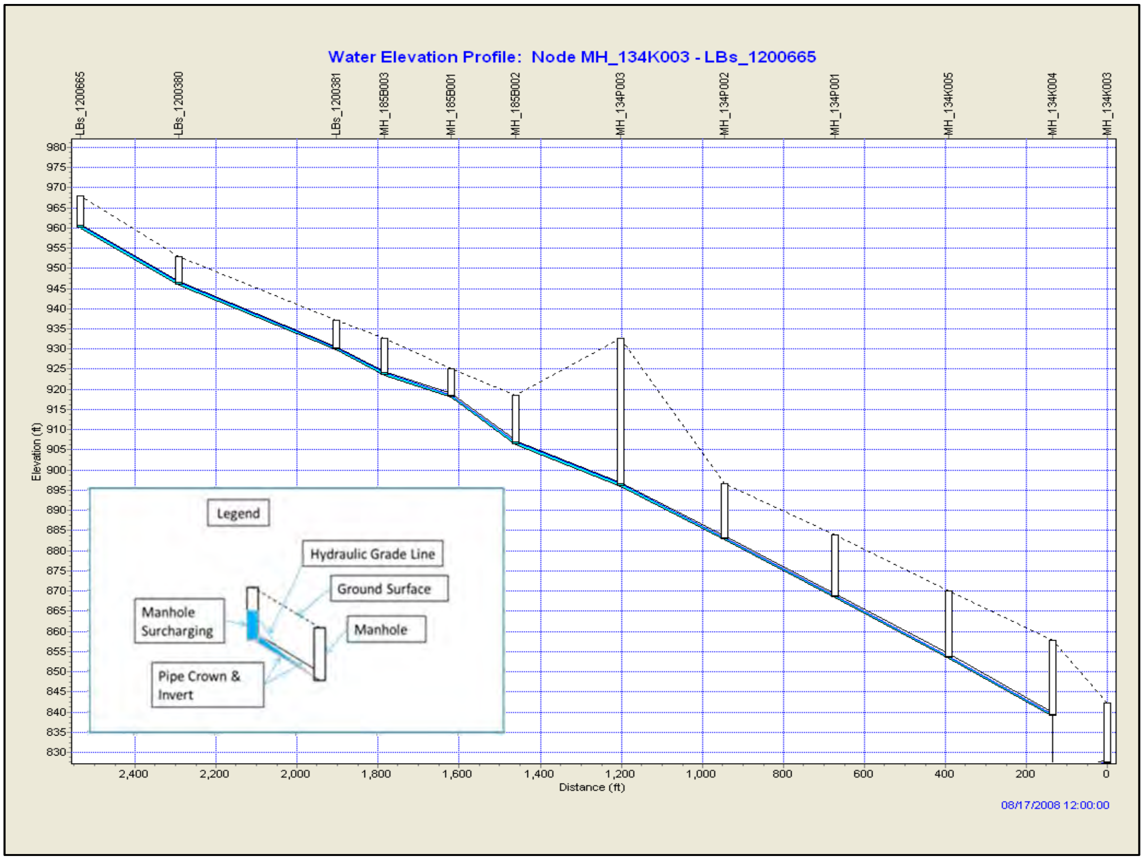
As is indicated in Figure M42-5-3c, under the current system configuration, including existing CSO diversion chamber settings, relatively minor manhole surcharging occurs at two locations in upper reaches of the Glass Run Road Trunk Sewer. More extensive surcharging is indicated at the lower end of the sewer due to backwater effects from the Streets Run Trunk Sewer.

FIGURE M42-5-3D: M-42 MIFFLIN ROAD TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure M42-5-3d, under the current system configuration, including existing CSO diversion chamber settings, significant manhole surcharging, including manhole flooding occurs along the middle portion and upper end of the Brentwood Road Trunk Sewer.

FIGURE M42-5-3E: M-42 MIFFLIN ROAD TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure M42-5-3e, the Lebanon Road trunk sewer functions acceptably under the current system configuration, including existing CSO diversion chamber settings.

5.2.2 2046 Peak Flows and Volumes to M-42 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the

PWSA system. ALCOSAN made similar assumptions1, and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve four overflows per typical year, as well as additional consolidation/relief piping to convey increased flows to the M-42 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the M-42 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances from ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year.

The control alternatives developed and evaluated by both ALCOSAN and PWSA, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the M-42 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from the Borough of Baldwin, Borough of Brentwood, Borough of Pleasant Hills, Borough of West Mifflin and the Borough of Whitehall indicate that each of them plan to convey all their flows to the M-42 trunk sewer system for the duration of the planning period. They have no plans to implement controls that would alter the modeled flows upon which the recommended alternative was based. This information is summarized in Table M42-5-6.

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

TABLE M42-5-6: M-42 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

Tributary Municipality	Volume*		
	Captured	Treated	Conveyed
Borough of Baldwin	N/A	N/A	All modeled flows
Borough of Brentwood	N/A	N/A	All modeled flows
Borough of Pleasant Hills	N/A	N/A	All modeled flows
Borough of West Mifflin	N/A	N/A	All modeled flows
Borough of Whitehall	N/A	N/A	All modeled flows

*Following implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve four overflows per typical year, as well as increased conveyance piping to convey increased flows to the M-42 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of regulator modifications and additional consolidation piping designed to control CSOs from the PWSA diversion structures to four overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the M-42 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-M42-C-4 are consolidation piping, CSO screening facilities, and diversion structure modifications. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment M42-5-1.

5.4.1 Consolidation Piping

In the M-42 sewershed, additional conveyance capacity was provided through the use of parallel relief sewers to convey flows to the M-42 POC. As detailed earlier, relief sewers were added to areas of the system that exhibited manhole flooding or surcharging at any time during the 24-hour design storm events. All improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewers.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street
- Other values included in the cost – Trench excavations and backfill, rock excavation, trench wall support, street opening, clearing and grubbing, street restoration, flow maintenance, traffic maintenance

5.4.2 CSO Screening Facilities

It was assumed that each outfall location will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

It was assumed that adjustments to existing regulator settings, including more effective and improved methods of flow control and monitoring, improved access, etc., would be sufficiently extensive as to make it more cost effective to simply replace each structure. The unit cost associated with the installation of each new diversion structure was assumed to be $200,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $360,000.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure M42-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible "knee of the curve" is evident from this data.

These costs are also presented in a tabular format in Table M42-5-7.

The selected level of CSO control - 4 OF/yr - was determined based upon the costs anticipated and the expectation of meeting water quality standards. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-M42-C-4 are summarized in Table M42-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE M42-5-4: M-42 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

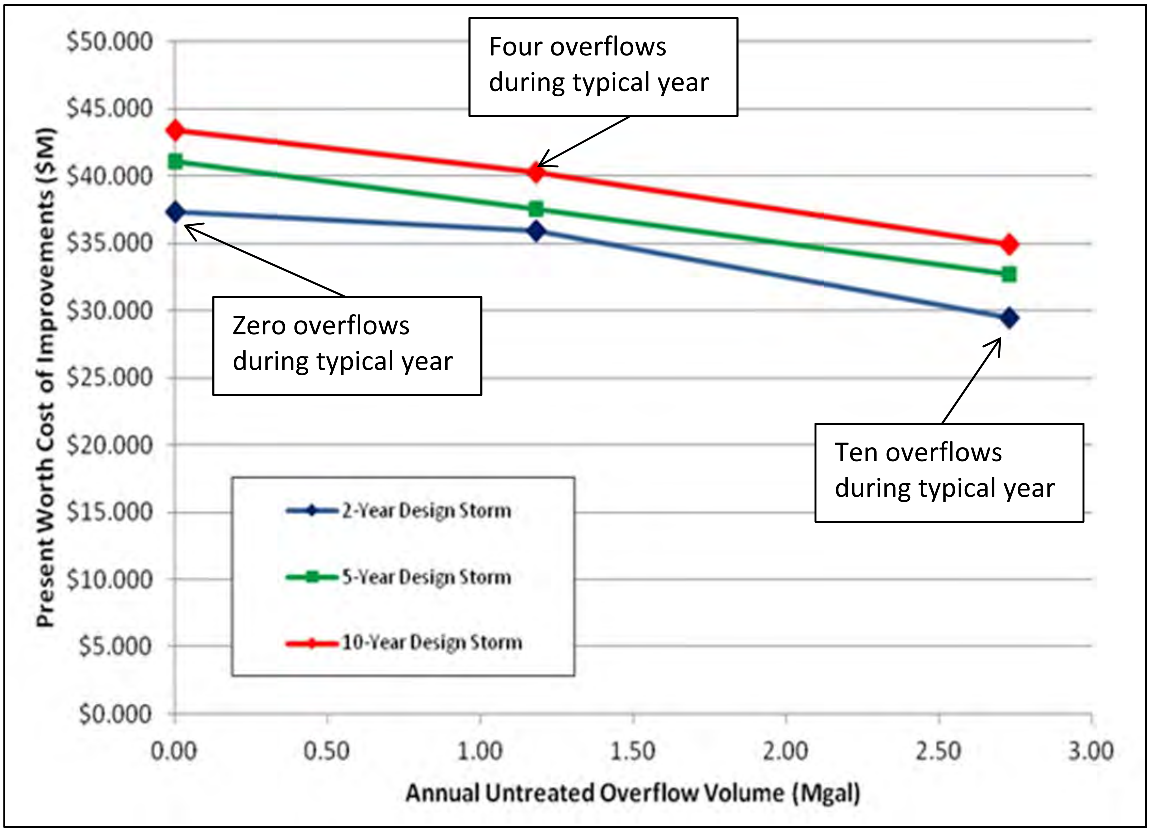


TABLE M42-5-7: M-42 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control				
	Untreated CSO Volume (MG)	**CSO Control Level (OF/yr)**	**PW Capital Cost ($MM)**	**PW O&M Cost* ($MM)**	**TPW CSO Control ($MM)**
POC-M42-C-0	0	0	$36.5	$0.8	$37.3
POC-M42-C-4	1.2	4	$22.6	$0.4	$23.0
POC-M42-C-10	2.7	10	$28.7	$0.7	$29.4
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-M42-C-0	0	2-year	$0	$0	$0
POC-M42-C-4	0	2-year	$0	$0	$0
POC-M42-C-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE M42-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-M42-C-4

Capital Improvements	Size/Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Replace diversion structures: DC134A001 DC184E001 DC185H001	4 OF/yr Each	$1.08	$1.08	$1.09
Add screening to diversion structures: DC134A001 DC184E001 DC185H001	3.2 to 6.5 mgd overflow rates	$1.35	$1.35	$1.36
Conveyance piping	12-in dia.	$5.26	$5.26	$5.36
Conveyance piping	18-in dia.	$3.34	$3.34	$3.37
Conveyance piping	30-in dia.	$5.16	$5.16	$5.25
Conveyance piping	36-in dia.	$2.58	$2.58	$2.63
Conveyance piping	48-in dia.	$3.82	$3.82	$3.89

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA and their tributary municipalities have agreed that the basis of allocation for future operation and maintenance costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the M-42 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, Storage Tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC M-42 overflow is intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the “Selected Plan” to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the “Recommended Plan”. This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the “Selected Plan” is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

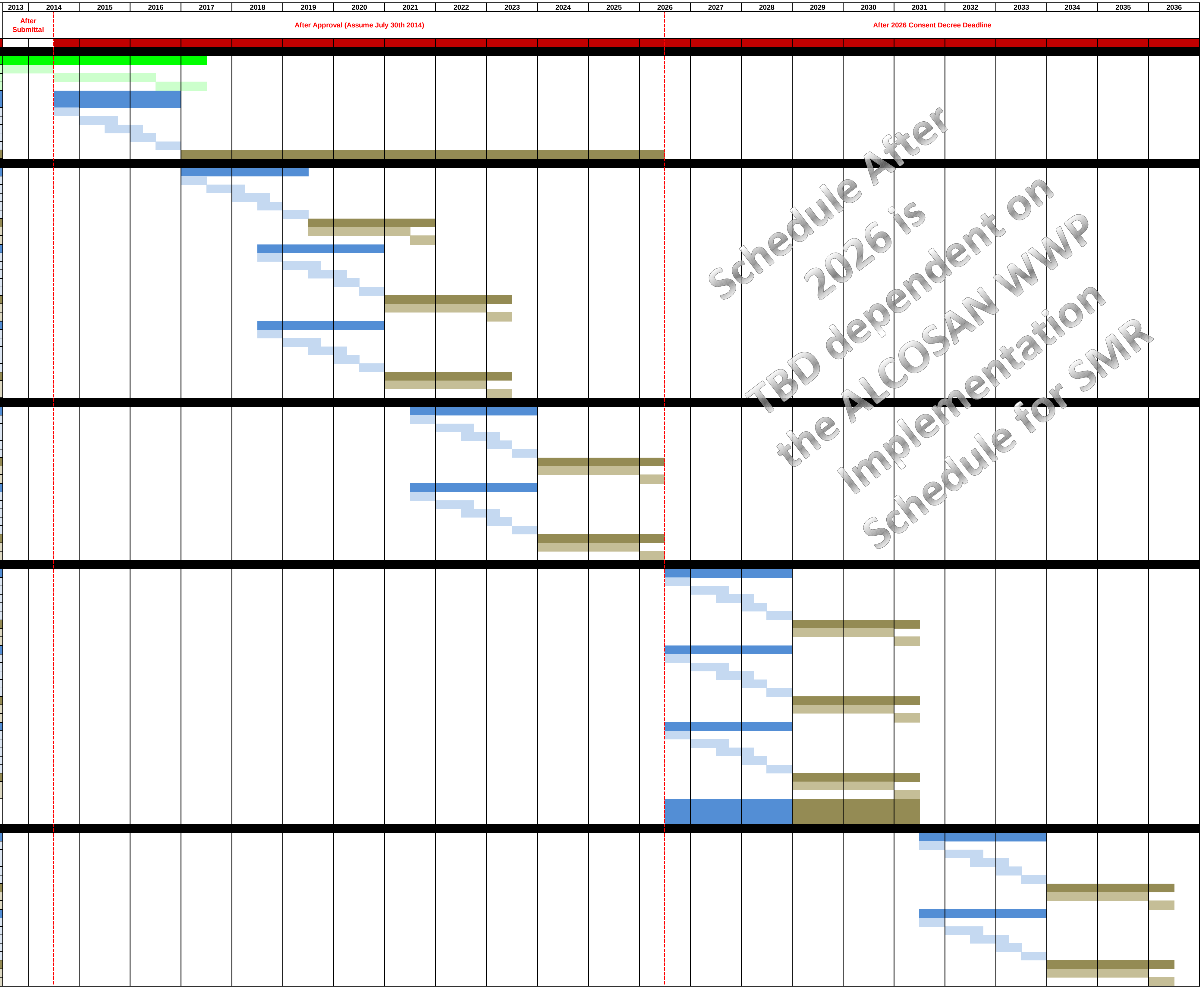
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it’s important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the Monongahela River tunnel segment, extending toward M-42, of regional plan is being implemented by 2026. Per PWSA’s implementation schedule, M-42 is included in Phase 3 (mid 2021 to mid- 2026) due to the preference to follow the design /construction of the ALCOSAN Monongahela River tunnel segment., as well as to apply considerations for balanced distribution of costs and resources throughout the duration of the implementation schedule.

ATTACHMENT B

FIGURE M42-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the M-42 sewershed. These considerations include Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Baldwin Borough, Brentwood Borough, West Mifflin Borough, Whitehall Borough and the Pittsburgh Water and Sewer Authority. Other considerations regarding the M-42 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the “2-year design storm” for the municipal separate sanitary system portions and “4 OF/ typical year” for the PWSA’s combined system outside of Saw Mill Run where “0 OF/ typical year” is proposed.

A set of guiding principles were produced for use in developing cost allocation procedures. These principles form the basis of a DRAFT Memorandum of Understanding by and between Baldwin Borough, Brentwood Borough, West Mifflin Borough, Whitehall Borough and the Pittsburgh Water and Sewer Authority, and include:

- The major goal is to develop a fair and equitable cost allocation process.

- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.
- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.
- Cost allocations should be simple and easy to calculate in the future.
- The final cost allocation methodology should encourage efficiencies between municipalities.
- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.
- Unless agreed to by all parties, existing contracts should not form the only basis for cost allocations.

6.1.1 Cost Sharing Concept and Method

Two distinctive categories of cost allocations will need to be addressed by the PWSA and their tributary municipalities: capital cost allocations and O&M cost allocations. A number of methods for capital cost allocation were considered, based on the following:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution
- Proportion of internal municipal costs

All of these approaches could be modified by the addition of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc. The following discussion describes each of these methodologies.

"Agreed Upon" Basis: This approach could be as simple as each party agreeing to a fixed share of each element of cost or all costs across the board. Negotiation of the

basis of the percent share is left to the discretion of the involved parties. Shares could be fixed for the term of the agreement, or they could be adjustable on a scheduled or otherwise agreed to basis. This approach is usually successful where there are existing agreements or a long history of collaboration between the affected parties.

Capacity Basis: Capacity based cost sharing is predicated on the design capacity of the shared facilities and the portion that is allocable to the various parties to the Agreement. For the types of facilities being evaluated, wet weather flow rate and volume would be the primary capacity parameters. A Design Engineer's Report, normally submitted as part of the construction permitting process, should clearly specify and set forth the flow rate and volumetric design basis, as well as the capacity needs associated with all municipal entities. This information can serve as the basis for pro rata distribution of cost elements such as Debt Service and initial costs. One issue that should be addressed is how and whether unused and/or excess capacity utilized by "others" will be subject to cost reimbursement.

Expected Annual Flow Contribution: This method would utilize estimated flow rates for a predetermined average year as the basis for the evaluation of cost allocations. This may work well for systems where a hybrid approach of wet weather flow rate and volume is desired.

Proportion of Internal Municipal Cost: This approach requires municipalities to evaluate their own internal projects. This evaluation would include outlining control alternatives and selecting the highest ranked alternative for their internal solution. The municipalities' share of the combined project becomes a "not-to-exceed" or proportional value of its internal cost to the total regional cost.

6.1.2 Evaluation and Selection of Capital Cost Allocation Methodology

Four sewersheds, not including the M-42 POC sewershed, were selected by 3RWW and their PM Team as pilot sewersheds for cost allocation evaluations. Monthly meetings were held at which the meeting attendees selected the methodologies that they thought were appropriate, and the 3RWW/PM Team provided the necessary statistics for use in evaluating and selecting the best methodology.

Statistics intended to support the various allocation methodologies were developed and discussed with each POC participant. Over the course of several meetings, the major point of discussion was the identification of ways to ensure the allocation was

fair and equitable by assigning the costs proportionally to the cost-causative items. In addition, participants agreed with the idea that it would not be fair for downstream municipalities pay for upstream sections of the project, given that they did not contribute flows directly into that sewer.

Following these discussions, the first decision regarded the need to use peak wet weather flows as the basis for the cost allocation. The PM Team evaluated three main types of peak flow based analysis:

Percentage of Flow at POC: In this approach, the total flows at the POC and at each connection point tributary to the POC are obtained from the H&H Model. The flow rate for each connection point is then divided by the total POC flow to obtain its ratio. This represents the connection point's portion of the total cost of the regional project. It should be noted that portions of the project dedicated to a single municipality would be subtracted from the total cost of the regional project.

Percentage by Length of Use: In this approach, the distance from the POC is used as a "weighing factor" in the cost allocation calculation.

Segmental: In this approach, areas that are tributary to a project or a portion of a project would divide the cost based on peak wet weather flow rates from each tributary area.

In all of the cost allocation procedures, the calibrated ALCOSAN H&H Model was the accepted tool for determining peak flow rates. In some cases where two or more municipalities were combined into one loading point, the agreement was to use the model to affect the required split through RTK and area adjustments (if separate) and area adjustment (if combined).

6.1.3 Operation & Maintenance Cost Allocation

In the development of O&M cost allocation methods, it is important to define what constitutes O&M. The following is a general list of those items considered for each POC sewershed:

- Sewer Inspection
- CCTV and cleaning
- Utilities and power requirements for pump stations and storage basins

- Chemical costs for CSO facilities
- Minor repair and rehabilitation
- Staff salaries, wages and fringe benefits
- Replacement costs (sewers and structures - 100 years; mechanical equipment – 25 years)
- SSO Response Plan

The next step was to categorize these expenses into at least groups – those items impacted by peak flow (such as CCTV and sewer cleaning) and those items impacted by volume of wastewater (such as storage basins). Once categorized, various methodologies for O&M cost allocation could be investigated. A number of approaches to O&M cost allocation were considered, and three of those chosen for capital cost allocation were also chosen for O&M cost allocations:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution

As was the case for the capital cost allocation methods, each of these approaches can be modified by the application of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc.

6.1.4 Selected Capital Cost Allocation Method

The selected method of capital cost allocation between the PWSA and their tributary municipalities is based upon the use of peak wet weather flows, as determined using the segmental approach.

Using this approach, areas of each municipality tributary to a section of new consolidation / conveyance piping would divide the cost based on peak wet weather flow rates from each municipal tributary area. The calibrated ALCOSAN H&H Model was the accepted tool for use in determining those peak flow rates.

For the purposes of this Feasibility Study, alternative POC-S15-C-0 has been divided into nineteen (19) segments. Seven (7) of these segments receive flows from one or more tributary municipalities and flows into the PWSA system, and are subject to the allocation of capital costs. The remaining twelve (12) segments convey flows generated solely by and in the tributary municipalities. General locations of the 19 inter-municipal segments of the recommended alternative are illustrated in Figure M42-6-1.

It is anticipated that the conceptual capital cost allocation estimates for each segment will be based on the municipal peak wet weather flow percentages shown in Table M42-6-1.

TABLE M42-6-1: MUNICIPAL PEAK WET WEATHER FLOW PERCENTAGES

Segment	**Percentage (%)**				
	PWSA	**Baldwin Borough**	**Brentwood Borough**	**West Mifflin Borough**	**Whitehall Borough**
1	0	15.54	0.94	0	83.52
2	0	25.73	0.82	2.13	71.31
3	0	21.61	0	0	78.39
4	0	31.59	0.56	1.97	65.88
5	0	34.93	0.49	7.44	57.14
6	0	41.56	0.42	8.03	49.99
7	0	47.15	0.35	6.68	45.82
8	0	0.74	60.26	0	39.00
9	0	4.70	80.93	0	14.37
10	0	30.31	58.39	0	11.29
11	0	39.80	22.05	4.47	33.68
12	0	42.24	21.15	4.29	32.31
13	0.31	49.10	17.64	5.99	26.95
14	0.46	50.22	17.21	5.82	26.29
15	1.96	50.59	16.56	5.60	25.30
16	73.34	0	0	26.66	0
17	12.85	42.46	13.30	11.05	20.33
18	21.46	78.54	0	0	0
19	22.07	42.25	10.27	9.73	15.68

If work is done by a municipality to reduce flow below the flows currently predicted and the municipality wants to revise these percentages, that the municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties prior to the commencement of design.

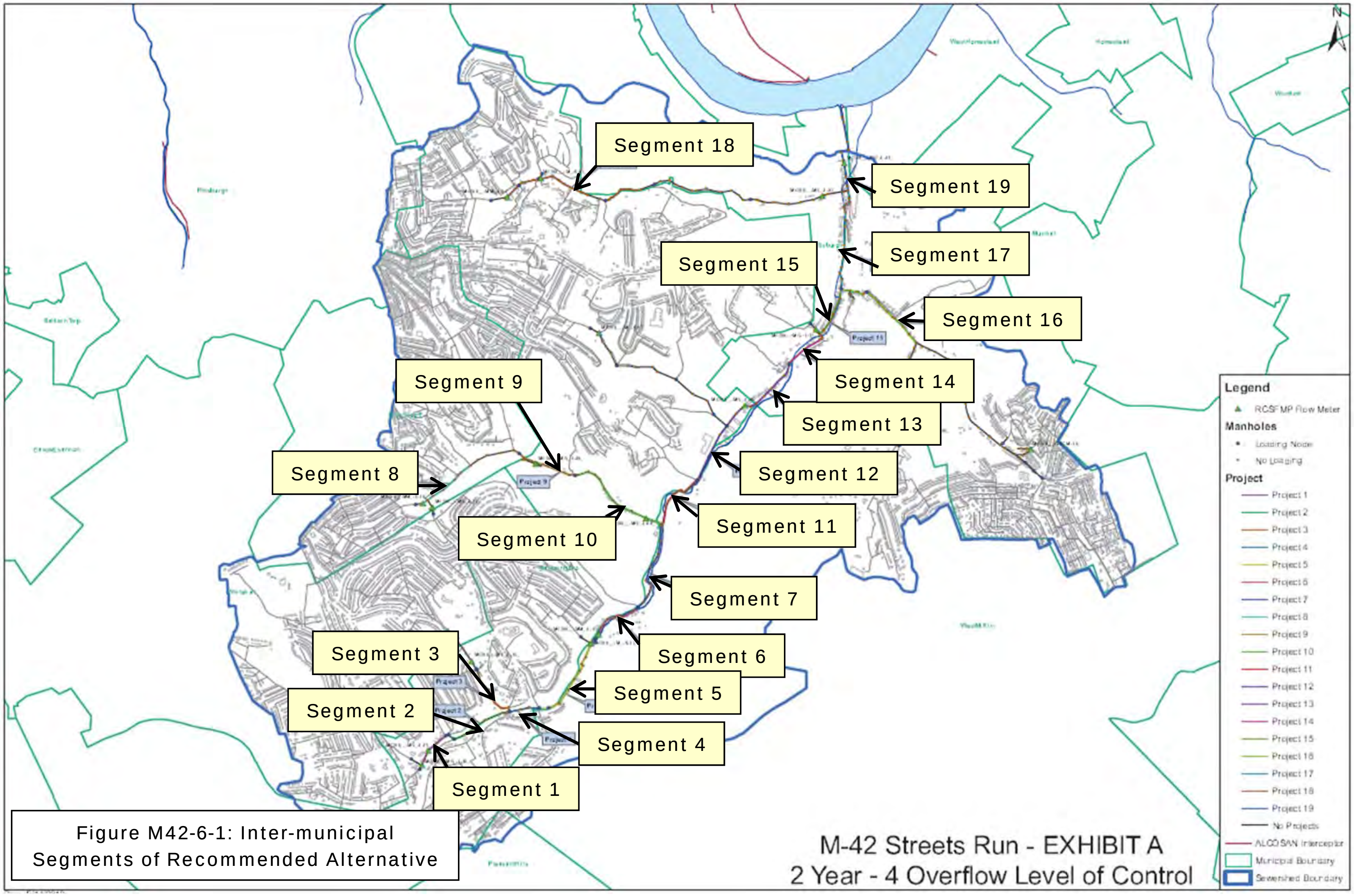


Figure M42-6-1: Inter-municipal Segments of Recommended Alternative

6.1.5 Selected O&M Cost Allocation Method

For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

One of the early steps taken to facilitate the development of up-to-date and relevant MOUs and/or inter-municipal agreements was to determine whether or not there were any existing, applicable MOUs or service agreements. 3RWW, working with the University of Pittsburgh, collected many of the existing agreements. The FSWG also formed an inter-municipal agreements subcommittee to review those existing agreements, develop an agreement outline for use by the municipalities, and prepare draft agendas for use in multi-municipal meetings.

The various inter-municipal agreements that have been compiled by 3RWW were reviewed for the purpose of summarizing the provisions that are relevant to allowable flow contributions. The results of this review are presented below. All specific references to “sanitary sewers”, “sanitary sewage” or other characterizations of the tributary sewer systems were extracted and presented below. In addition, specific information regarding cost sharing arrangements was also extracted from the agreements and is presented below.

1. In an agreement dated July 6, 1935, the City of Pittsburgh and Brentwood Borough reached an agreement. Relevant terms of that agreement are:
    - City to construct Main Trunk Sanitary Sewer along Streets Run to the dividing line of the City and Mifflin and Baldwin Townships.
    - City agrees to permit the Borough to connect trunk sanitary sewer to be constructed by it to the City trunk sewer at the City line.
    - Borough agrees to pay $20,000 as equitable share of the construction cost of the City trunk sewer.
    - City to maintain and repair the City line and the Borough to pay 25% of the cost of same.

- Borough not to permit any other municipality to discharge any sewage into the Borough's trunk sewer without written City permission.
- Sewers are to convey sanitary or domestic drainage only.

2. In an agreement dated May 8, 1941, the City of Pittsburgh and Baldwin Township reached an agreement. Relevant terms of that agreement are:
   - City permits the Township to discharge its sanitary sewage into the Streets Run Trunk Sewer and to carry the sewage discharged through the extension of said trunk sewer beyond the City line.
   - The Township pays the City $26,500 fixed as its share of the cost of constructing the trunk sanitary sewer through the City.
   - City agrees to maintain and keep in repair the trunk sewer from the City line to the River and the Township agrees to pay 30% of the cost of said maintenance as determined by the City.
   - The Township agrees that no drainage other than sanitary or domestic drainage shall be admitted into any part of the said trunk sewer and that surface drainage and roof drainage shall be specifically excluded therefrom. Failure by the Township to conform to this provision shall render the entire contract voidable at the option of the City, and the City shall thereupon have authority to cancel this contract and exclude the Township and all residents thereof from further use of said sewer until the Township complies with this provision.

3. In an agreement dated October 10, 1953, the City of Pittsburgh and West Mifflin Borough reached an agreement. Relevant terms of that agreement are:
   - "The City agrees to permit the Borough to discharge sewage from a parcel of land having an area of 280 acres, lying in the Borough, into the City sanitary sewer on Mifflin Road."
   - "The sanitary sewer to be constructed by the Borough on Lebanon Road through the Borough and through the City will be constructed by the Borough without cost to the City..."
   - The City shall have the right and privilege to connect drainage from 89 acres in the City to this sewer without charges or costs from the Borough.
   - The Borough pays the city $21,216."
   - "If and when the City finds it necessary to reconstruct the lower portion of the Streets Run sanitary sewer or to construct a relief sewer at that place, the

Borough shall pay the City 18% of the cost thereof, limited to 18% of $120,000 or $21,600…"

- "The Borough agrees to maintain and keep in repair the sanitary sewer constructed by them on Lebanon Road, and the City agrees to maintain and keep in repair the branch trunk sanitary sewer on Mifflin Road and the Streets Run sanitary sewer. 'Maintenance', as used in this agreement shall include reconstruction or enlargement of relief sewers as may be necessary, and as determined by the City. The Borough shall pay 18% of the cost incurred by the City on such maintenance repairs." The necessity for any of the above work and the cost will be determined by the City.
- "It is understood and agreed by the Borough that it shall not permit any other municipality, individual or corporation not located within the area specified in this agreement to discharge any sewage into the Lebanon Road sanitary sewer to be constructed by the Borough."
- "The Borough agrees that no drainage other than sanitary or domestic sewage shall be admitted to any part of the Lebanon Road sanitary sewer, and that surface drainage and roof drainage shall be specifically excluded therefrom. The Borough further agrees that upon demand of the City it will make an investigation and check of surface drainage and roof drainage which might be entering into the sewer. On this investigation the City shall be represented by a person designated by the Director of the Department of Public Works. Should storm water be found entering the sewer the Borough agrees to immediately institute such action as may be necessary to discontinue such discharge, and on their failure to successfully do this the City shall take such legal action against the Borough as the City deems advisable."

4. In an agreement dated April 1, 1957, the City of Pittsburgh and West Mifflin Borough reached an agreement. Relevant terms of that agreement are:
    - "The City agrees to permit the Borough to discharge sewage from a parcel of land having an area of 12 acres, lying in the Borough, into the City sanitary sewer on Mifflin Road."
    - "The sanitary sewer to be constructed by the Borough will be constructed without cost to the City."
    - The Borough agrees to pay the City $900.
    - The requirements for limiting flow to sanitary sewage contained in the 1953 agreement (including testing on demand by the City, etc.) are included by reference.

It should be emphasized that the agreements listed above are not anticipated to be used as the inter-municipal agreement for this project. The draft MOU developed per the following subsections would serve as an initial understanding of what would form a new future agreement between the municipalities.

6.2.1 Development of MOU and Inter-Municipal Agreements

When more than one municipality is involved in the design, construction and operation of wet weather control facilities, it is intended that they will develop inter-municipal agreements to outline their mutual understanding of the project as well as their municipal, customer and legal responsibilities. These responsibilities include, but are not limited to, joint permitting, joint ownership, joint cost sharing, and who will operate and maintain the facility on a long term basis.

In addition, it is the PWSA's position that any agreements or MOUs should contain provisions for periodic review and amendment as necessary by the respective parties and their solicitors.

6.2.2 MOU and Inter-Municipal Agreements

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. It is currently being reviewed by each of the parties.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

In summary, the draft MOU states that, for the purpose of submitting the feasibility study, the municipalities agree that the preliminary estimated total cost to be expended on the inter-municipal segments of the recommended alternative, as shown in Figure M42-6-1, is $17,070,000. This cost represents the cost associated with the elements of the required improvements in the sewershed that provide multi-municipal service (i.e. convey or otherwise handle flows generated by more than one municipality). Each municipality shall have the right to void the MOU if the total cost exceeds $20,500,000. The draft MOU also states that the municipalities agree that the basis of allocation for costs of each segment is based on percentage of peak flow contributed to each segment at the time of the MOU, multiplied by the preliminary estimated total cost of each segment agreed to by the municipalities that will share in such costs.

It is intended that an agreement will be entered into by all parties after an implementation order has been issued by the PADEP and/or the ACHD. Such an order would indicate that the cost to each party would be based on the cost of each segment, to be adjusted for changes in costs made during construction.

The draft MOU further states that, for the purpose of submitting the Feasibility Study, the municipalities agree that the preliminary estimate of the percentage and amount of the total cost of implementation of the recommended alternative for each municipality will be as indicated below:

- Baldwin Township 37.19% ($6,350,000)
- Brentwood Borough 16.03% ($2,740,000)
- The Pittsburgh Water and Sewer Authority 11.92% ($2,040,000)
- West Mifflin Sanitary Sewer Municipal Authority 8.07% ($1,380,000)
- Whitehall Borough 26.78% ($4,570,000)

It is noted that these costs represent the allocated costs for joint conveyance facilities. These costs do not include additional costs that may be associated with other recommended improvements in the sewershed within individual municipalities. The draft MOU is provided in Attachment M42-6-1. Also, signed copies of the MOU, if provided by the municipality, would be provided in Addendum M42-6-1.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended M-42 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after M-42 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

Phase I	2013 through 2017
Phase II	2017 through 2023
Phase III	2021 through 2026
Phase IV	TBD
Phase V	TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure M42-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the M-42 shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

6.3.2 Joint Municipal Planning and Implementation

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. The draft MOU contains provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

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[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

The specific municipal tasks and efforts necessary to effect implementation of the Feasibility Study involve the completion of the 19 project segments listed above in Table M42-6-1.

All associated parties in the POC sewershed have participated in planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. Signature pages of executed MOUs or other expressions of agreement as provided by the municipalities are attached as Addendum M42-6-1 to this POC report.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$35,046,000; $17,070,000 of which would be part of the inter-municipal agreement.

- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance

- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of

annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table M42-6-2. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE M42-6-2: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638
Baldwin Borough	Not Available	Not Available	Not Available
Brentwood Borough	$438	$1,182	Not Available
West Mifflin Borough	Not Available	Not Available	Not Available
Whitehall Borough	$407	$1,292	Not Available

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure M42-6-2.

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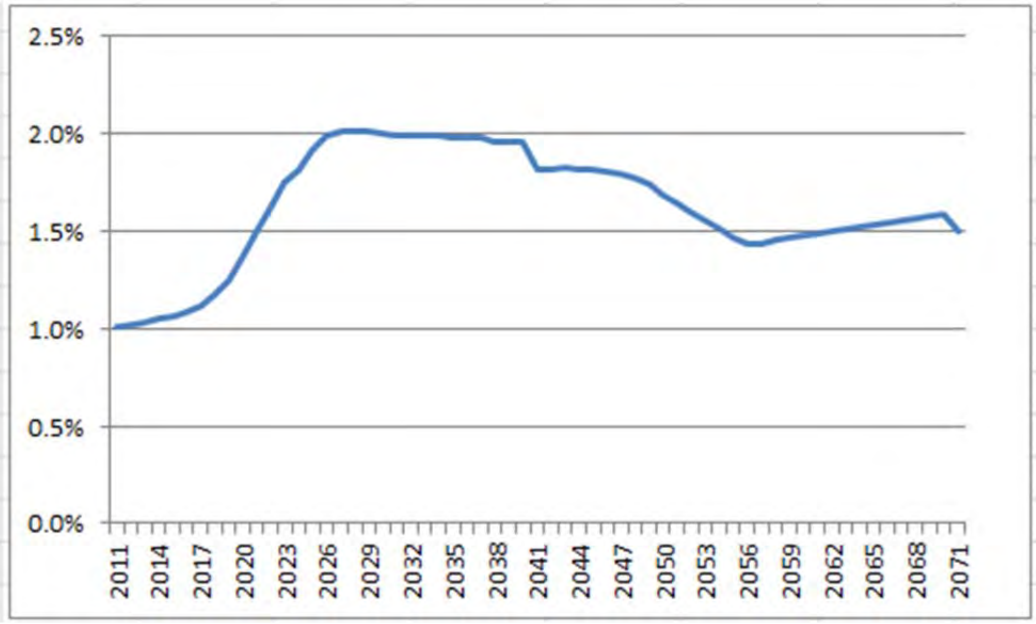
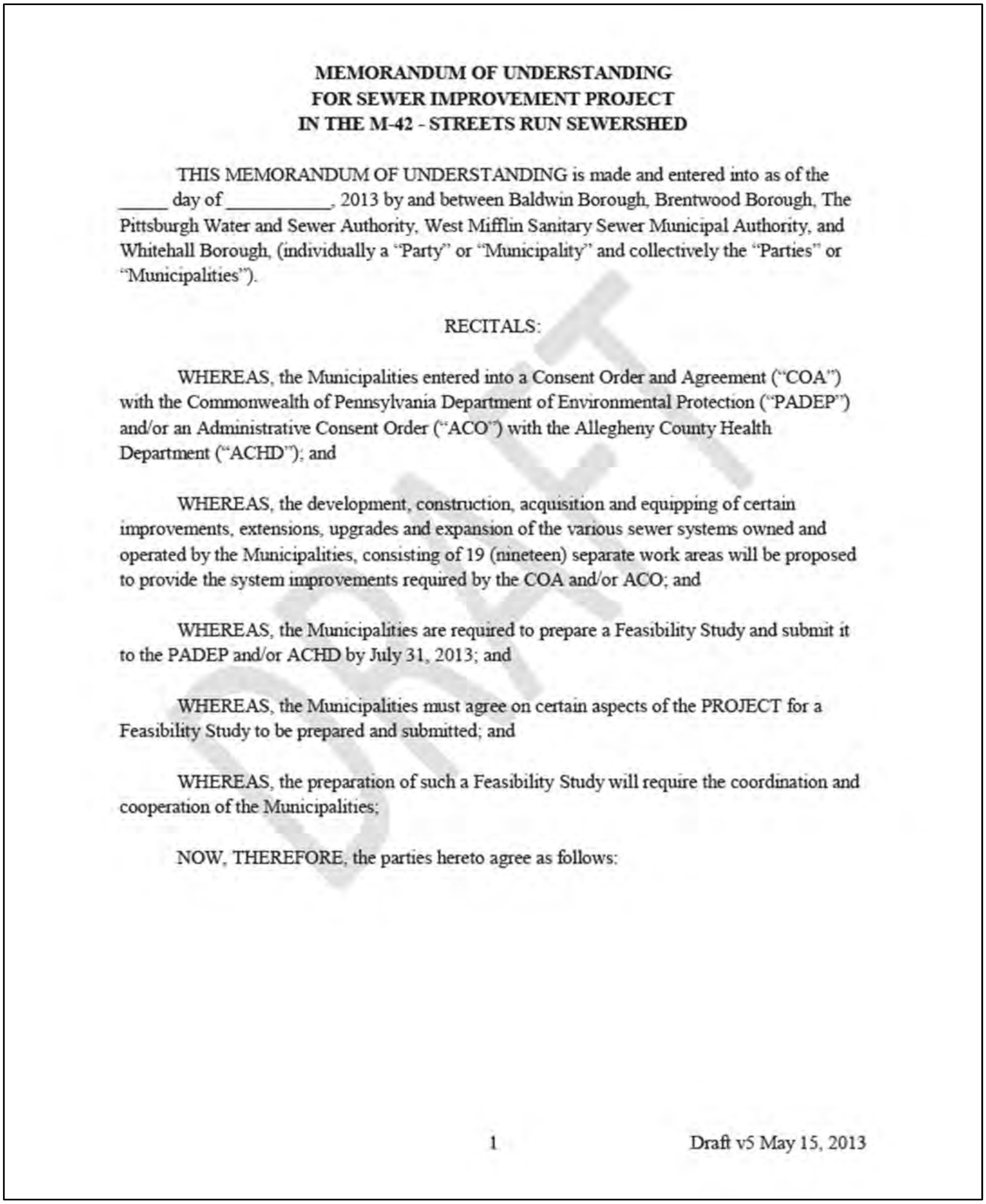
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.

[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

FIGURE M42-6-2 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.



MEMORANDUM OF UNDERSTANDING FOR SEWER IMPROVEMENT PROJECT IN THE M-42 - STREETS RUN SEWERSHED

THIS MEMORANDUM OF UNDERSTANDING is made and entered into as of the _____ day of ___________, 2013 by and between Baldwin Borough, Brentwood Borough, The Pittsburgh Water and Sewer Authority, West Mifflin Sanitary Sewer Municipal Authority, and Whitehall Borough, (individually a "Party" or "Municipality" and collectively the "Parties" or "Municipalities").

RECITALS:

WHEREAS, the Municipalities entered into a Consent Order and Agreement ("COA") with the Commonwealth of Pennsylvania Department of Environmental Protection ("PADEP") and/or an Administrative Consent Order ("ACO") with the Allegheny County Health Department ("ACHD"); and

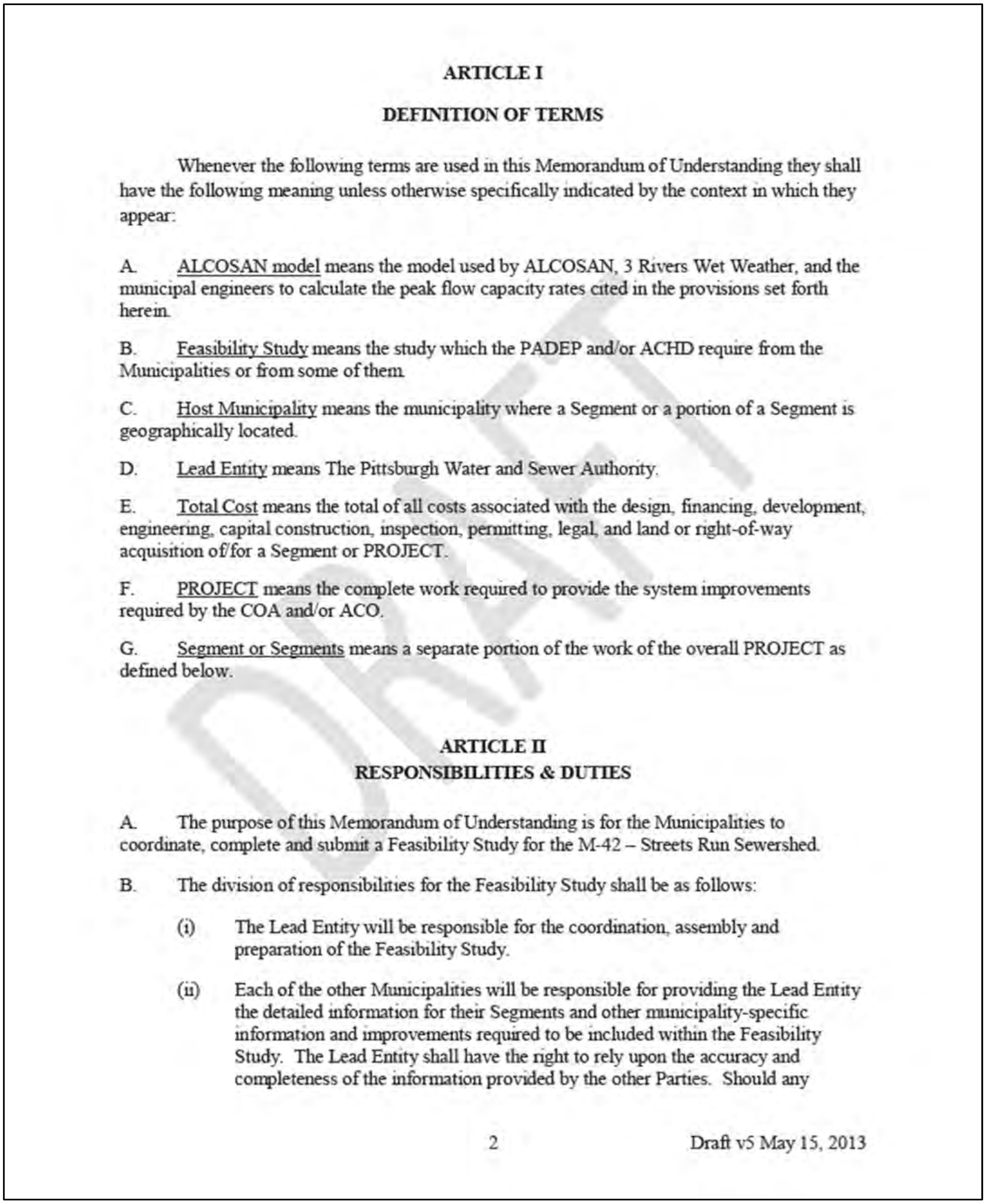
WHEREAS, the development, construction, acquisition and equipping of certain improvements, extensions, upgrades and expansion of the various sewer systems owned and operated by the Municipalities, consisting of 19 (nineteen) separate work areas will be proposed to provide the system improvements required by the COA and/or ACO; and

WHEREAS, the Municipalities are required to prepare a Feasibility Study and submit it to the PADEP and/or ACHD by July 31, 2013; and

WHEREAS, the Municipalities must agree on certain aspects of the PROJECT for a Feasibility Study to be prepared and submitted; and

WHEREAS, the preparation of such a Feasibility Study will require the coordination and cooperation of the Municipalities;

NOW, THEREFORE, the parties hereto agree as follows:



ARTICLE I

DEFINITION OF TERMS

Whenever the following terms are used in this Memorandum of Understanding they shall have the following meaning unless otherwise specifically indicated by the context in which they appear:

A. ALCOSAN model means the model used by ALCOSAN, 3 Rivers Wet Weather, and the municipal engineers to calculate the peak flow capacity rates cited in the provisions set forth herein.

B. Feasibility Study means the study which the PADEP and/or ACHD require from the Municipalities or from some of them.

C. Host Municipality means the municipality where a Segment or a portion of a Segment is geographically located.

D. Lead Entity means The Pittsburgh Water and Sewer Authority.

E. Total Cost means the total of all costs associated with the design, financing, development, engineering, capital construction, inspection, permitting, legal, and land or right-of-way acquisition of/for a Segment or PROJECT.

F. PROJECT means the complete work required to provide the system improvements required by the COA and/or ACO.

G. Segment or Segments means a separate portion of the work of the overall PROJECT as defined below.

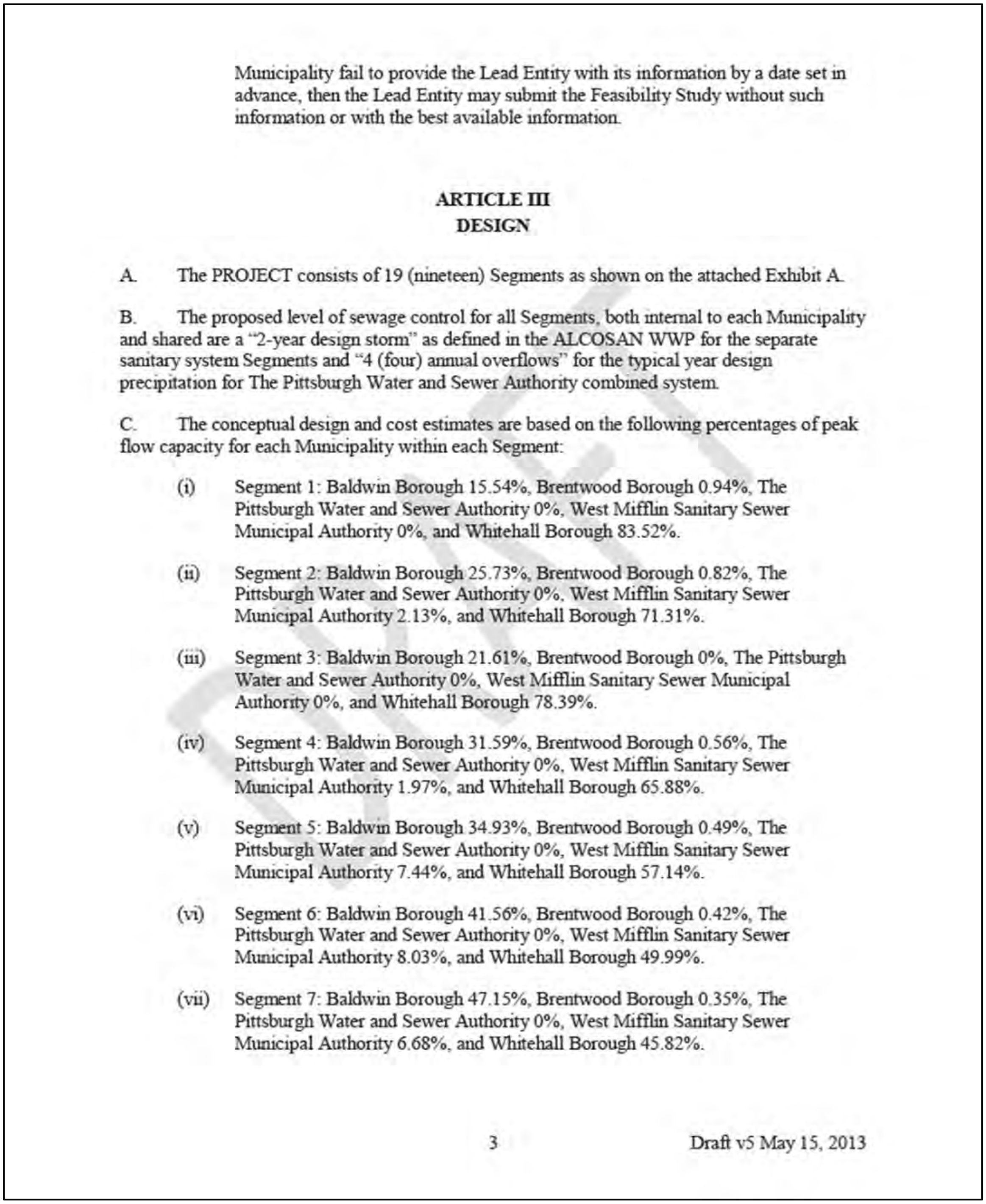
ARTICLE II
RESPONSIBILITIES & DUTIES

A. The purpose of this Memorandum of Understanding is for the Municipalities to coordinate, complete and submit a Feasibility Study for the M-42 – Streets Run Sewershed.

B. The division of responsibilities for the Feasibility Study shall be as follows:

(i) The Lead Entity will be responsible for the coordination, assembly and preparation of the Feasibility Study.

(ii) Each of the other Municipalities will be responsible for providing the Lead Entity the detailed information for their Segments and other municipality-specific information and improvements required to be included within the Feasibility Study. The Lead Entity shall have the right to rely upon the accuracy and completeness of the information provided by the other Parties. Should any



Municipality fail to provide the Lead Entity with its information by a date set in advance, then the Lead Entity may submit the Feasibility Study without such information or with the best available information.

ARTICLE III
DESIGN

A. The PROJECT consists of 19 (nineteen) Segments as shown on the attached Exhibit A.

B. The proposed level of sewage control for all Segments, both internal to each Municipality and shared are a "2-year design storm" as defined in the ALCOSAN WWP for the separate sanitary system Segments and "4 (four) annual overflows" for the typical year design precipitation for The Pittsburgh Water and Sewer Authority combined system.

C. The conceptual design and cost estimates are based on the following percentages of peak flow capacity for each Municipality within each Segment:

(i) Segment 1: Baldwin Borough 15.54%, Brentwood Borough 0.94%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 0%, and Whitehall Borough 83.52%.

(ii) Segment 2: Baldwin Borough 25.73%, Brentwood Borough 0.82%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 2.13%, and Whitehall Borough 71.31%.

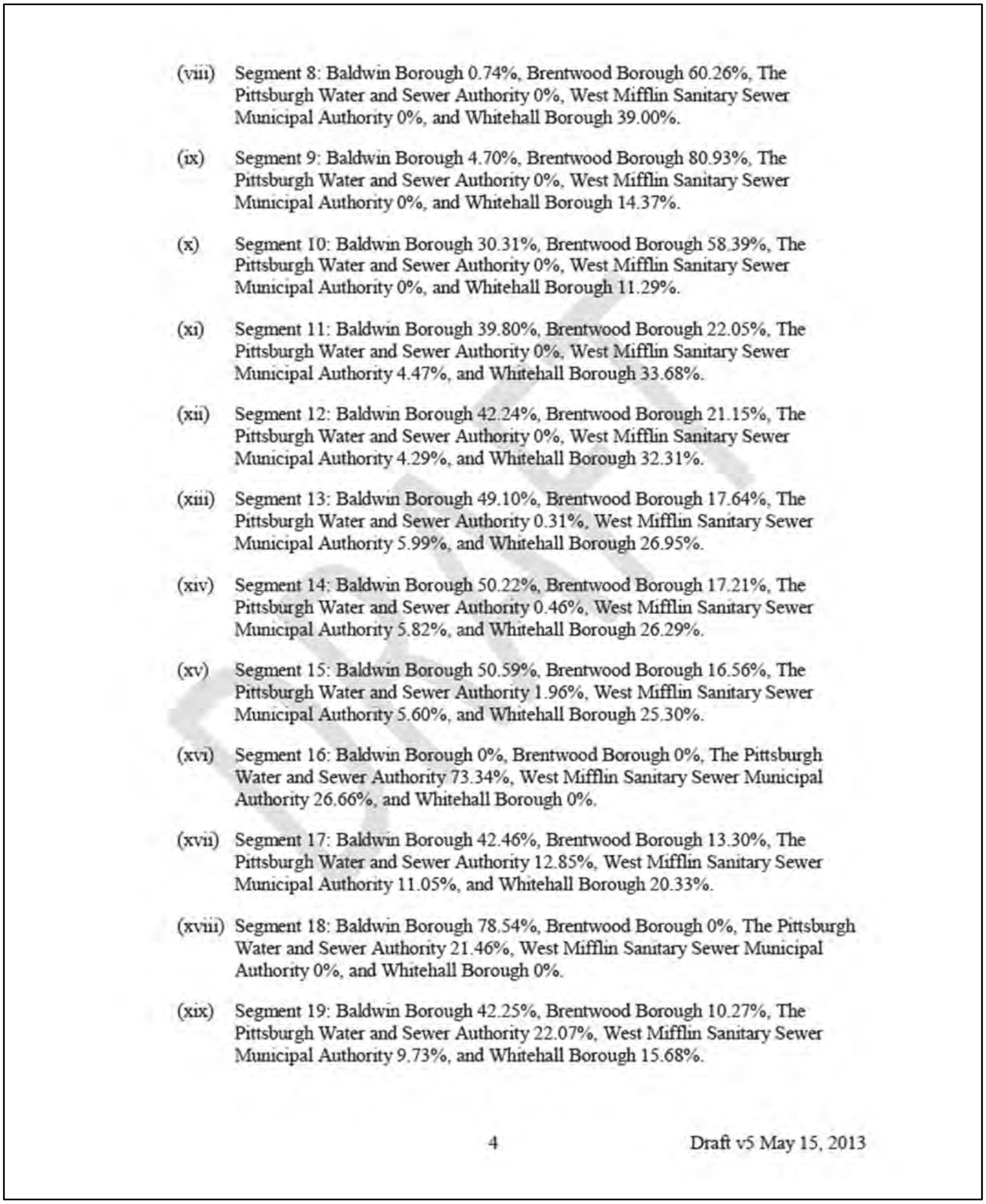
(iii) Segment 3: Baldwin Borough 21.61%, Brentwood Borough 0%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 0%, and Whitehall Borough 78.39%.

(iv) Segment 4: Baldwin Borough 31.59%, Brentwood Borough 0.56%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 1.97%, and Whitehall Borough 65.88%.

(v) Segment 5: Baldwin Borough 34.93%, Brentwood Borough 0.49%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 7.44%, and Whitehall Borough 57.14%.

(vi) Segment 6: Baldwin Borough 41.56%, Brentwood Borough 0.42%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 8.03%, and Whitehall Borough 49.99%.

(vii) Segment 7: Baldwin Borough 47.15%, Brentwood Borough 0.35%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 6.68%, and Whitehall Borough 45.82%.



(viii) Segment 8: Baldwin Borough 0.74%, Brentwood Borough 60.26%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 0%, and Whitehall Borough 39.00%.

(ix) Segment 9: Baldwin Borough 4.70%, Brentwood Borough 80.93%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 0%, and Whitehall Borough 14.37%.

(x) Segment 10: Baldwin Borough 30.31%, Brentwood Borough 58.39%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 0%, and Whitehall Borough 11.29%.

(xi) Segment 11: Baldwin Borough 39.80%, Brentwood Borough 22.05%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 4.47%, and Whitehall Borough 33.68%.

(xii) Segment 12: Baldwin Borough 42.24%, Brentwood Borough 21.15%, The Pittsburgh Water and Sewer Authority 0%, West Mifflin Sanitary Sewer Municipal Authority 4.29%, and Whitehall Borough 32.31%.

(xiii) Segment 13: Baldwin Borough 49.10%, Brentwood Borough 17.64%, The Pittsburgh Water and Sewer Authority 0.31%, West Mifflin Sanitary Sewer Municipal Authority 5.99%, and Whitehall Borough 26.95%.

(xiv) Segment 14: Baldwin Borough 50.22%, Brentwood Borough 17.21%, The Pittsburgh Water and Sewer Authority 0.46%, West Mifflin Sanitary Sewer Municipal Authority 5.82%, and Whitehall Borough 26.29%.

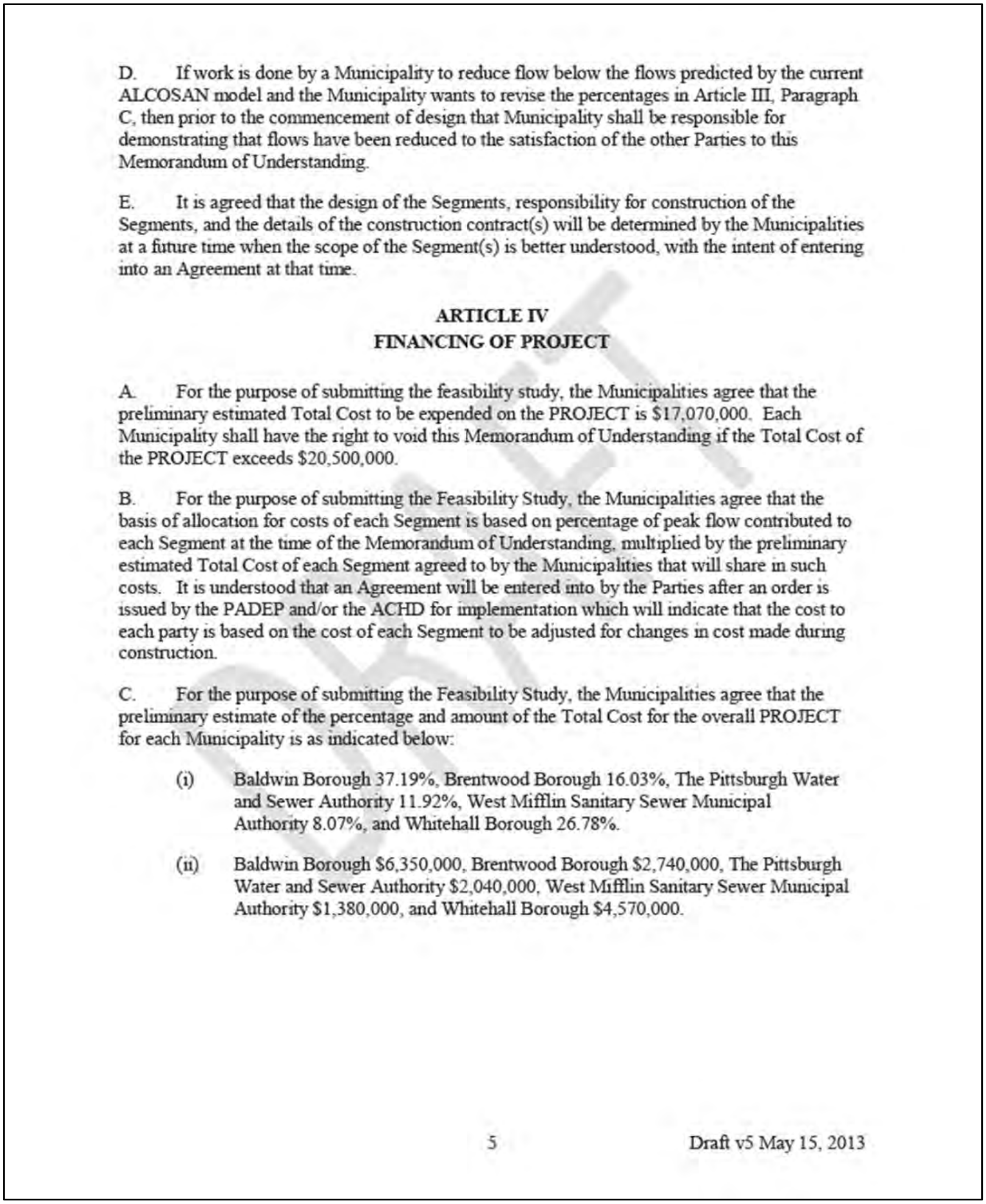
(xv) Segment 15: Baldwin Borough 50.59%, Brentwood Borough 16.56%, The Pittsburgh Water and Sewer Authority 1.96%, West Mifflin Sanitary Sewer Municipal Authority 5.60%, and Whitehall Borough 25.30%.

(xvi) Segment 16: Baldwin Borough 0%, Brentwood Borough 0%, The Pittsburgh Water and Sewer Authority 73.34%, West Mifflin Sanitary Sewer Municipal Authority 26.66%, and Whitehall Borough 0%.

(xvii) Segment 17: Baldwin Borough 42.46%, Brentwood Borough 13.30%, The Pittsburgh Water and Sewer Authority 12.85%, West Mifflin Sanitary Sewer Municipal Authority 11.05%, and Whitehall Borough 20.33%.

(xviii) Segment 18: Baldwin Borough 78.54%, Brentwood Borough 0%, The Pittsburgh Water and Sewer Authority 21.46%, West Mifflin Sanitary Sewer Municipal Authority 0%, and Whitehall Borough 0%.

(xix) Segment 19: Baldwin Borough 42.25%, Brentwood Borough 10.27%, The Pittsburgh Water and Sewer Authority 22.07%, West Mifflin Sanitary Sewer Municipal Authority 9.73%, and Whitehall Borough 15.68%.



D. If work is done by a Municipality to reduce flow below the flows predicted by the current ALCOSAN model and the Municipality wants to revise the percentages in Article III, Paragraph C, then prior to the commencement of design that Municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties to this Memorandum of Understanding.

E. It is agreed that the design of the Segments, responsibility for construction of the Segments, and the details of the construction contract(s) will be determined by the Municipalities at a future time when the scope of the Segment(s) is better understood, with the intent of entering into an Agreement at that time.

ARTICLE IV
FINANCING OF PROJECT

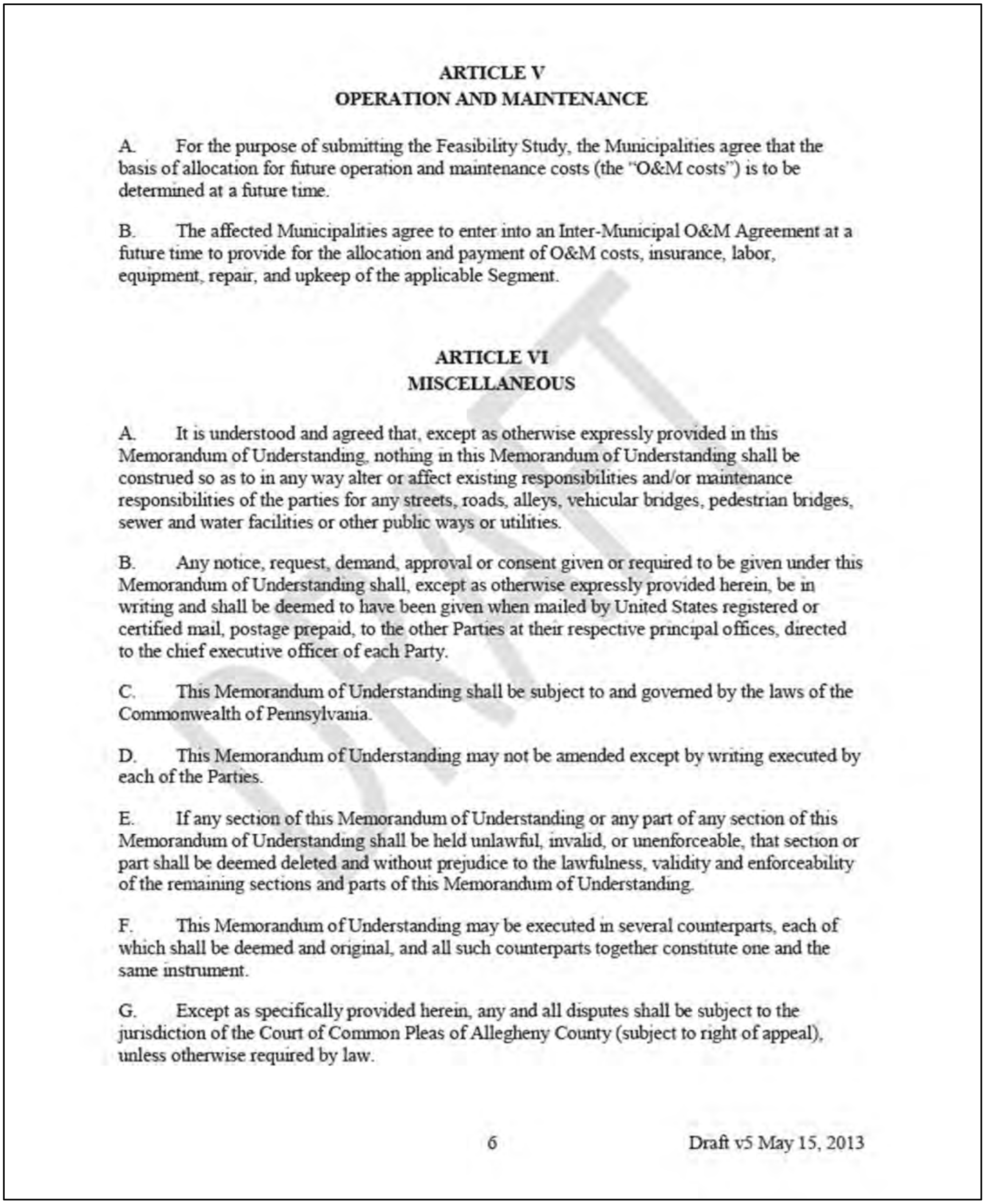
A. For the purpose of submitting the feasibility study, the Municipalities agree that the preliminary estimated Total Cost to be expended on the PROJECT is $17,070,000. Each Municipality shall have the right to void this Memorandum of Understanding if the Total Cost of the PROJECT exceeds $20,500,000.

B. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for costs of each Segment is based on percentage of peak flow contributed to each Segment at the time of the Memorandum of Understanding, multiplied by the preliminary estimated Total Cost of each Segment agreed to by the Municipalities that will share in such costs. It is understood that an Agreement will be entered into by the Parties after an order is issued by the PADEP and/or the ACHD for implementation which will indicate that the cost to each party is based on the cost of each Segment to be adjusted for changes in cost made during construction.

C. For the purpose of submitting the Feasibility Study, the Municipalities agree that the preliminary estimate of the percentage and amount of the Total Cost for the overall PROJECT for each Municipality is as indicated below:

(i) Baldwin Borough 37.19%, Brentwood Borough 16.03%, The Pittsburgh Water and Sewer Authority 11.92%, West Mifflin Sanitary Sewer Municipal Authority 8.07%, and Whitehall Borough 26.78%.

(ii) Baldwin Borough $6,350,000, Brentwood Borough $2,740,000, The Pittsburgh Water and Sewer Authority $2,040,000, West Mifflin Sanitary Sewer Municipal Authority $1,380,000, and Whitehall Borough $4,570,000.



ARTICLE V
OPERATION AND MAINTENANCE

A. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for future operation and maintenance costs (the "O&M costs") is to be determined at a future time.

B. The affected Municipalities agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the applicable Segment.

ARTICLE VI
MISCELLANEOUS

A. It is understood and agreed that, except as otherwise expressly provided in this Memorandum of Understanding, nothing in this Memorandum of Understanding shall be construed so as to in any way alter or affect existing responsibilities and/or maintenance responsibilities of the parties for any streets, roads, alleys, vehicular bridges, pedestrian bridges, sewer and water facilities or other public ways or utilities.

B. Any notice, request, demand, approval or consent given or required to be given under this Memorandum of Understanding shall, except as otherwise expressly provided herein, be in writing and shall be deemed to have been given when mailed by United States registered or certified mail, postage prepaid, to the other Parties at their respective principal offices, directed to the chief executive officer of each Party.

C. This Memorandum of Understanding shall be subject to and governed by the laws of the Commonwealth of Pennsylvania.

D. This Memorandum of Understanding may not be amended except by writing executed by each of the Parties.

E. If any section of this Memorandum of Understanding or any part of any section of this Memorandum of Understanding shall be held unlawful, invalid, or unenforceable, that section or part shall be deemed deleted and without prejudice to the lawfulness, validity and enforceability of the remaining sections and parts of this Memorandum of Understanding.

F. This Memorandum of Understanding may be executed in several counterparts, each of which shall be deemed and original, and all such counterparts together constitute one and the same instrument.

G. Except as specifically provided herein, any and all disputes shall be subject to the jurisdiction of the Court of Common Pleas of Allegheny County (subject to right of appeal), unless otherwise required by law.

IN WITNESS WHEREOF, the parties hereto have caused this Memorandum of Understanding to be executed all as of the day and year first above written.

BALDWIN BOROUGH

____

BRENTWOOD BOROUGH

____

THE PITTSBURGH WATER AND SEWER AUTHORITY

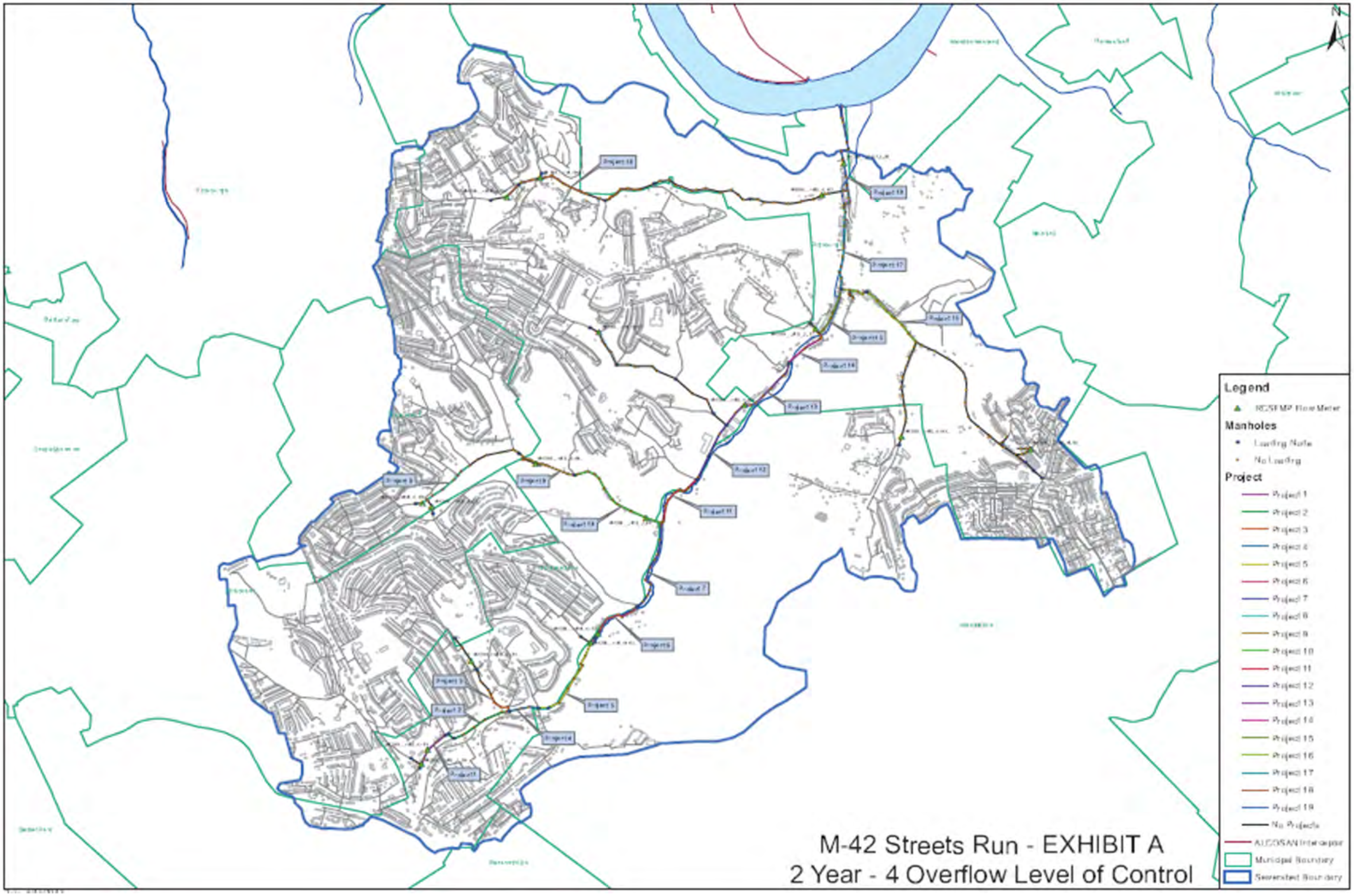
____

WEST MIFFLIN SANITARY SEWER MUNICIPAL AUTHORITY

____

WHITEHALL BOROUGH

____


Project 10
Project 18
Project 17
Project 16
Project 4
Project 14
Project 13
Project 12
Project 11
Project 9
Project 8
Project 10
Project 7
Project 6
Project 5
Project 3
Project 2
Project 4
Project 1
Legend
RCSFMP Flow Meter
Manholes
Loading Node
No Loading
Project
Project 1
Project 2
Project 3
Project 4
Project 5
Project 6
Project 7
Project 8
Project 9
Project 10
Project 11
Project 12
Project 13
Project 14
Project 15
Project 16
Project 17
Project 18
Project 19
No Projects
ALCOSAN Interceptor
Municipal Boundary
Sewershed Boundary
M-42 Streets Run - EXHIBIT A
2 Year - 4 Overflow Level of Control

7.0 STAKEHOLDER INVOLVEMENT

Stakeholder meetings titled POC Sewershed Coordination Meetings, facilitated by 3RWW, were held during the site and technology selection and alternative development processes. These meetings facilitated cooperation, information exchange and consensus building between the PWSA, its stakeholders and tributary municipalities essential to the development of the PWSA Feasibility Study Report and supporting POC-based feasibility studies. For the meetings listed in Table 7-1, POC M-34 was the focus of the discussion and representatives from municipalities' tributary to the Becks Run sewershed were in attendance. Meeting topics included source reduction and green infrastructure, alternatives analysis, affordability and implementation schedule, and cost allocation. Other stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

The Wet Weather Feasibility Study Coordination Meeting, led by the PWSA, facilitated stakeholder participation between the PWSA and Baldwin Borough and Mt. Oliver Borough communities tributary to the Becks Run watershed. The purpose of this meeting was to coordinate the development of planning information specific to the multi-municipal sewershed, reach a consensus agreement on the recommended improvements and receive authorization to submit the results.

TABLE 7-1: STREETS RUN M-42 POC MEETINGS

Title/Purpose	Date	Time	Location
WW Feasibility Study Coordination	3/20/12	1:30 PM	PWSA Office
POC Sewershed Coordination	2/27/13	1:00 PM	PWSA Office
POC Sewershed Coordination	3/19/13	1:00 PM	Green Tree Municipal Building

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
M-47: NINE MILE RUN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

ATTACHMENT B

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report On The Current Status Of The Development Of The Wet Weather Feasibility Study For The City Of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh, Braddock Hills, Churchill, Edgewood, Penn Hills, Swissvale, and Wilkinsburg. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.
- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.
- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.
- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.
- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.
- Section 7.0 describes how stakeholders were included in the plan development.

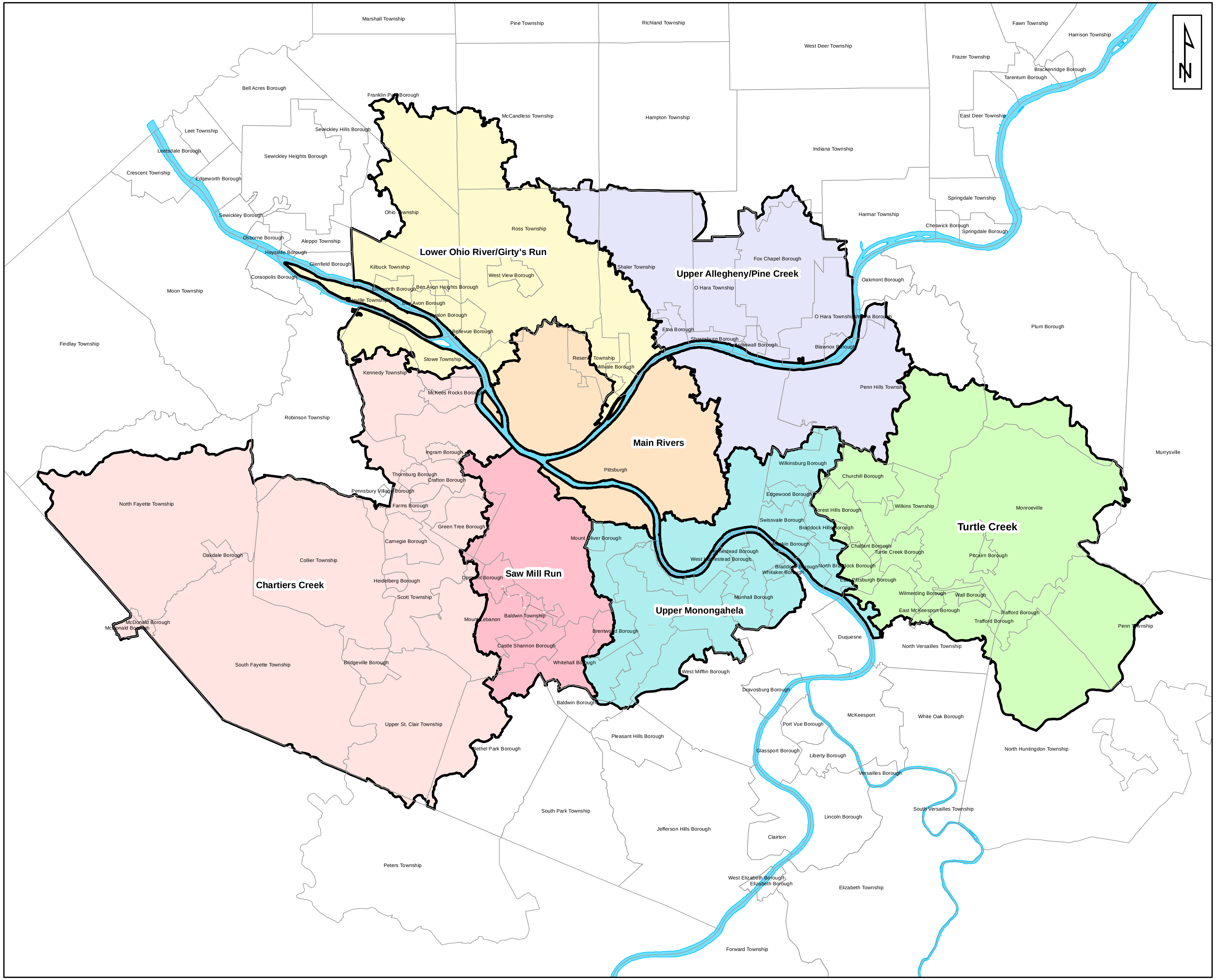
1.2 EXISTING SYSTEM DESCRIPTION

This POC FS Report addresses POC M-47, also known as Nine Mile Run. The M-47 sewershed is located in the Upper Monongahela Planning Basin. The Upper Monongahela basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

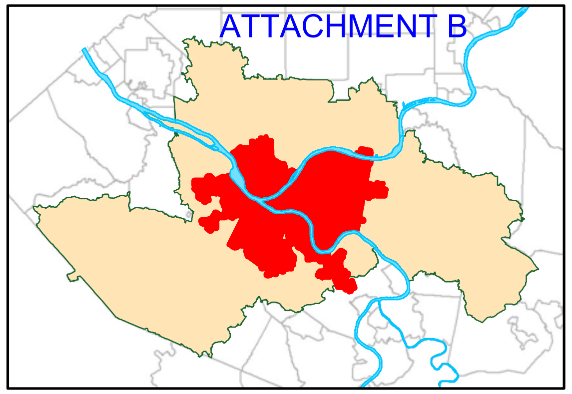
The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: M-47 Nine Mile Run Existing Facilities Map*. The M-47 sewershed is served by a single trunk sewer along the Fern Hollow/Nine Mile Run corridor in Frick Park. The trunk line travels from Reynolds Street in Point Breeze to the M-47 ALCOSAN CSO diversion structure near the Monongahela River. Along the combined trunk sewer in Frick Park is a parallel 54 inch diameter overflow sewer that conveys excess flows to a PWSA outfall near the Parkway East overpass. Some of the PWSA diversion structures located in Frick Park along the referenced trunk sewer divert excess flows into the referenced overflow sewer and are received by Nine Mile Run Sewershed.

There are seven PWSA CSO diversion chambers in the sewershed that overflow to Nine Mile Run and the Monongahela River at four permitted CSOs. The M-47 sewershed encompasses approximately 4,111 acres. The sewershed contains 1,925 acres of the City of Pittsburgh, 95 acres of Braddock Hills, 127 acres of Churchill, 375 acres Edgewood, 7 acres of Penn Hills, 209 acres of Swissvale, and 1,375 acres of

Wilkinsburg. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to M-47* for specific information on this POC.



ATTACHMENT B



ALCOSAN Service Area Overview

Legend

- ☐ Municipal Boundary
- 🟥 Chartiers Creek
- 🟨 Lower Ohio River / Girty's Run
- 🟧 Main Rivers
- 🟥 Saw Mill Run
- 🟩 Turtle Creek
- 🟪 Upper Allegheny / Pine Creek
- 🟦 Upper Monongahela
- 🟦 River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins Feasibility Study Report

PWSA
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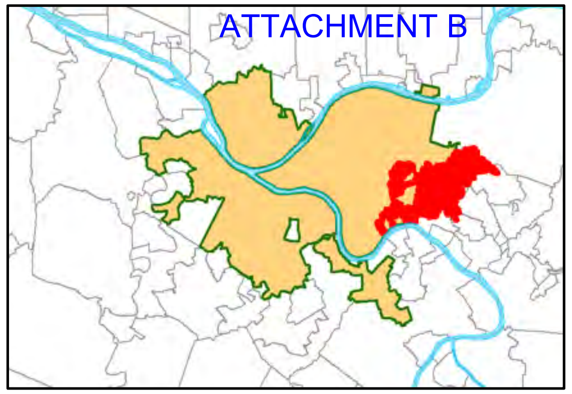
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd

ATTACHMENT B

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



PWSA Service Area Overview

Legend

- ● PWSA CSO Diversion Structure
- — Trunk Sewer
- — Collector Sewer
- ☐ M-47 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- ▨ River

Existing ALCOSAN Interceptor

- - - Deep Tunnel
- — Shallow Cut

1,900 950 0 1,900 Feet

Figure 1 - 2: M-47 Nine Mile Run Existing Facilities

PWSA THE PITTSBURGH WATER & SEWER AUTHORITY Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\NINE MILE RUN (M-47)\FIGURE 1-2_NMR_47Existing Overflows.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR MUNICIPALITIES TRIBUTARY TO M-47

COMPLEX SHED CHARACTERISTICS		MUNICIPALITY					
	City of Pittsburgh	Braddock Hills	Churchill[1]	Edgewood	Municipality of Penn Hills[2]	Swissvale	Wilkinsburg
Tributary Area (Acres)	1,925	95	127	375	7	209	1,375
Population	13,370	320	641	3,121	85	3,355	14,498
Combined							
Inch-Miles	745	0	0	0	0	0.3	3
Linear Feet	205,600	0	0	0	0	200	600
Inch-Miles/Acre	0.39	0	0	0	0	0.001	0.002
Separate							
Inch-Miles	81	18	29.5	137	0.31	86	482
Linear Feet	42,300	11,700	19,480	65,400	1,501	49,400	261,400
Inch-Miles/Acre	0.04	0.19	0.23	0.37	0.31	0.41	0.35

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows that are not released to the environment by the upstream PWSA diversion structures are regulated by the M-47 ALCOSAN CSO diversion structure located in Duck Hollow.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to M-47*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

---

[1] Data provided by Churchill Borough per municipal RFI.
[2] Data provided by the Municipality of Penn Hills.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO M-47

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
129B001	DC129B001	CSO129B001	Swisshelm Park	Nine Mile Run
128R002	DC128D001 DC128D002 DC128D003 DC176J001 DC176J002 DC176J003	CSO128R002	Frick Park	Nine Mile Run

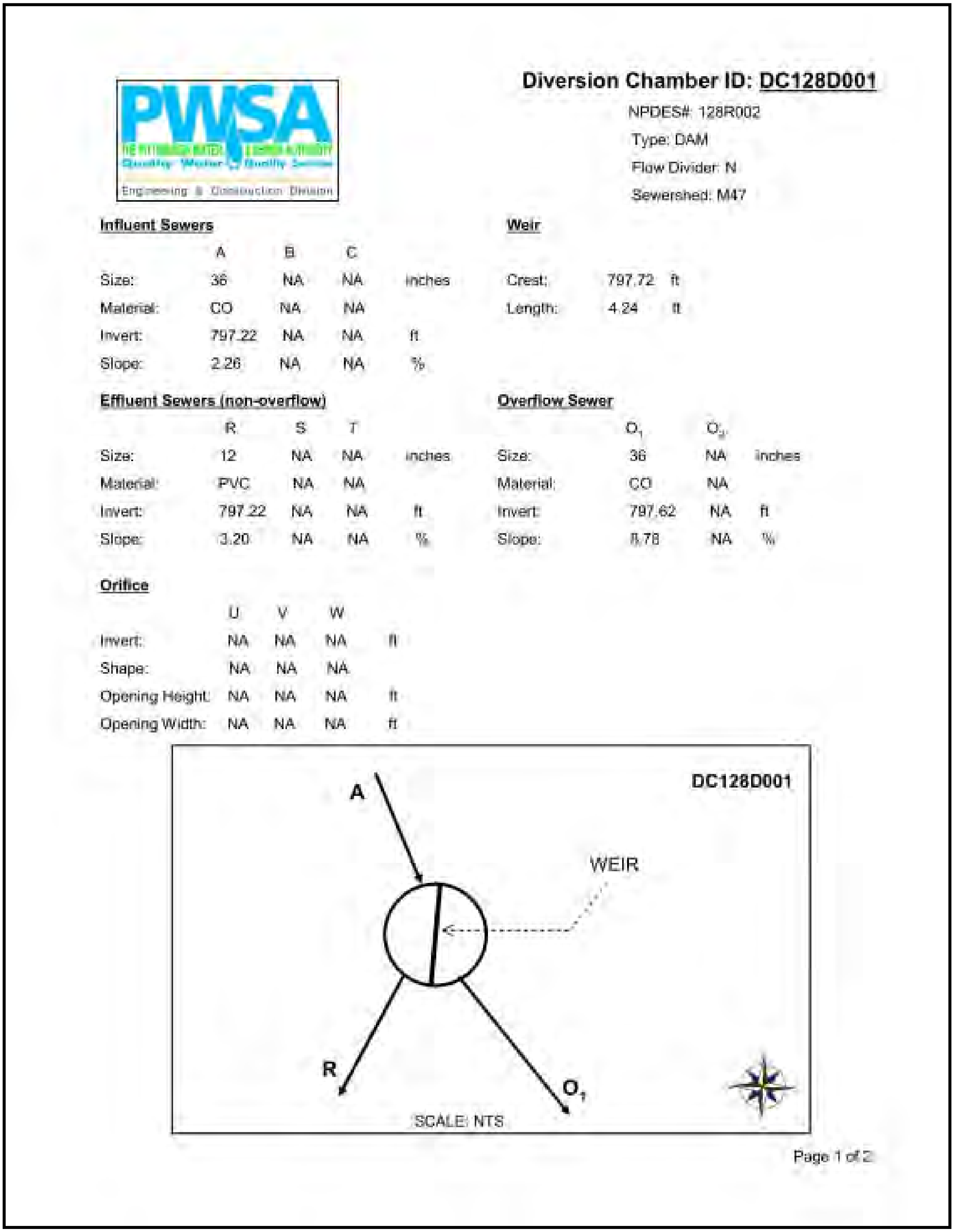
As shown in *Table 1-3: M-47 Sewershed Typical Year Overflow Statistics*, during the typical year these seven structures overflow 32 times. The largest overflow volume is 7.8 million gallons per event and the total annual volume is 17.5 million gallons.

TABLE 1-3: M-47 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC128D001	32	132.56	17.56	8.27	7.81	0.61	0.15	17.53
DC128D002								
DC128D003								
DC129B001								
DC176J001								
DC176J002								
DC176J003								
Total Annual Volume								**17.53**

1.2.1 Diversion Structure Sketches

The following sketches of the M-47 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.



PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC128D001

NPDES#: 128R002
Type: DAM
Flow Divider: N
Sewershed: M47

Influent Sewers

	A	B	C	
Size:	36	NA	NA	inches
Material:	CO	NA	NA	
Invert:	797.22	NA	NA	ft
Slope:	2.26	NA	NA	%

Weir

Crest:	797.72	ft
Length:	4.24	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	12	NA	NA	inches
Material:	PVC	NA	NA	
Invert:	797.22	NA	NA	ft
Slope:	3.20	NA	NA	%

Overflow Sewer

	O_1	O_2	
Size:	36	NA	inches
Material:	CO	NA	
Invert:	797.62	NA	ft
Slope:	8.78	NA	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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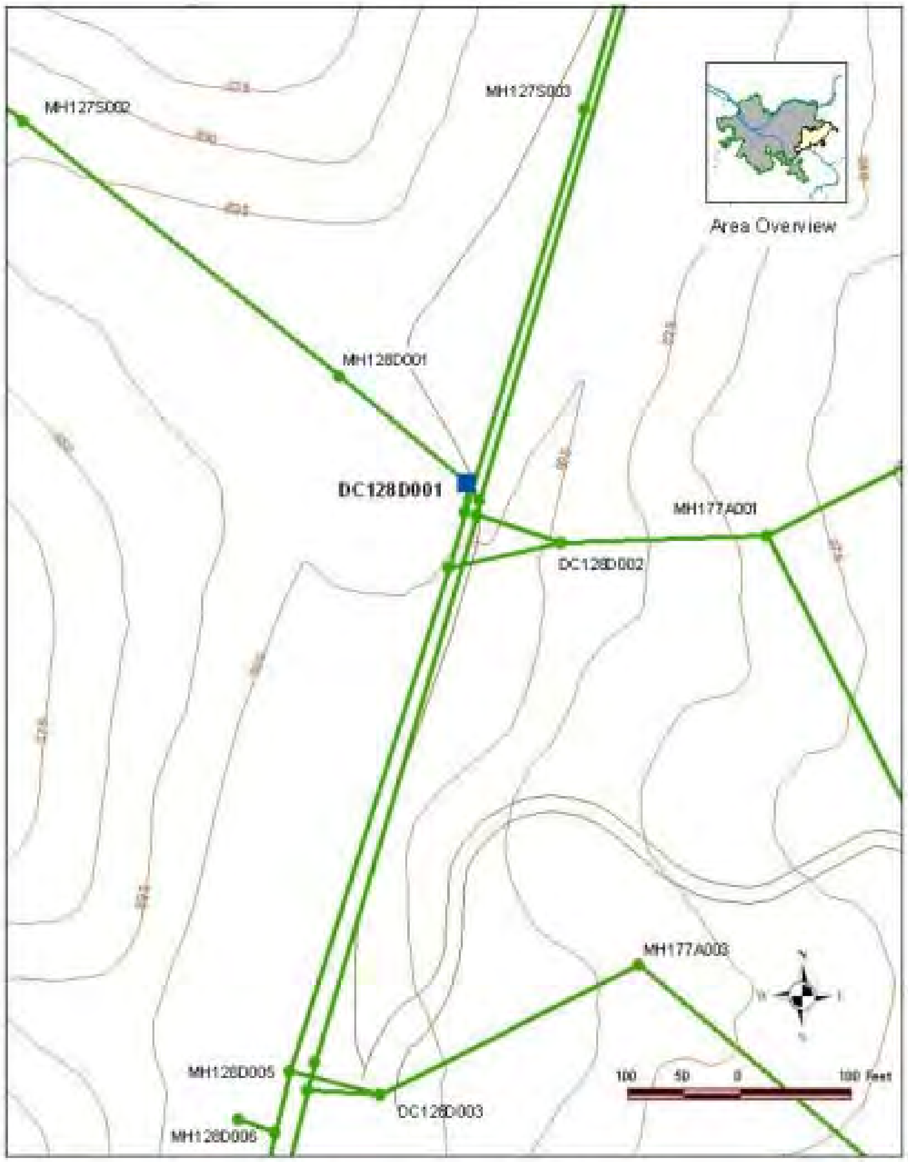

PWSA Diversion Structure DC128D001
Location Map

Nine Mile Run Sewershed

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PWSA
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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC128D002

NPDES#: 128R002
Type: DAM
Flow Divider: N
Sewershed: M47

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	T.C.	NA	NA	
Invert:	798.49	NA	NA	ft
Slope:	27.13	NA	NA	%

Weir

Crest:	798.99	ft
Length:	4.00	ft

Effluent Sewers (non-overflow)

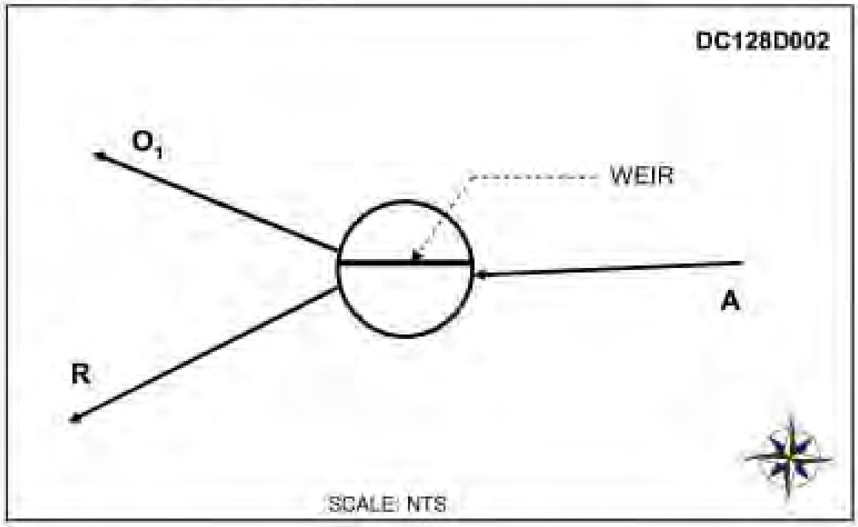
	R	S	T	
Size:	8.04	NA	NA	inches
Material:	PVC	NA	NA	
Invert:	798.49	NA	NA	ft
Slope:	8.18	NA	NA	%

Overflow Sewer

	O_1	O_2	
Size:	15	NA	inches
Material:	PVC	NA	
Invert:	798.99	NA	ft
Slope:	10.22	NA	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft



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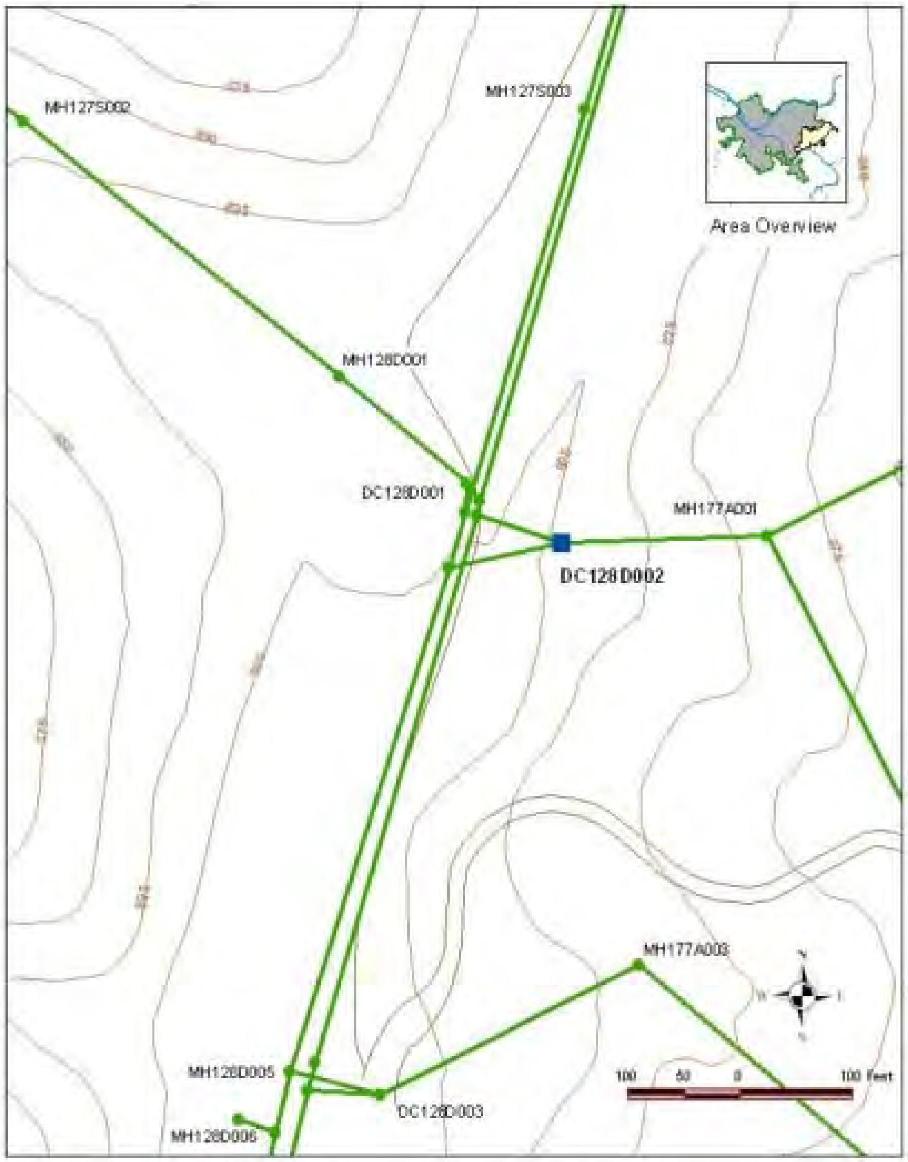

PWSA Diversion Structure DC128D002
Location Map

Nine Mile Run Sewershed

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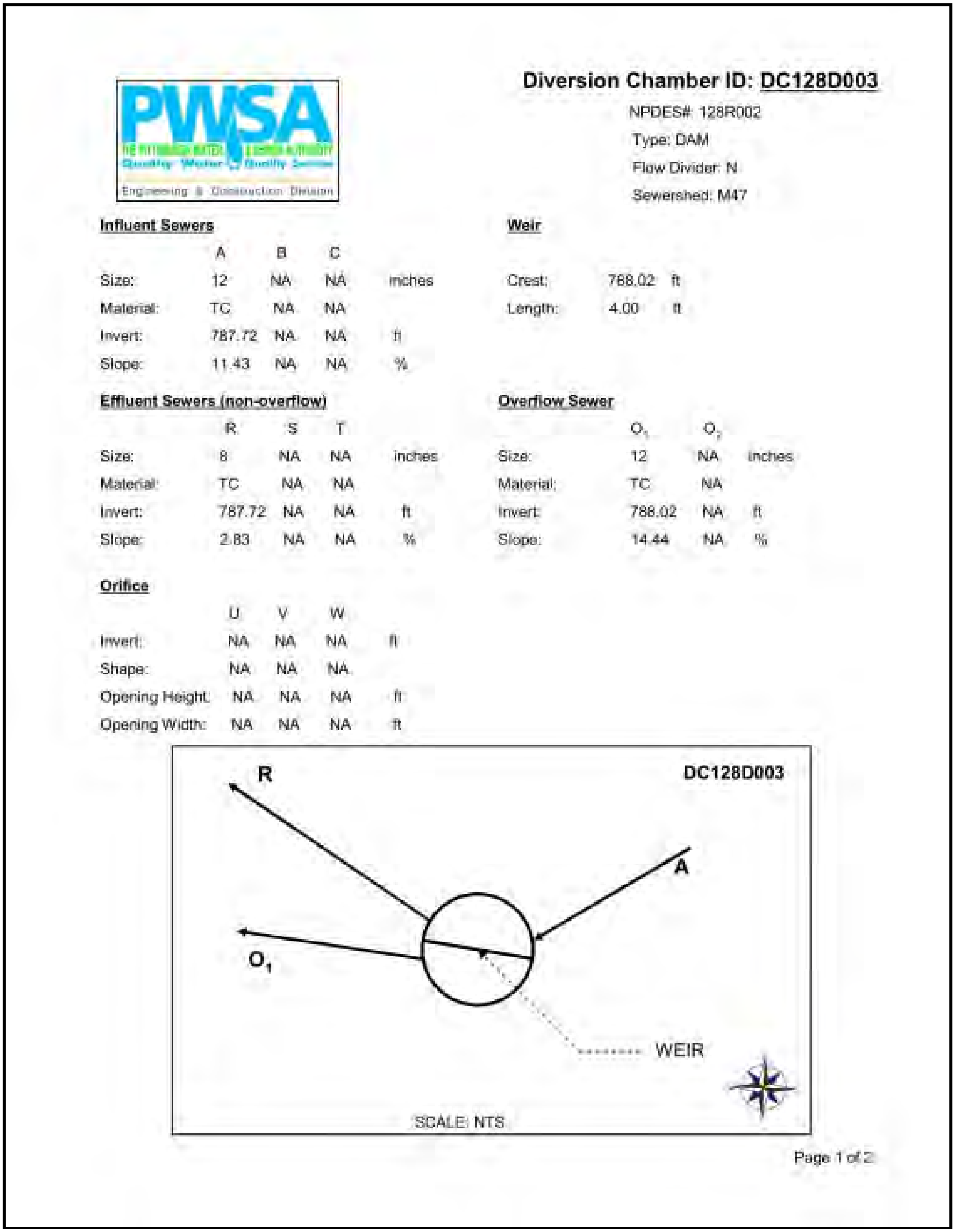

PWSA
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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC128D003

NPDES#: 128R002
Type: DAM
Flow Divider: N
Sewershed: M47

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	787.72	NA	NA	ft
Slope:	11.43	NA	NA	%

Weir

Crest:	788.02	ft
Length:	4.00	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	787.72	NA	NA	ft
Slope:	2.83	NA	NA	%

Overflow Sewer

	O_1	O_2	
Size:	12	NA	inches
Material:	TC	NA	
Invert:	788.02	NA	ft
Slope:	14.44	NA	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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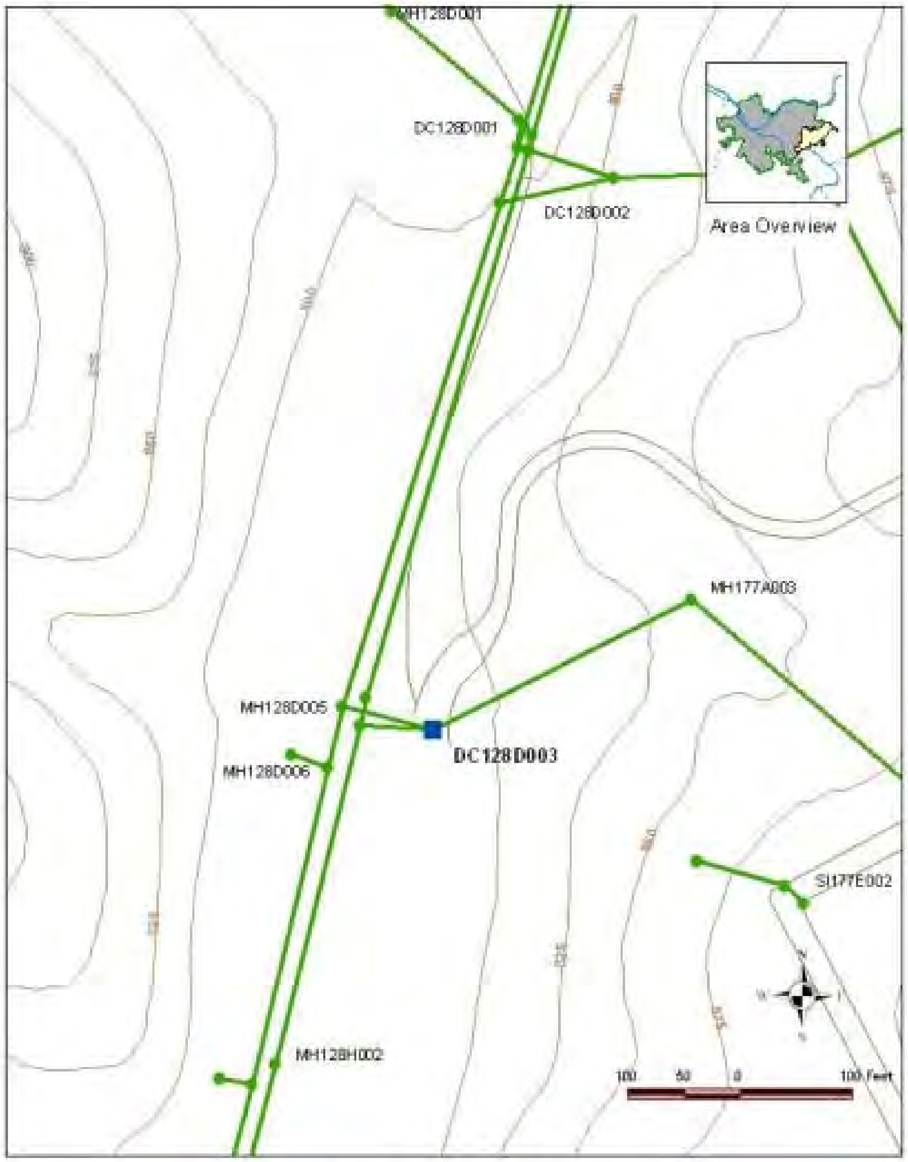

PWSA Diversion Structure DC128D003
Location Map

Nine Mile Run Sewershed

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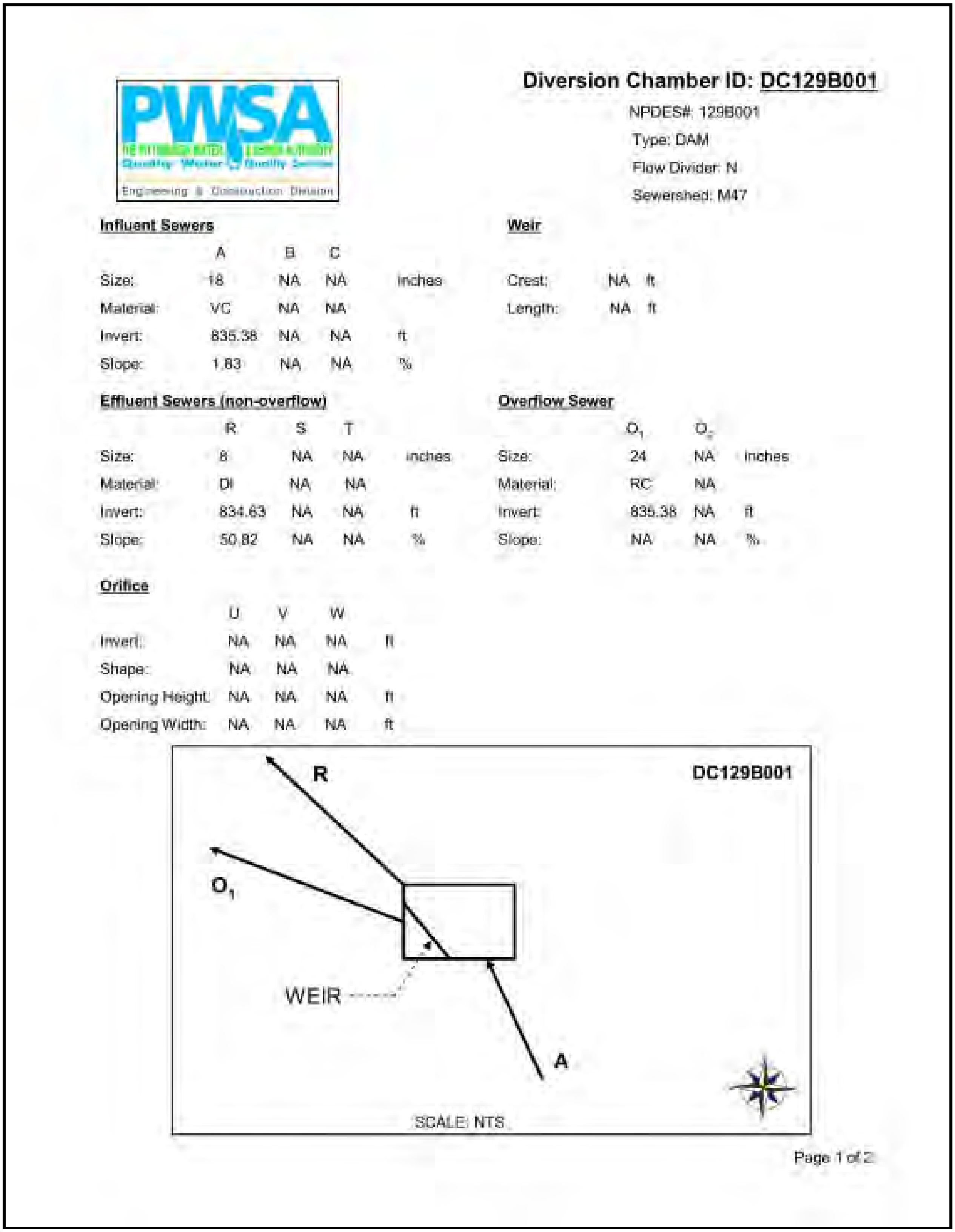

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water · Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC129B001

NPDES#: 129B001
Type: DAM
Flow Divider: N
Sewershed: M47

Influent Sewers

	A	B	C	
Size:	18	NA	NA	inches
Material:	VC	NA	NA	
Invert:	835.38	NA	NA	ft
Slope:	1.83	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	DI	NA	NA	
Invert:	834.63	NA	NA	ft
Slope:	50.82	NA	NA	%

Overflow Sewer

	O_1	O_2	
Size:	24	NA	inches
Material:	RC	NA	
Invert:	835.38	NA	ft
Slope:	NA	NA	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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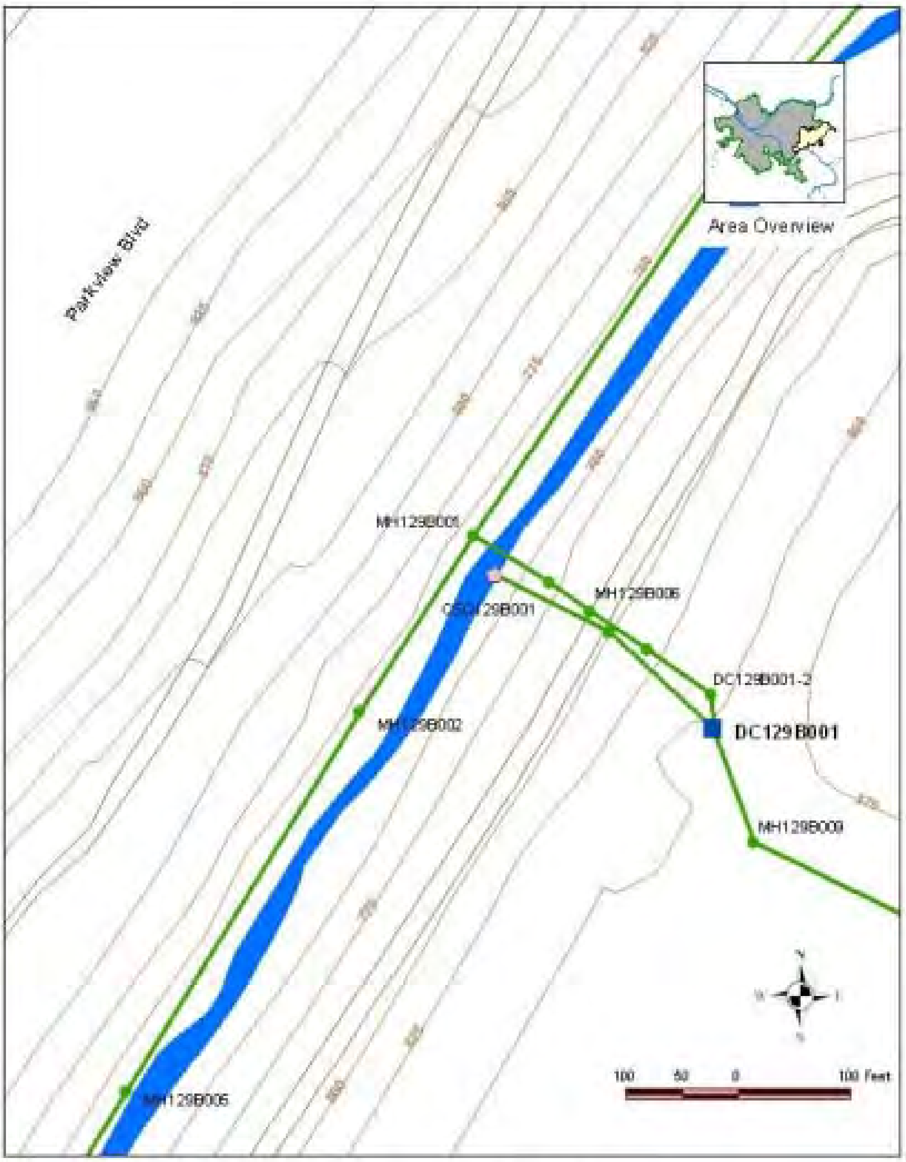

PWSA Diversion Structure DC129B001
Location Map

Nine Mile Run Sewershed

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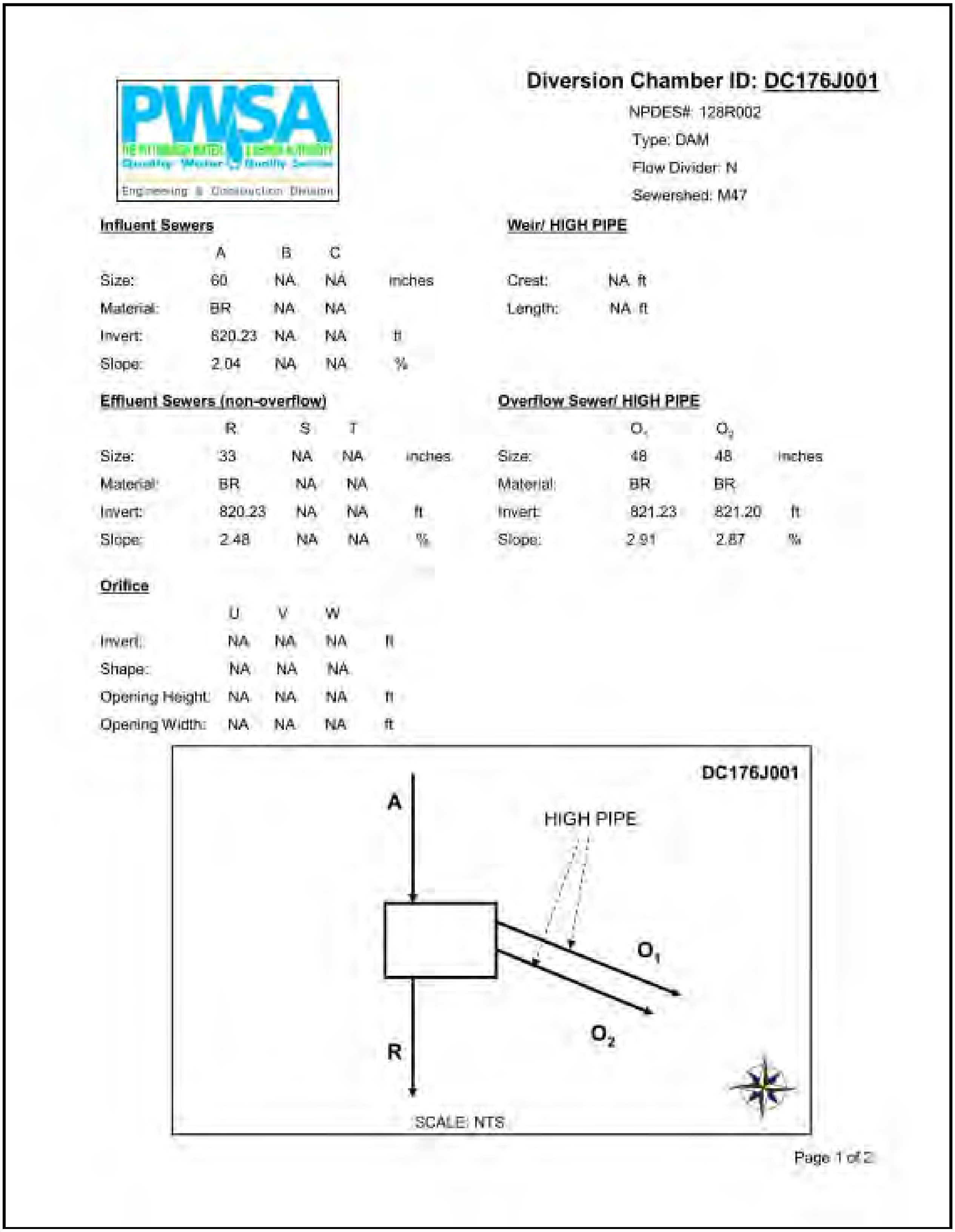

Diversion Chamber ID: DC176J001

NPDES#: 128R002
Type: DAM
Flow Divider: N
Sewershed: M47

Influent Sewers

	A	B	C	
Size:	60	NA	NA	inches
Material:	BR	NA	NA	
Invert:	820.23	NA	NA	ft
Slope:	2.04	NA	NA	%

Weir/ HIGH PIPE

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	33	NA	NA	inches
Material:	BR	NA	NA	
Invert:	820.23	NA	NA	ft
Slope:	2.48	NA	NA	%

Overflow Sewer/ HIGH PIPE

	O_1	O_2	
Size:	48	48	inches
Material:	BR	BR	
Invert:	821.23	821.20	ft
Slope:	2.91	2.87	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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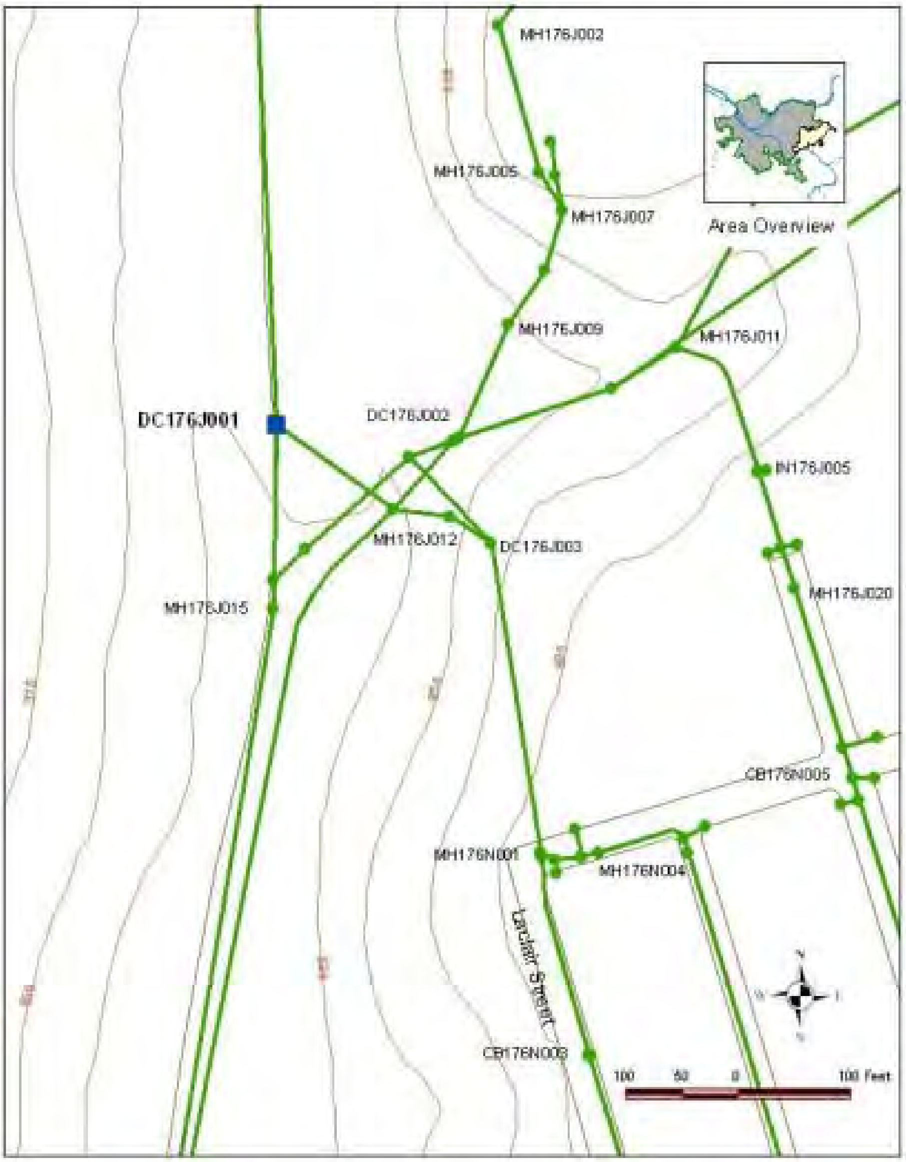

PWSA Diversion Structure DC176J001
Location Map

Nine Mile Run Sewershed

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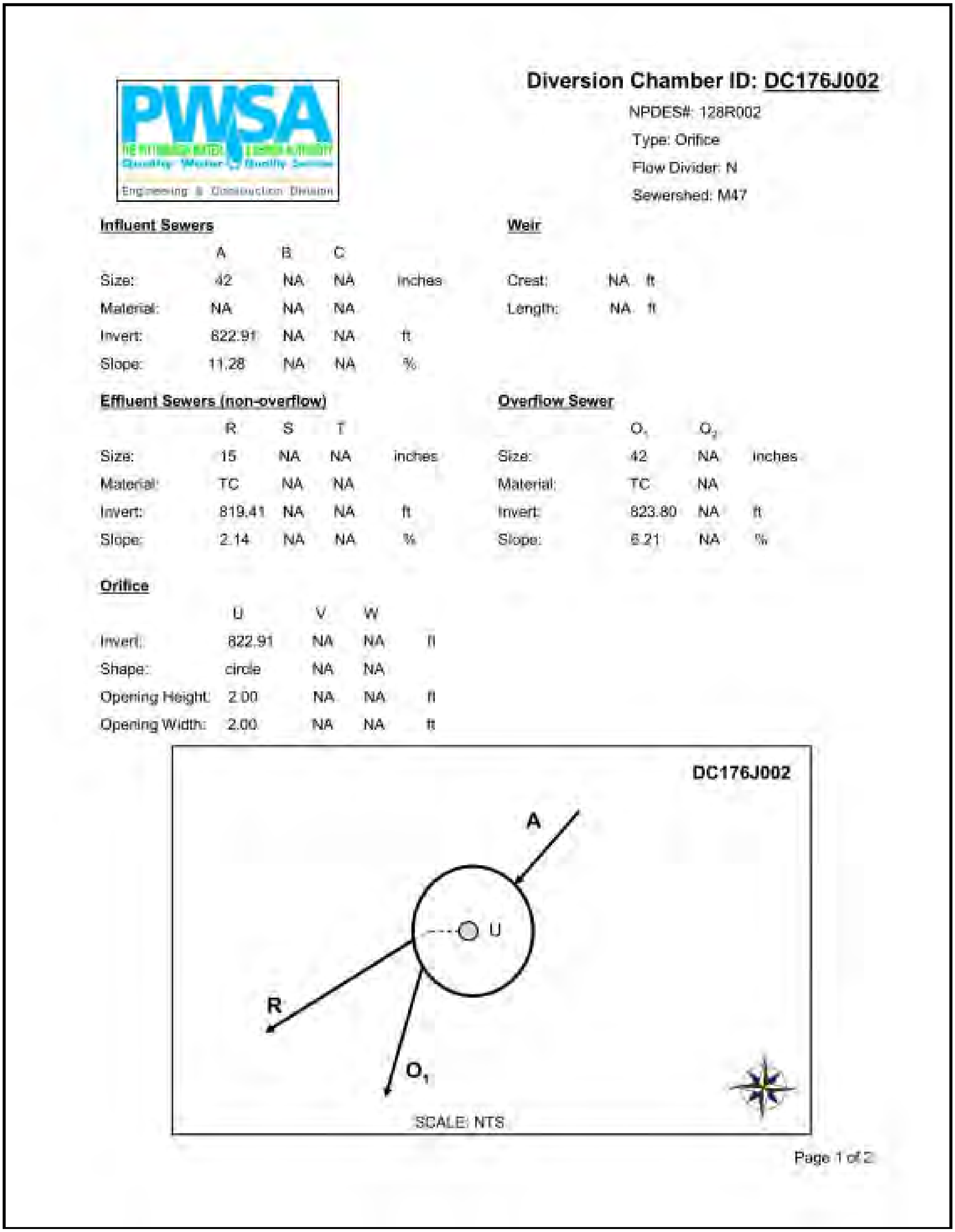

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC176J002

NPDES#: 128R002
Type: Orifice
Flow Divider: N
Sewershed: M47

Influent Sewers

	A	B	C	
Size:	42	NA	NA	inches
Material:	NA	NA	NA	
Invert:	822.91	NA	NA	ft
Slope:	11.28	NA	NA	%

Weir

Crest: NA ft
Length: NA ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	15	NA	NA	inches
Material:	TC	NA	NA	
Invert:	819.41	NA	NA	ft
Slope:	2.14	NA	NA	%

Overflow Sewer

	O_1	O_2	
Size:	42	NA	inches
Material:	TC	NA	
Invert:	823.80	NA	ft
Slope:	6.21	NA	%

Orifice

	U	V	W	
Invert:	822.91	NA	NA	ft
Shape:	circle	NA	NA	
Opening Height:	2.00	NA	NA	ft
Opening Width:	2.00	NA	NA	ft

SCALE: NTS

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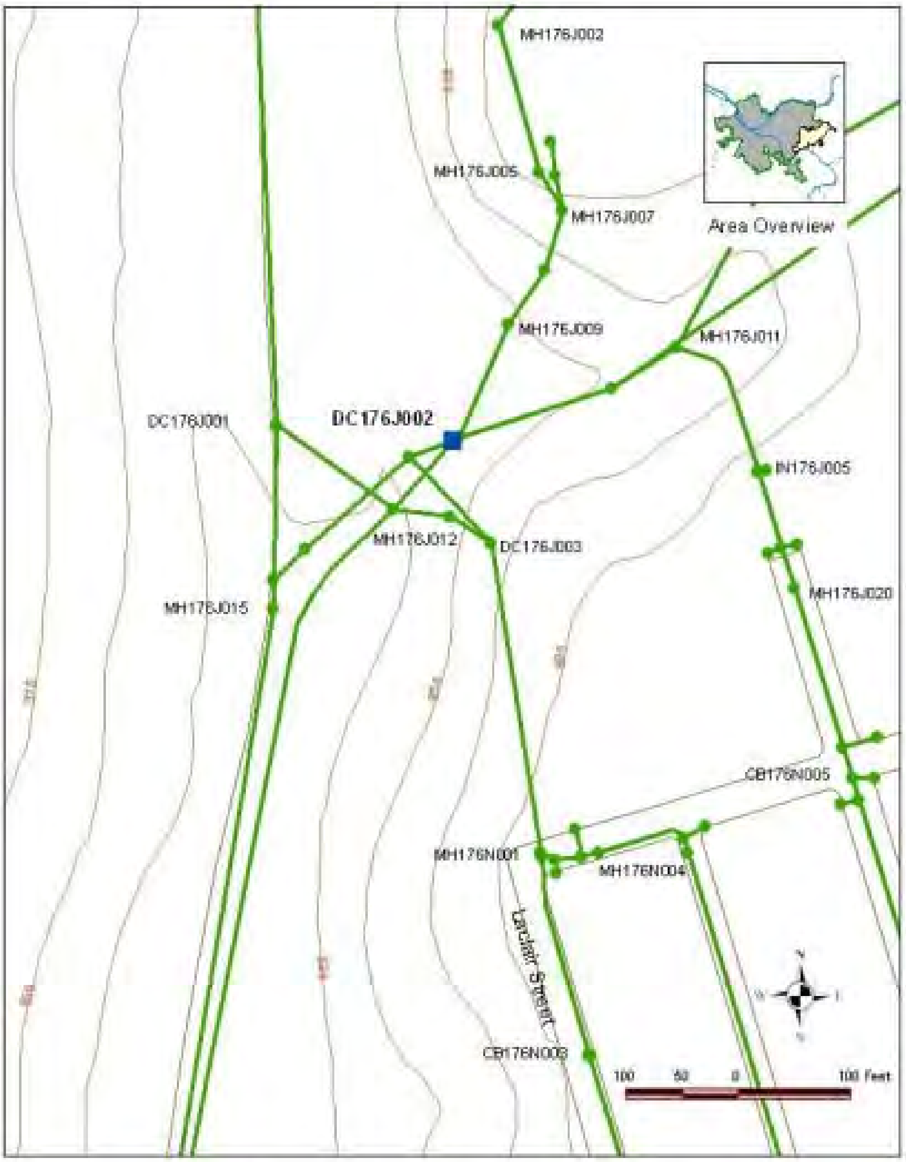

PWSA Diversion Structure DC176J002
Location Map

Nine Mile Run Sewershed

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PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC176J003

NPDES#: 128R002
Type: DAM
Flow Divider: N
Sewershed: M47

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	PVC	NA	NA	
Invert:	863.21	NA	NA	ft
Slope:	11.18	NA	NA	%

Weir

Crest:	863.51	ft
Length:	4.00	ft

Effluent Sewers (non-overflow)

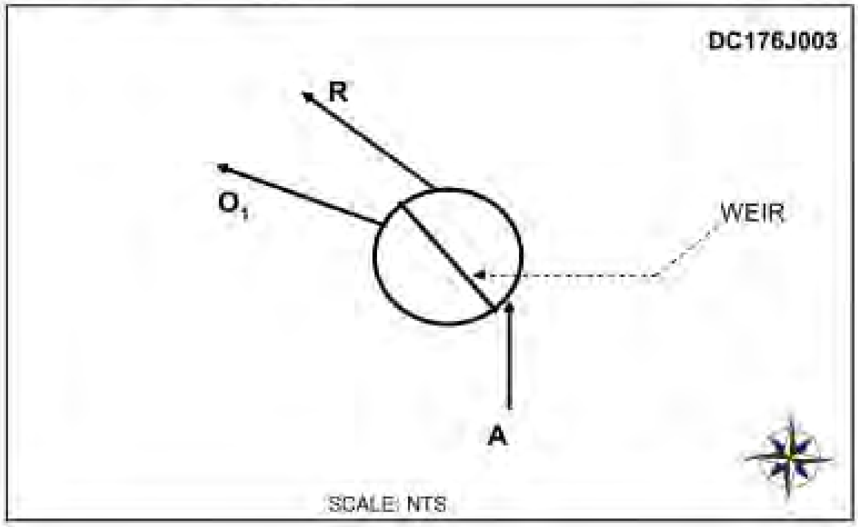
	R	S	T	
Size:	8	NA	NA	inches
Material:	PVC	NA	NA	
Invert:	863.21	NA	NA	ft
Slope:	34.61	NA	NA	%

Overflow Sewer

	O_1	O_2	
Size:	15	NA	inches
Material:	TC	NA	
Invert:	863.51	NA	ft
Slope:	46.77	NA	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft



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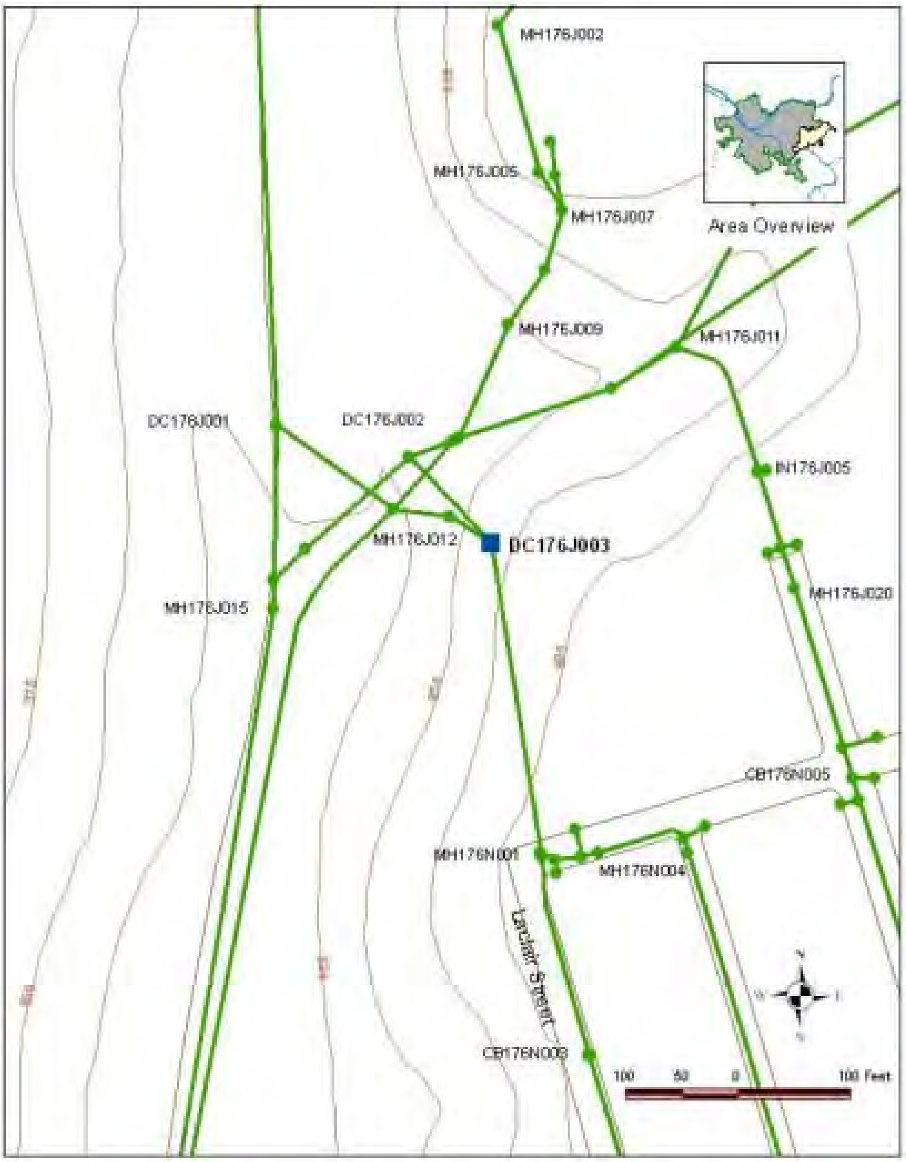

PWSA Diversion Structure DC176J003
Location Map

Nine Mile Run Sewershed

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2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC M-47: Nine Mile Run through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Upper Monongahela Basin Planners (UM_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for M-47.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the *Hydraulic and Hydrologic Characterization Report (September, 2008)* and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. Eighteen (18) flow meters located within the M-47 sewershed were used in the RCS-FMP. Details on the eighteen (18) RCS-FMP flow monitors installed within the M-47 sewershed are found in Table M47-2-1.

TABLE M47-2-1: M-47 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Term[1]
M4700__-IM_-S-09_	Wilkinsburg Borough	S
M4700__-IM_-S-10_	Wilkinsburg Borough	S
M4700__-IM_-S-11_	Wilkinsburg Borough	S
M4700__-IM_-S-16_	Churchill Borough	S
M4700__-MB_-L-02_	City of Pittsburgh	L
M4700__-MB_-L-04_	City of Pittsburgh	L
M4700__-MB_-L-06_	Edgewood Borough	L
M4700__-MB_-L-07_	Swissvale Borough	L
M4700__-MB_-L-13_	Wilkinsburg Borough	L
M4700__-MB_-L-15_	Wilkinsburg Borough	L
M4700__-MB_-S-03_	Swissvale Borough	S
M4700__-MM_-L-12_	Wilkinsburg Borough	L
M4700__-MM_-L-14_	Wilkinsburg Borough	L
M4700__-MPS-L-18_	City of Pittsburgh	L
M4700__-OSS-L-05_	Edgewood Borough	L
M4700__-OSS-L-05O	Edgewood Borough	L
M4700__-OSS-L-17_	Edgewood Borough	L
M4700__-POC-L-01_	City of Pittsburgh	L

[1] S=Short Term: 3-months to 6 months, M=Medium Term: 6 months to 9 months, L=Long Term: 1-year minimum to 21-month maximum.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

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[1] The flow monitor information in this table is from a file titled "Summary of Program Monitors by Name, Type and Dates.xls". This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled "Summary and Report of Flow Monitoring June 2009".

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).

- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.

- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.

- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the M-47 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the M-47 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.

- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The maximum, minimum, and average DWF and the GWI ratio for the, and GWI per inch-mile of sewer for each flow monitor within the M-47 sewershed are listed in Table M47-2-2. The GWI ratio is an estimated amount of the DWF that can be associated with GWI compared to the DWF peaking factor (i.e. Average Daily Maximum Flow vs. Average Daily Minimum Flow).

TABLE M47-2-2: M-47 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

POC	Average Daily Flow (mgd)			GWI Ratio (min/avg)
	Maximum	Minimum	Average	
M-47	7.7	3.7	6.0	63.6%

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table M47-2-3.

TABLE M47-2-3: M-47 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
M-47	5.83	5.92	1.5%

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[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Upper Monongahela Planning Basin – Table 4.3.

[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Upper Monongahela Planning Basin – Table 2-3

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event.

RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for M-47 are presented in Table M47-2-4.

TABLE M47-2-4: M-47 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	**Future Baseline Conditions (mgd)**	**Percent Difference**
M-47	120	119	-0.84%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not

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[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Upper Monongahela Planning Basin – Table 2-4

attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated. Figure M47-2-1a, M47-2-1b, M47-2-1c, M47-2-1d, and M47-1-1e present the computed hydraulic profiles of the existing Nine Mile Run, Swissvale, Edgewood, Wilkinsburg, and Fern Hollow trunk sewers, respectively. The profiles show the sewer system under projected 2-year design storm peak flow conditions. These figures illustrate how the trunk sewers operate under the current system configuration, including existing CSO diversion chamber settings. Extensive manhole surcharging, including manhole flooding occurs along the length of the Nine Mile Run, Swissvale, Edgewood, Wilkinsburg, and Fern Hollow trunk sewers.

Figure M47-2-2a, M47-2-2b, M47-2-2c, M47-2-2d, and M47-1-2e present the computed hydraulic profiles of the existing Nine Mile Run, Swissvale, Edgewood, Wilkinsburg, and Fern Hollow trunk sewers, respectively. The profiles show the sewer system under projected 5-year design storm peak flow conditions. These figures illustrate how the trunk sewers operate under the current system configuration, including existing CSO diversion chamber settings. Extensive manhole surcharging, including manhole flooding occurs along the length of the Nine Mile Run, Swissvale, Edgewood, Wilkinsburg, and Fern Hollow trunk sewers.

Figure M47-2-3a, M47-2-3b, M47-2-3c, M47-2-3d, and M47-1-3e present the computed hydraulic profiles of the existing Nine Mile Run, Swissvale, Edgewood, Wilkinsburg, and Fern Hollow trunk sewers, respectively. The profiles show the sewer system under projected 10-year design storm peak flow conditions. These figures illustrate how the trunk sewers operate under the current system configuration, including existing CSO diversion chamber settings. Extensive manhole surcharging, including manhole flooding occurs along the length of the Nine Mile Run, Swissvale, Edgewood, Wilkinsburg, and Fern Hollow trunk sewers.

Computed flow hydrographs for each of the design storms at the M-47 POC are presented in Figure M47-2-4. It is noted that the peak flows reaching the POC are truncated due to extensive manhole surcharging and manhole flooding.

FIGURE M47-2-1A: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-NINE MILE RUN TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

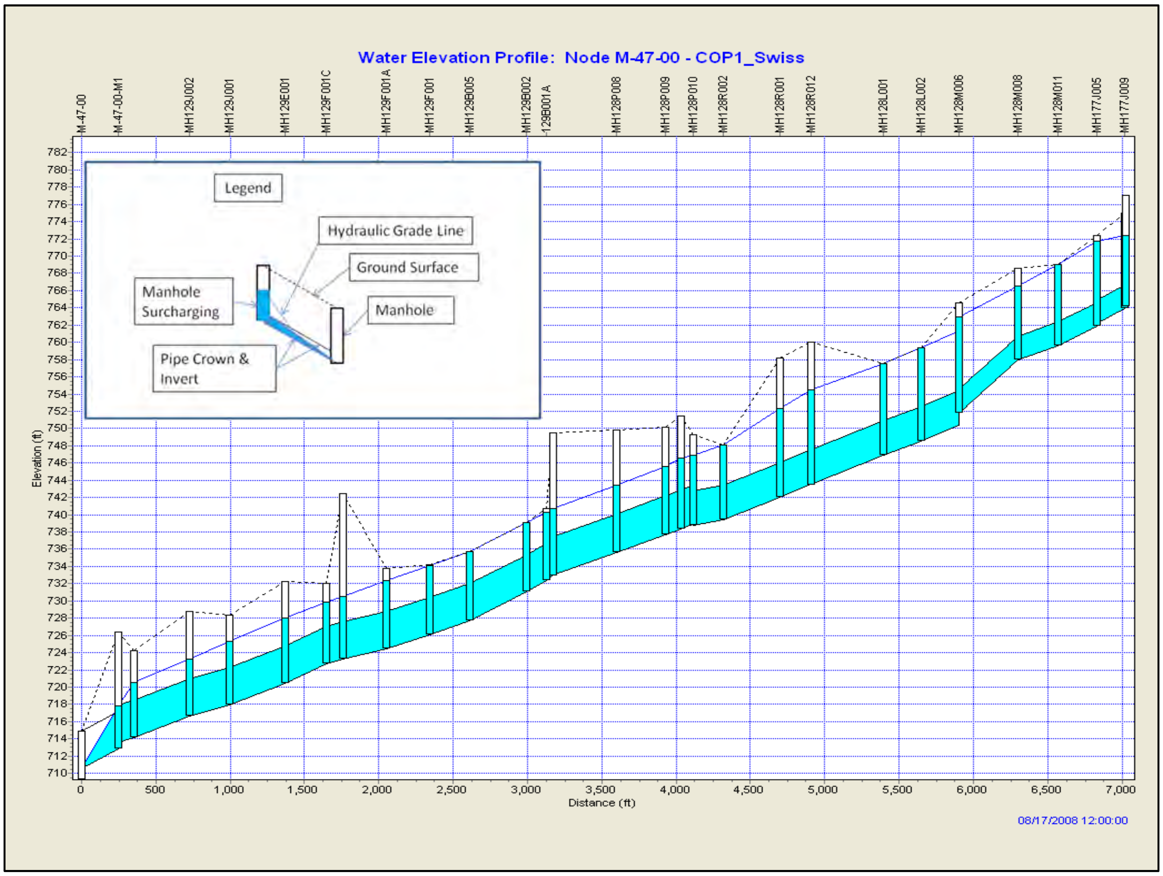


FIGURE M47-2-1B: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-SWISSVALE TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

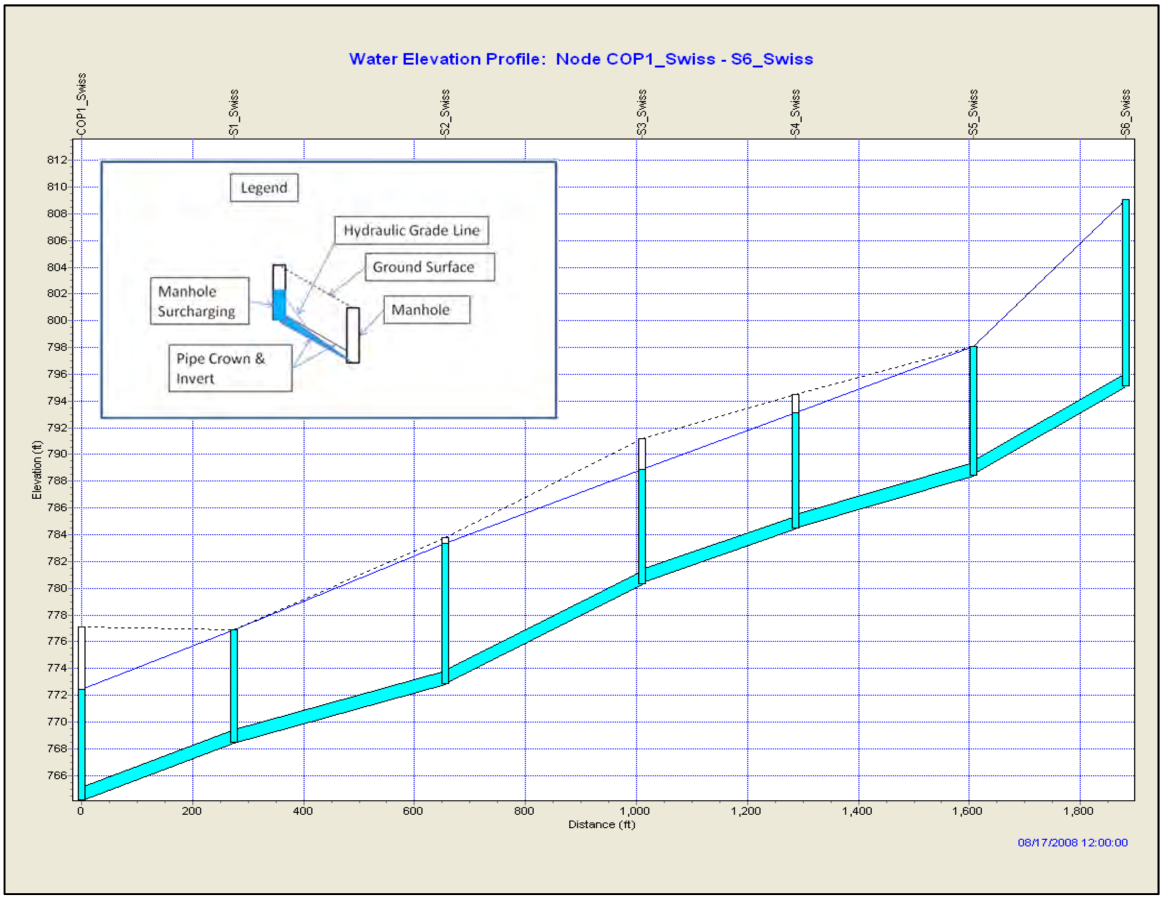


FIGURE M47-2-1C: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-EDGEWOOD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

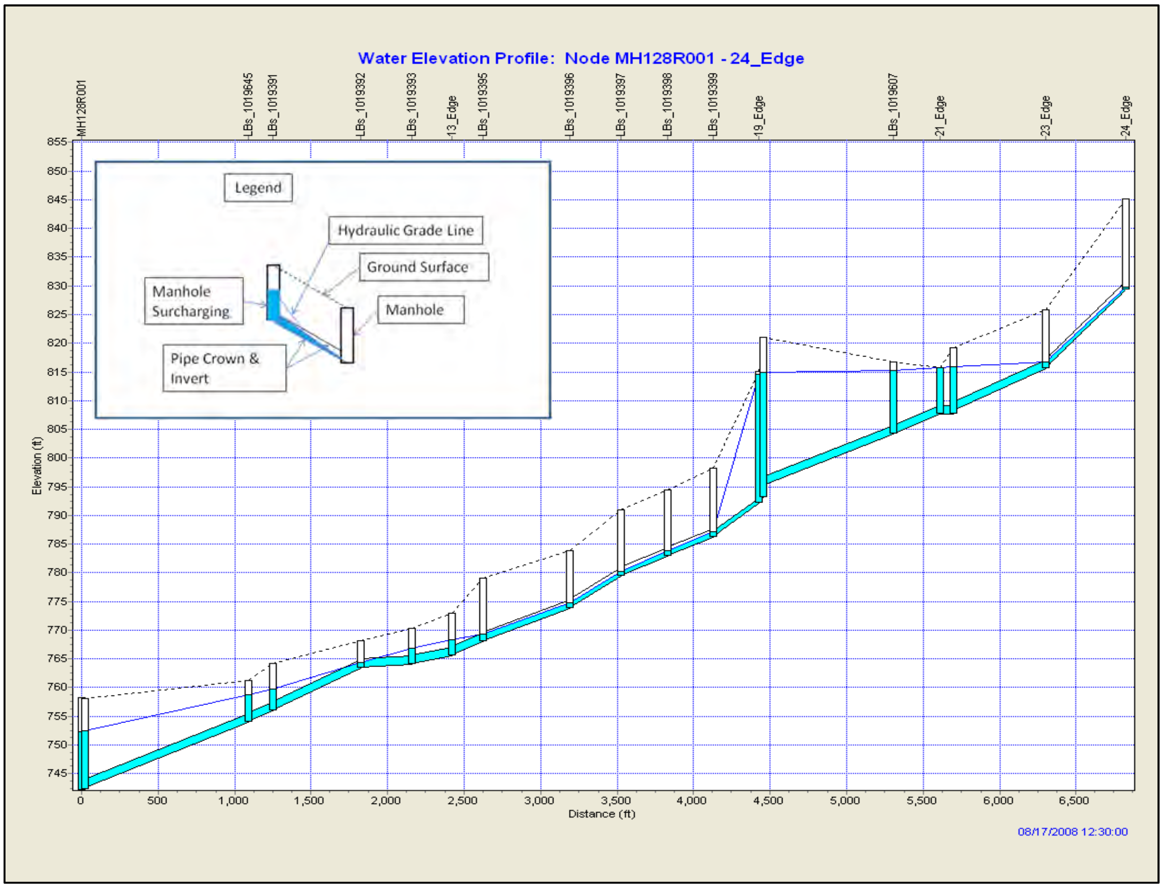


FIGURE M47-2-1D: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-WILKINSBURG TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

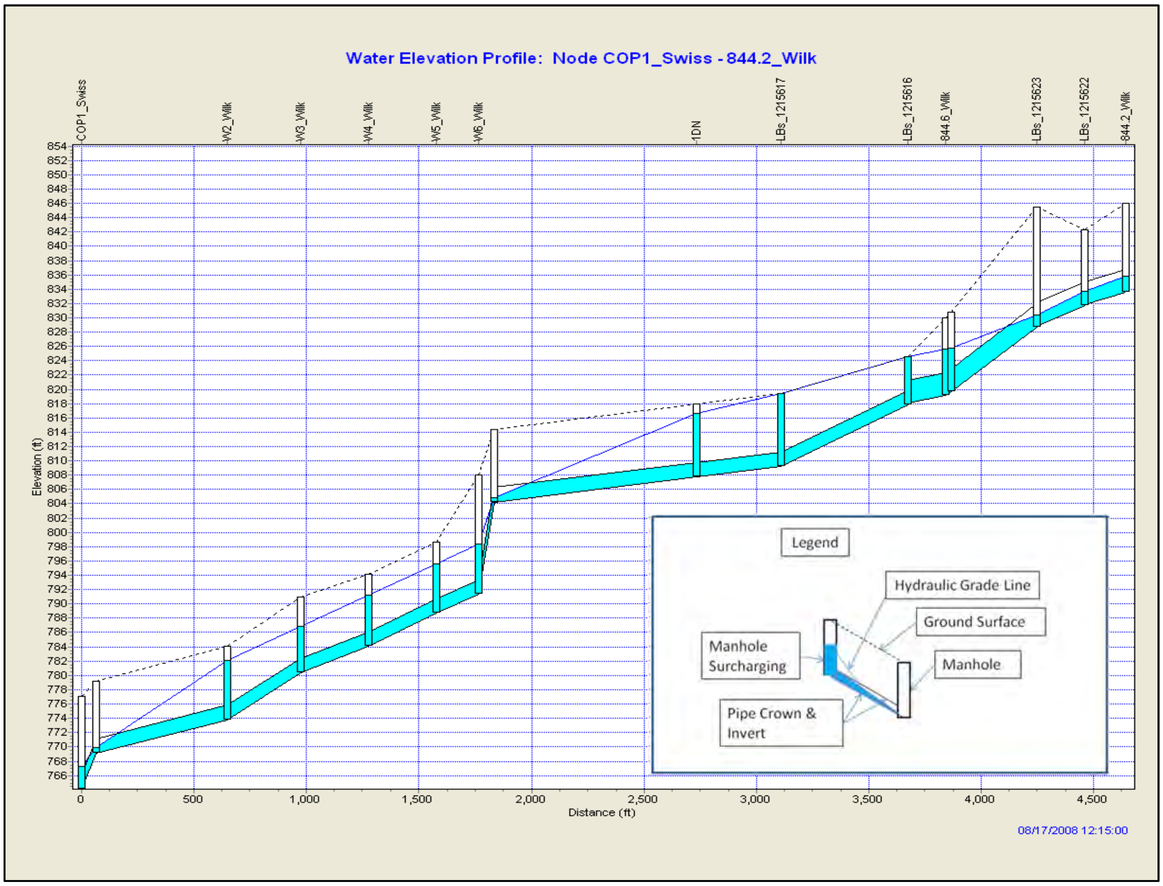


FIGURE M47-2-1E: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-LEBANON ROAD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

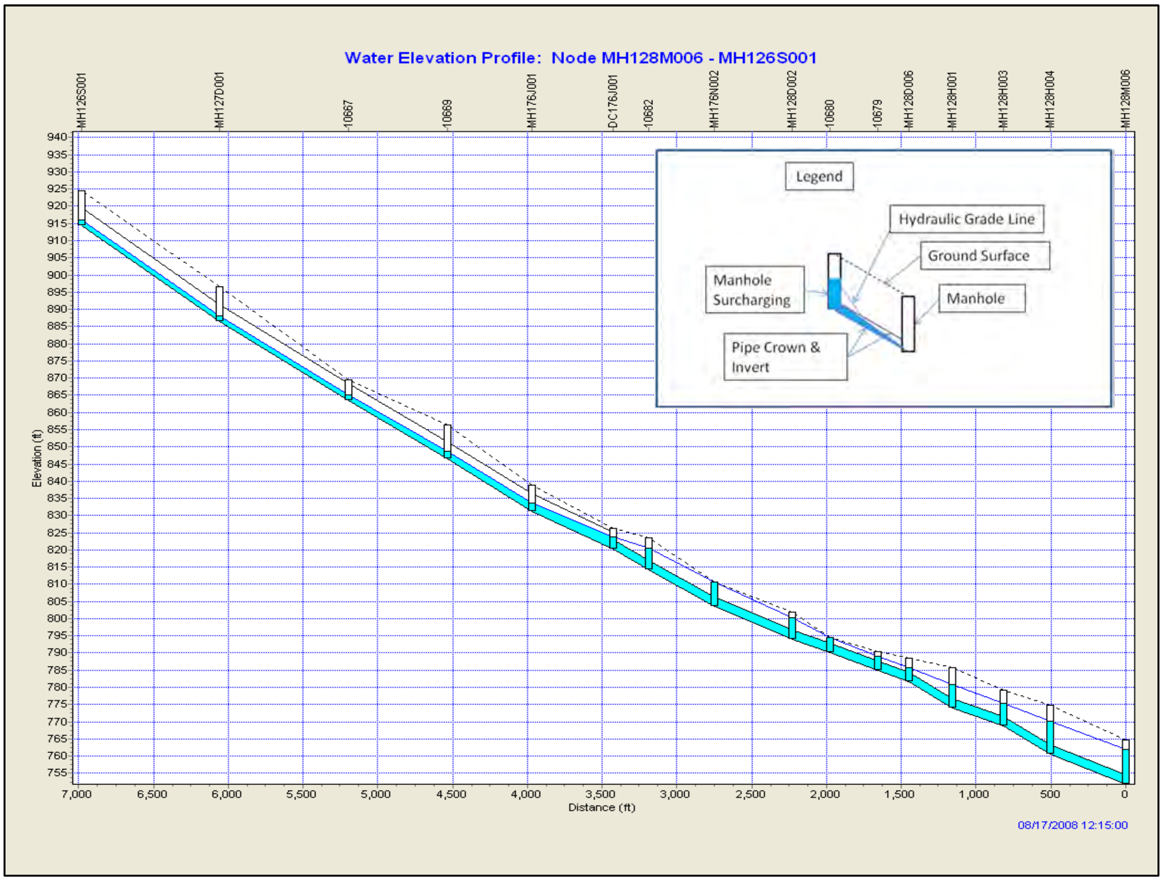


FIGURE M47-2-2A: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-NINE MILE RUN TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

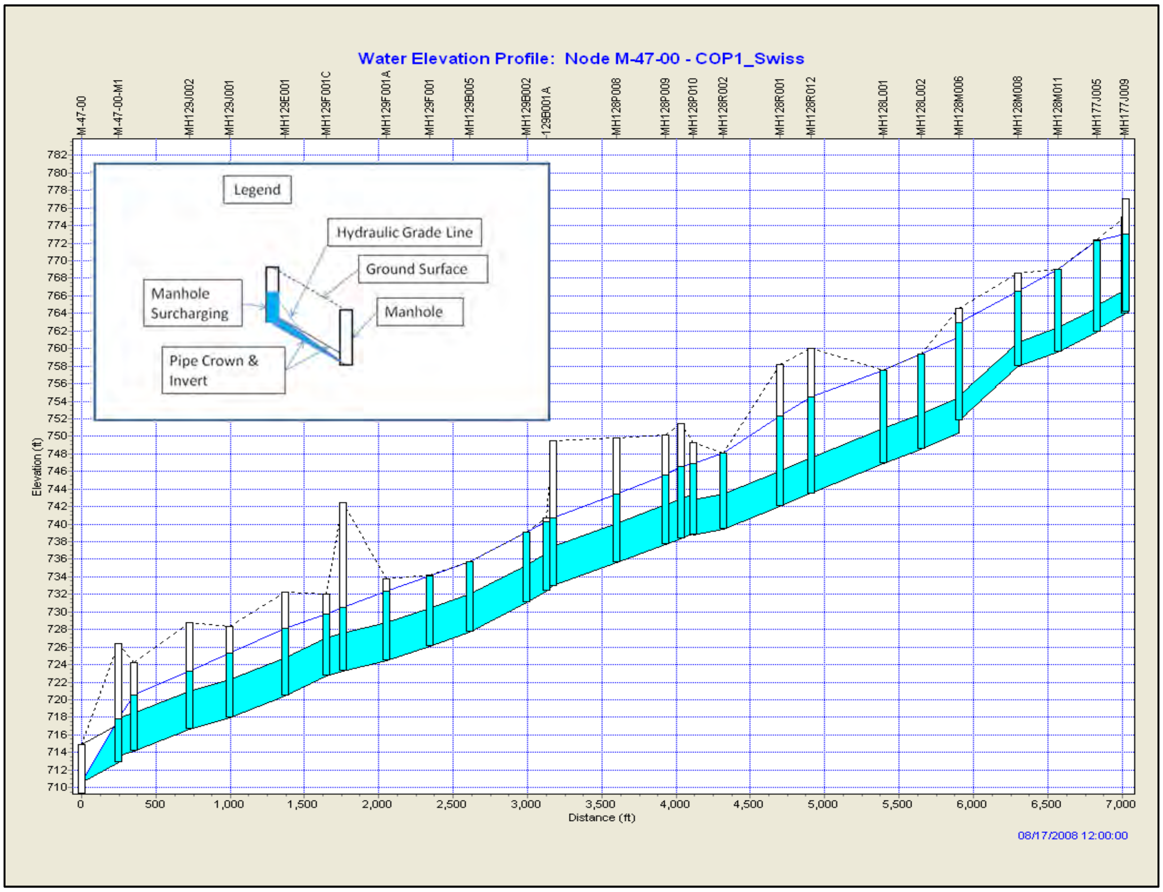


FIGURE M47-2-2B: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-SWISSVALE TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

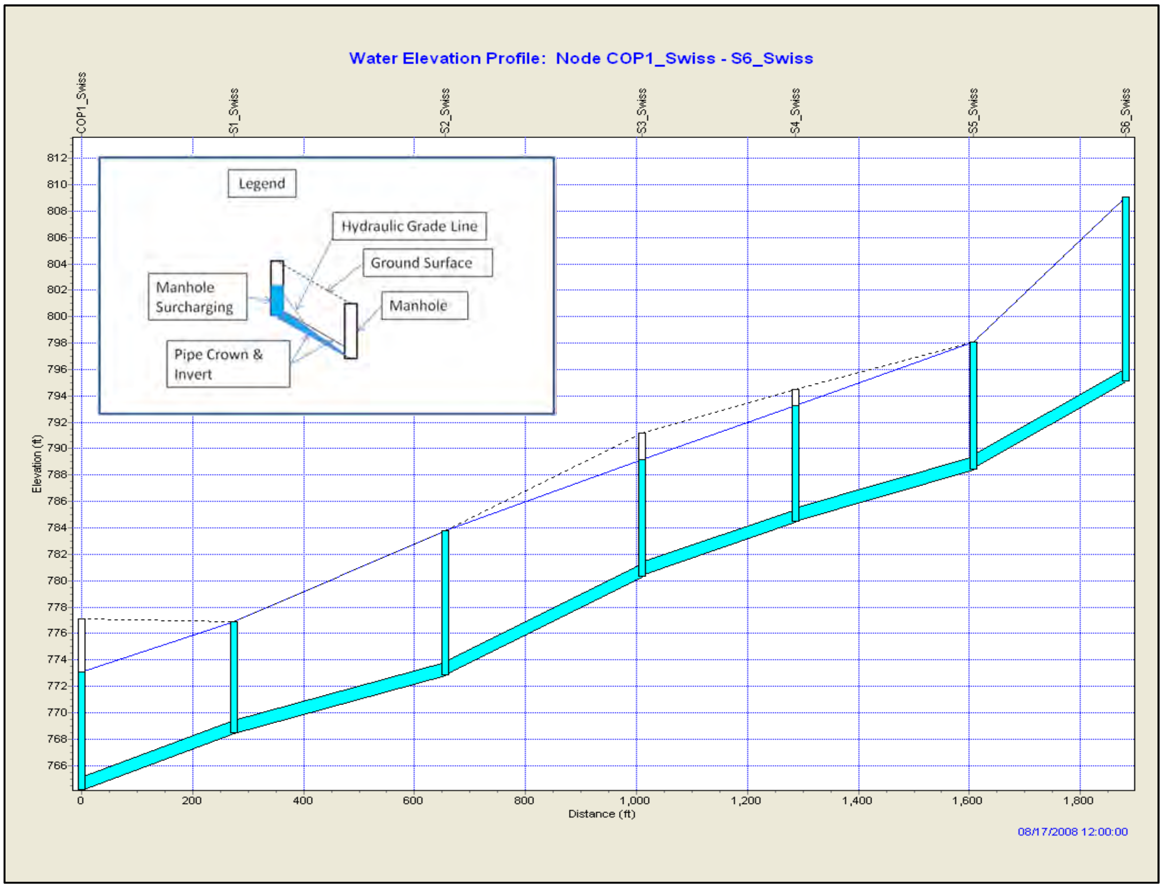


FIGURE M47-2-2C: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-EDGEWOOD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

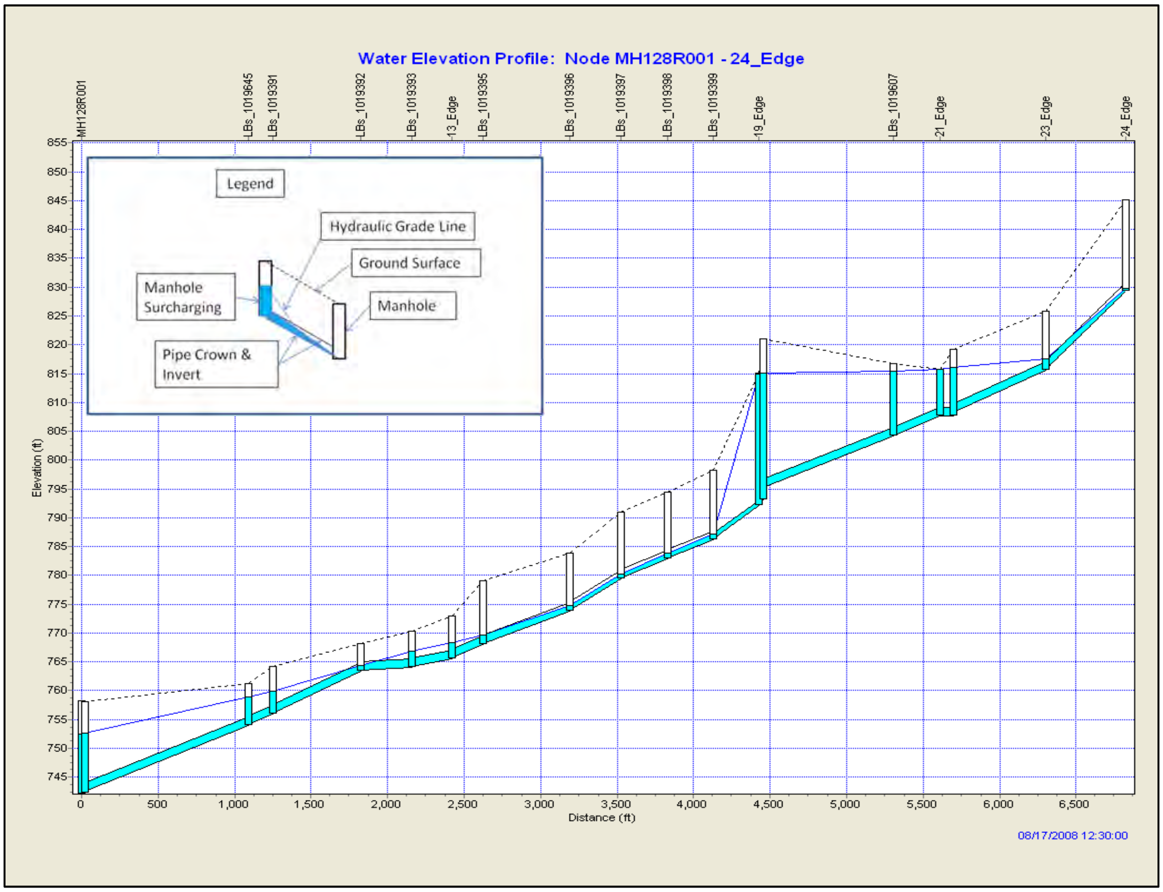


FIGURE M47-2-2D: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-WILKINSBURG TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

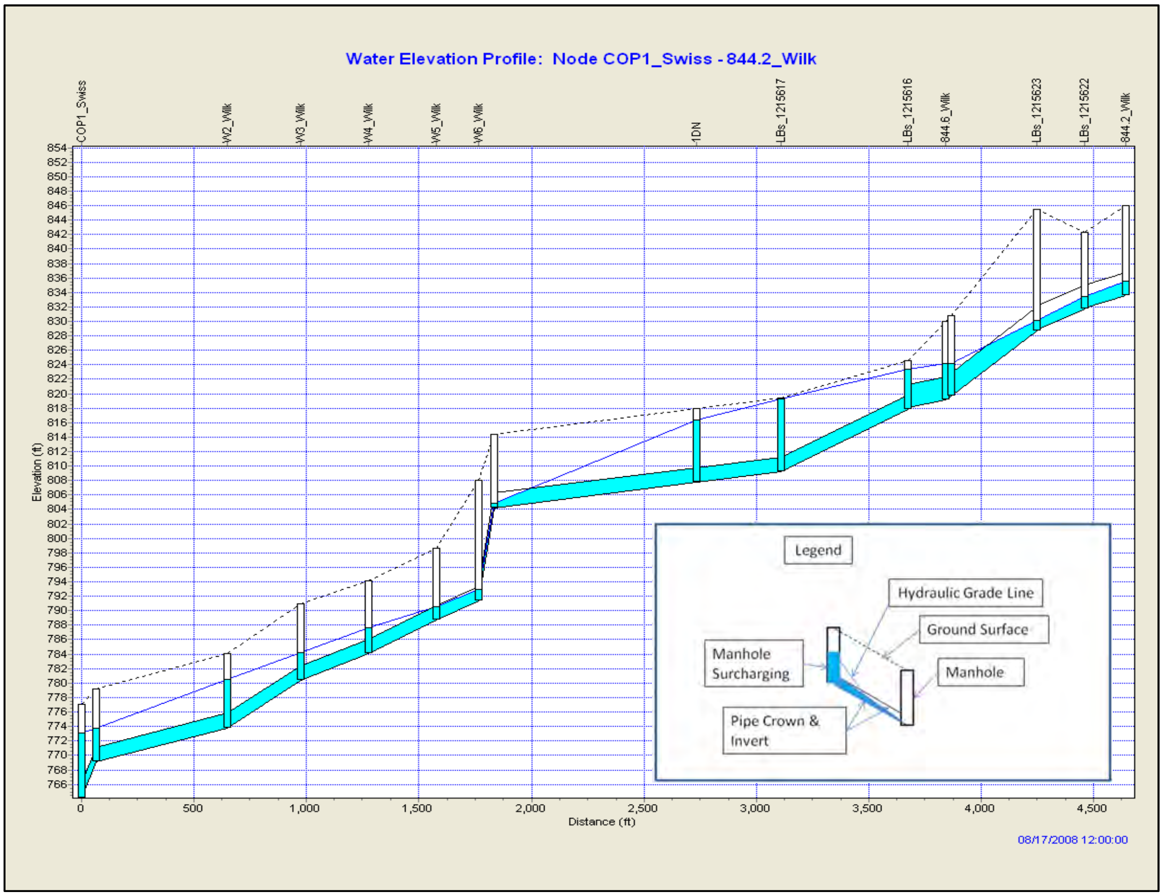


FIGURE M47-2-2E: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-FERN HOLLOW TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

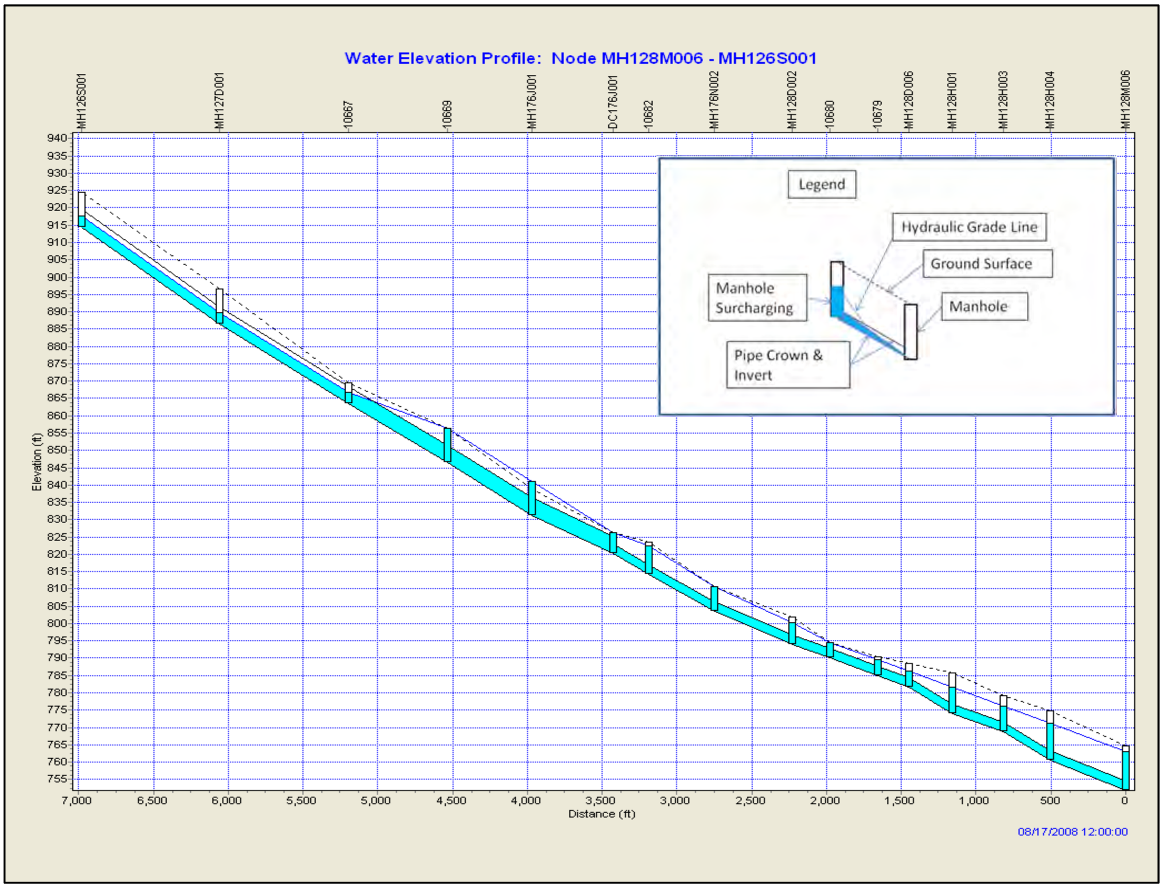


FIGURE M47-2-3A: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-NINE MILE RUN TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

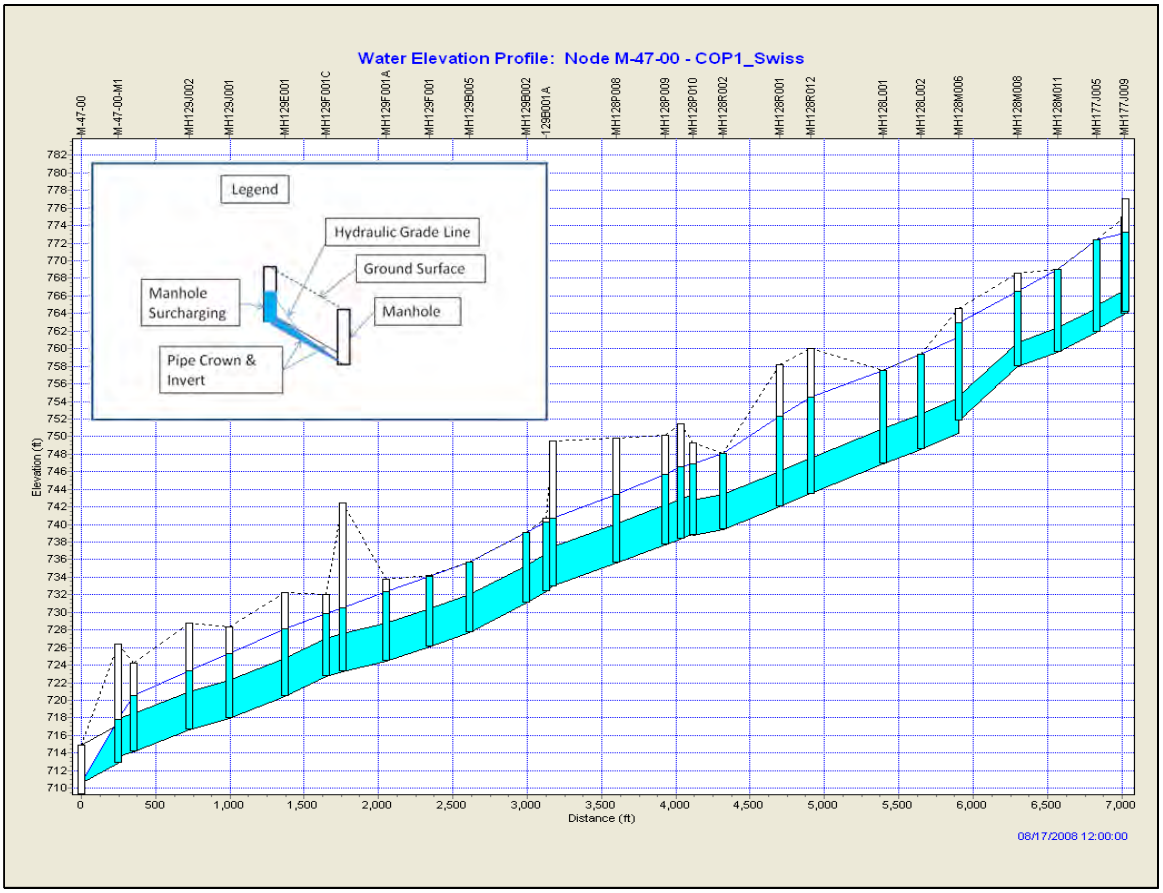


FIGURE M47-2-3B: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-SWISSVALE TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

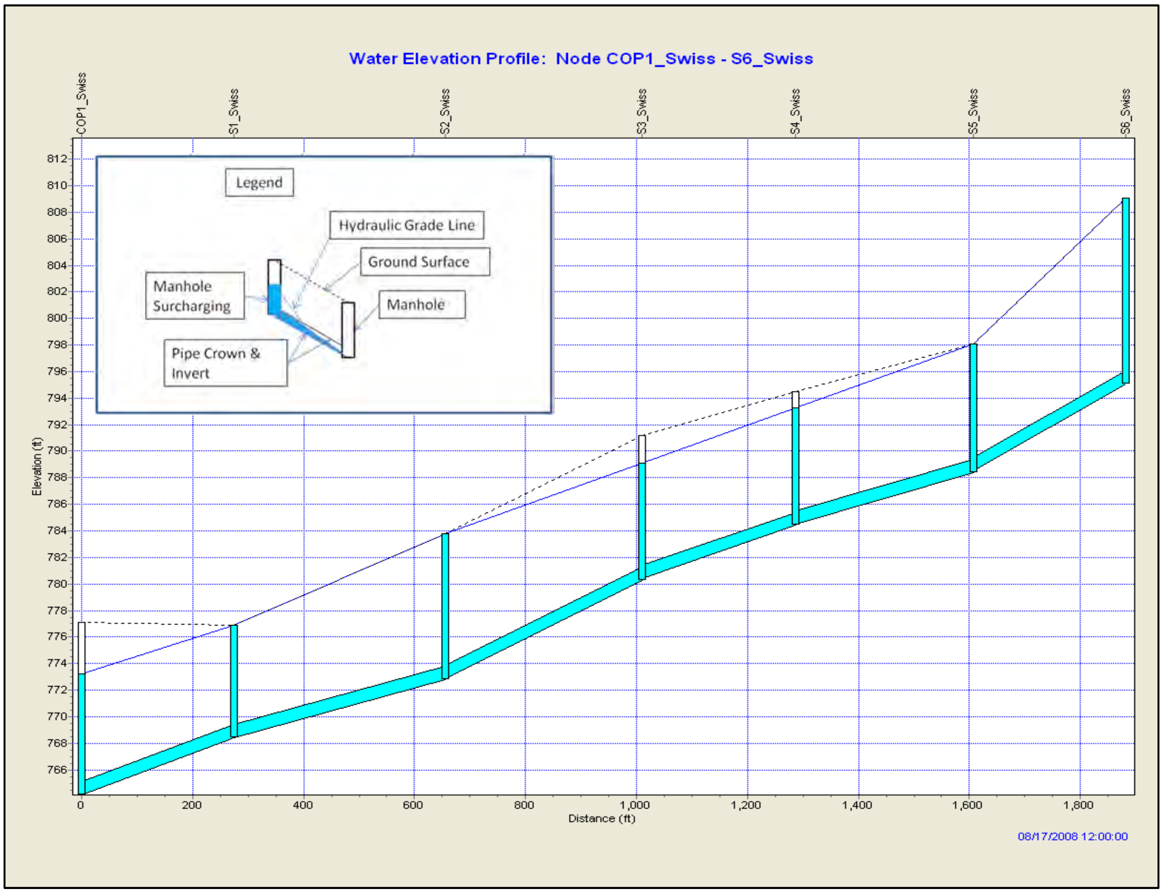


FIGURE M47-2-3C: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-EDGEWOOD TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

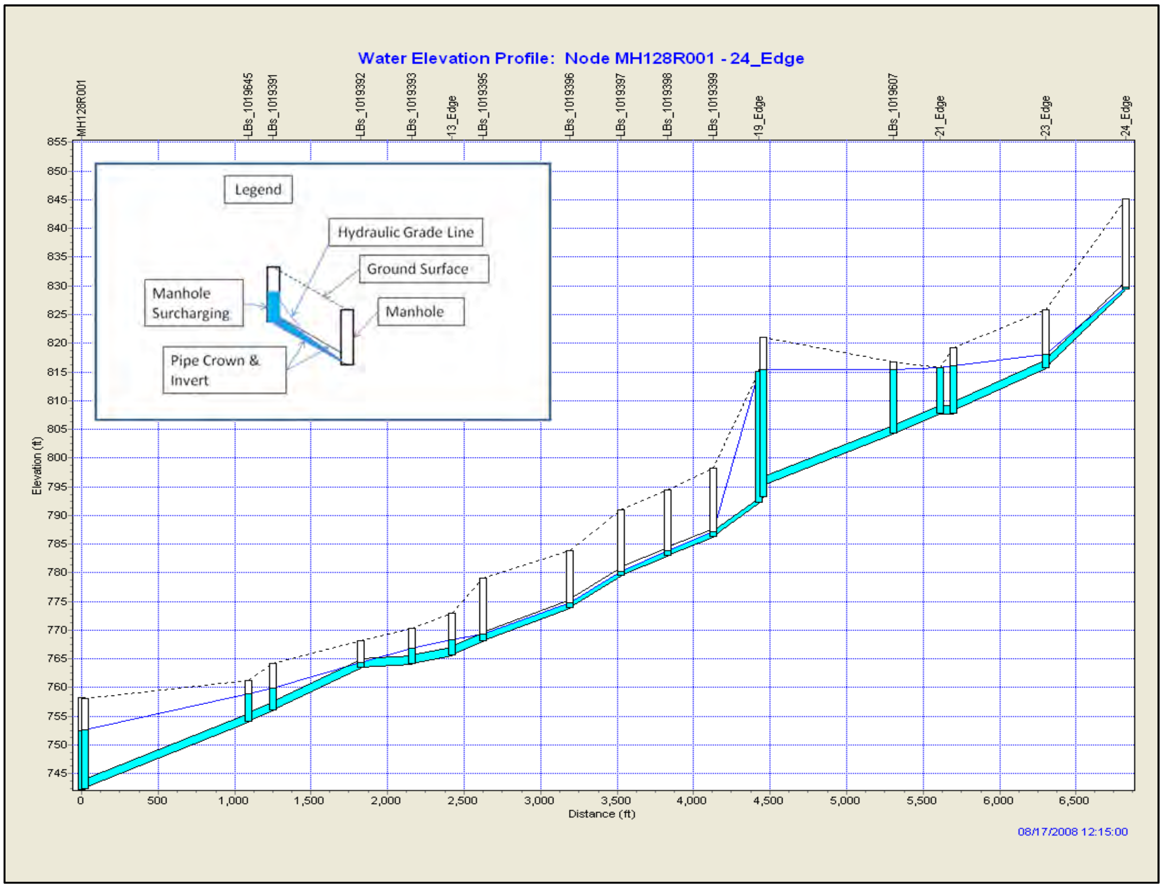


FIGURE M47-2-3D: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-WILKINSBURG TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

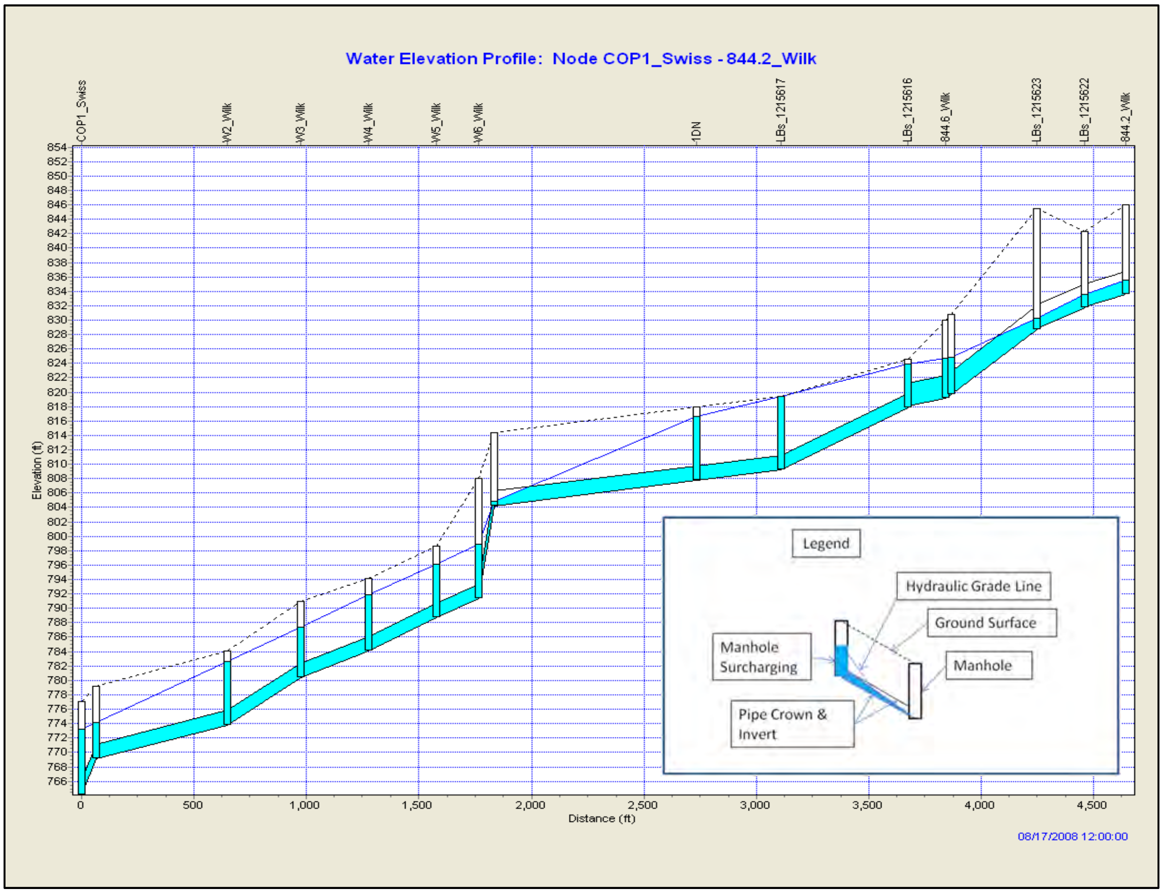


FIGURE M47-2-3E: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-FERN HOLLOW TRUNK SEWER

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

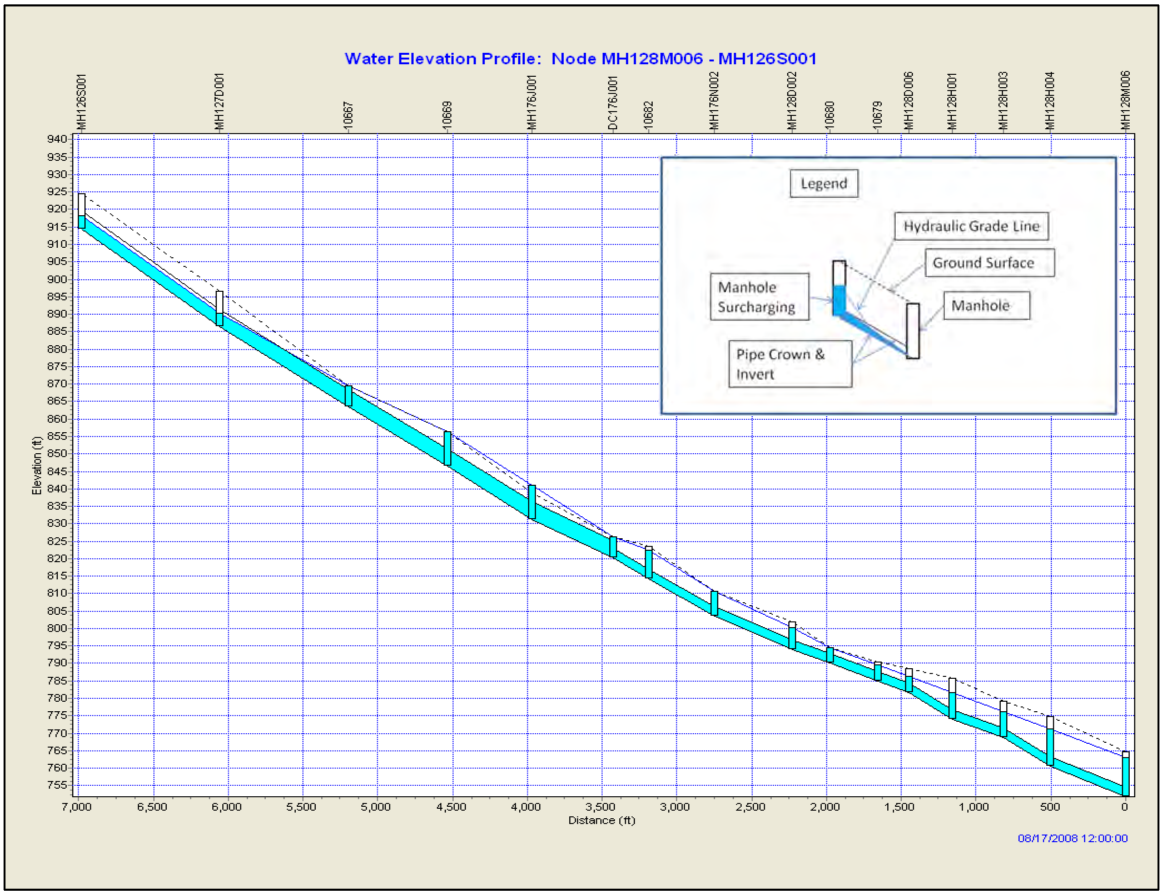
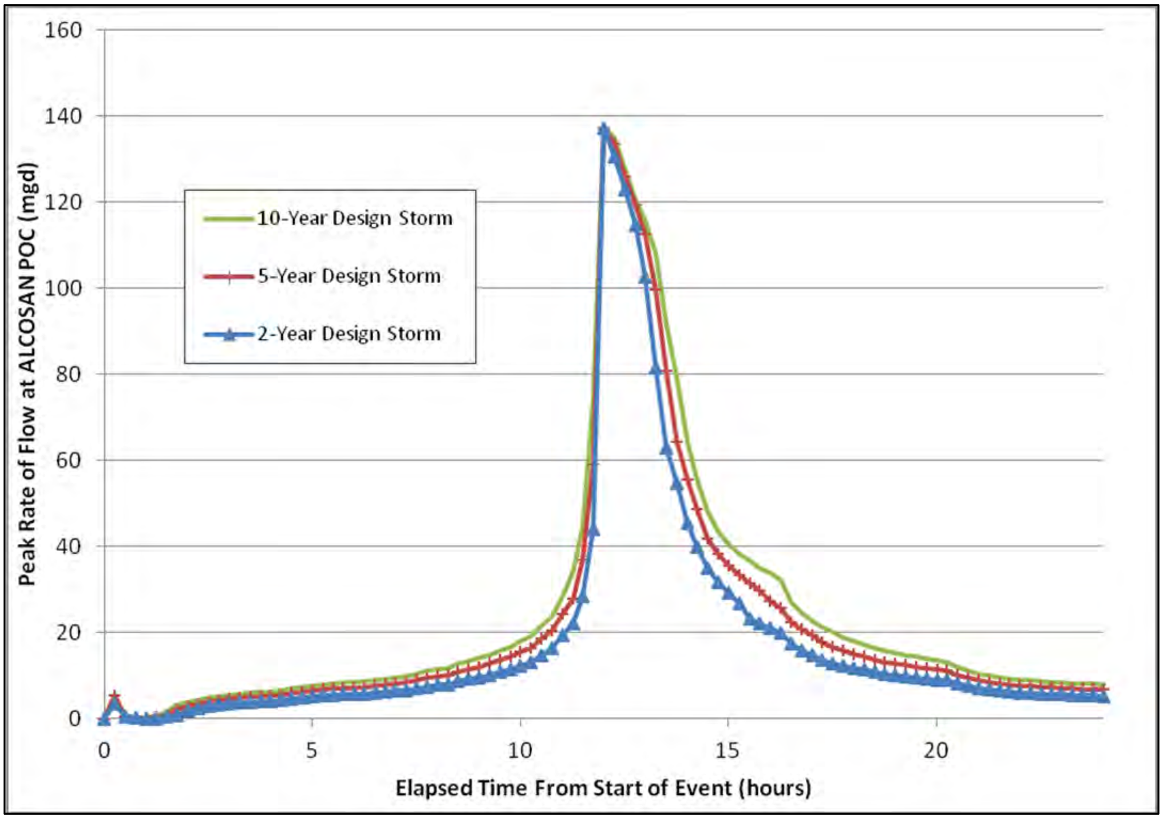


FIGURE M47-2-4: M-47 SEWERSHED PEAK FLOW RATES TO THE POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

Table M47-2-5 presents a summary of the identified chronic basement flooding locations within the PWSA portion of the Nine Mile Run sewershed. The neighboring municipalities, with the exception of Edgewood Borough, Churchill Borough and the Municipality of Penn Hills, that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. In response to complaints of historic periodic basement flooding reports, Edgewood Borough evaluated basement flooding reports on Willow Place and “Short” Race Street and found that several Edgewood residents were connected to the Wilkinsburg interceptor. Basement flooding reports were coincident with wet weather responses. As corrective measures with this finding, Edgewood Borough installed a new sanitary sewer collector and re-connected these residences to the Edgewood Borough system. Since the completion of the repairs the periodic basement backups have been resolved. Currently, there are no known existing basement flooding problems within Edgewood Borough. Churchill Borough, via a response letter to 3RWW in regards to a request for information indicated that Churchill does not have any basement flooding in M-47. The municipality of Penn Hills also indicated that Penn Hills does not have any basement flooding in M-47.

The data presented in Table M47-2-5 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.
- Eliminating repeat complaints from the same address for the same incident.
- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE M47-2-5: M-47 CHRONIC BASEMENT BACKUP LOCATIONS (PWSA SYSTEM)[5]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
120 Gilda St	2	2008
632 East End Ave	2	2010

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the M-47 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures M47-2-5a thru M47-1-5e and M47-2-6a thru M47-1-6e. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figures shows that under this range of operating conditions, the existing trunk sewer system does not have sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding. These results validate the findings and recommendations of the Draft Feasibility Study that anticipated the need to construct a consolidation/relief sewer to supplement the capacity of the existing trunk sewer system.

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[5] Information from analysis of PWSA SAP system

FIGURE M47-2-5A: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-NINE MILE RUN TRUNK SEWER

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

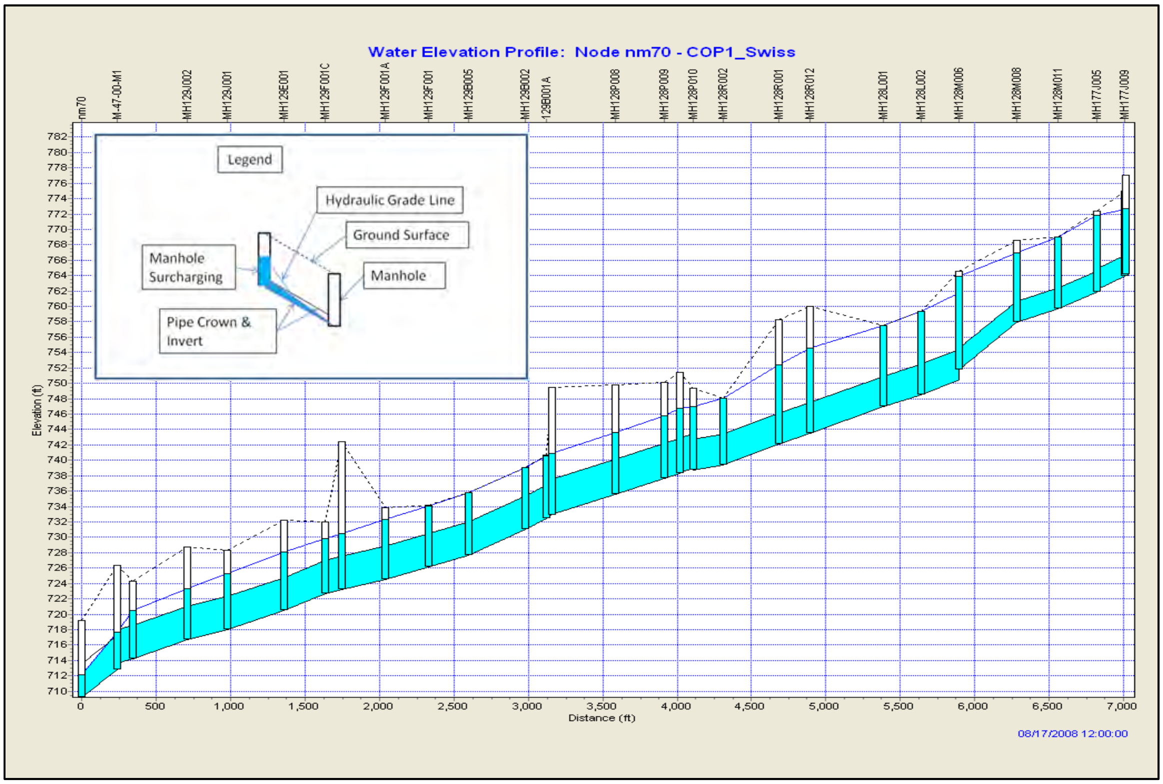


FIGURE M47-2-5B: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE- SWISSVALE TRUNK SEWER

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

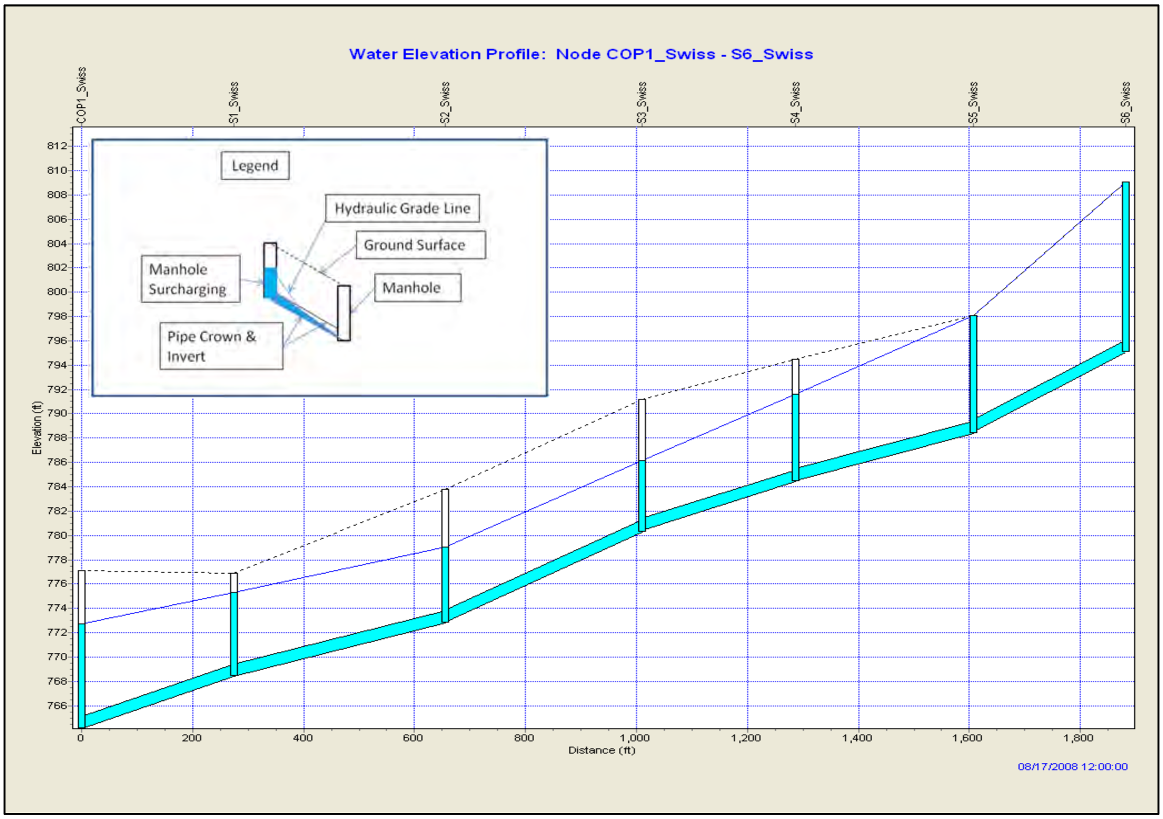


FIGURE M47-2-5C: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE- EDGEWOOD TRUNK SEWER

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

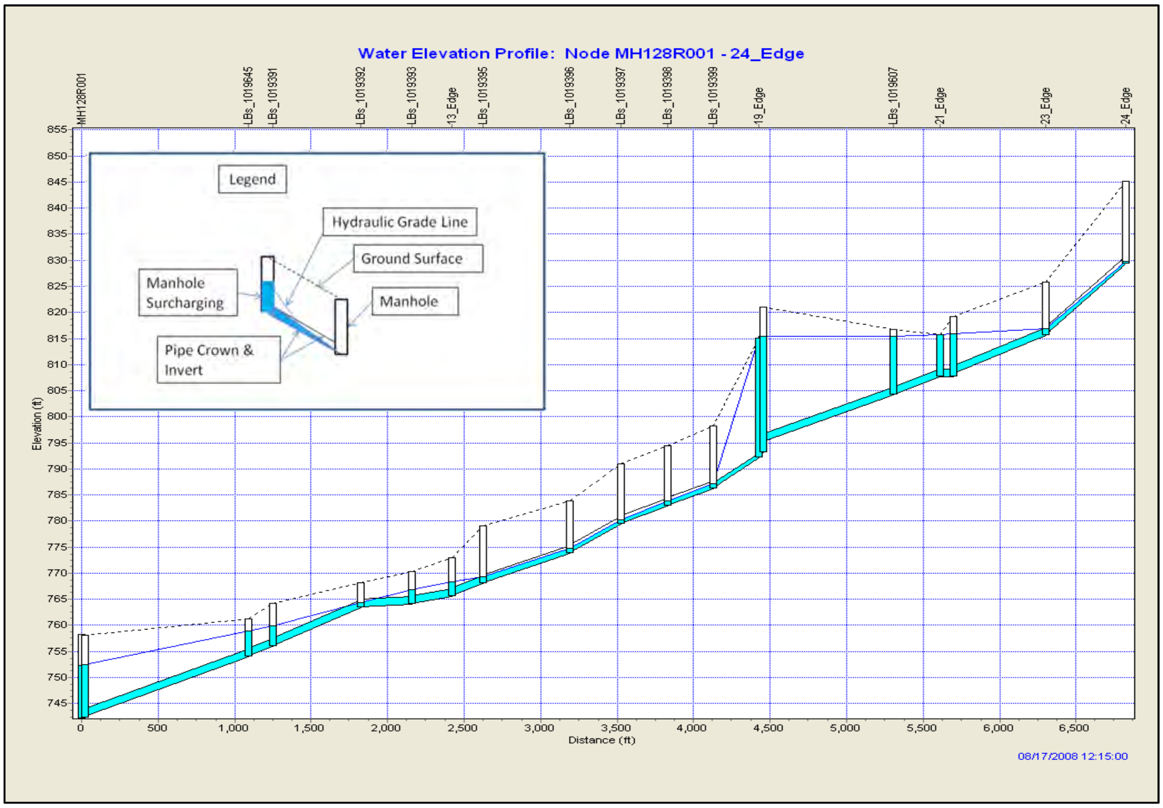


FIGURE M47-2-5D: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-WILKINSBURG TRUNK SEWER

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

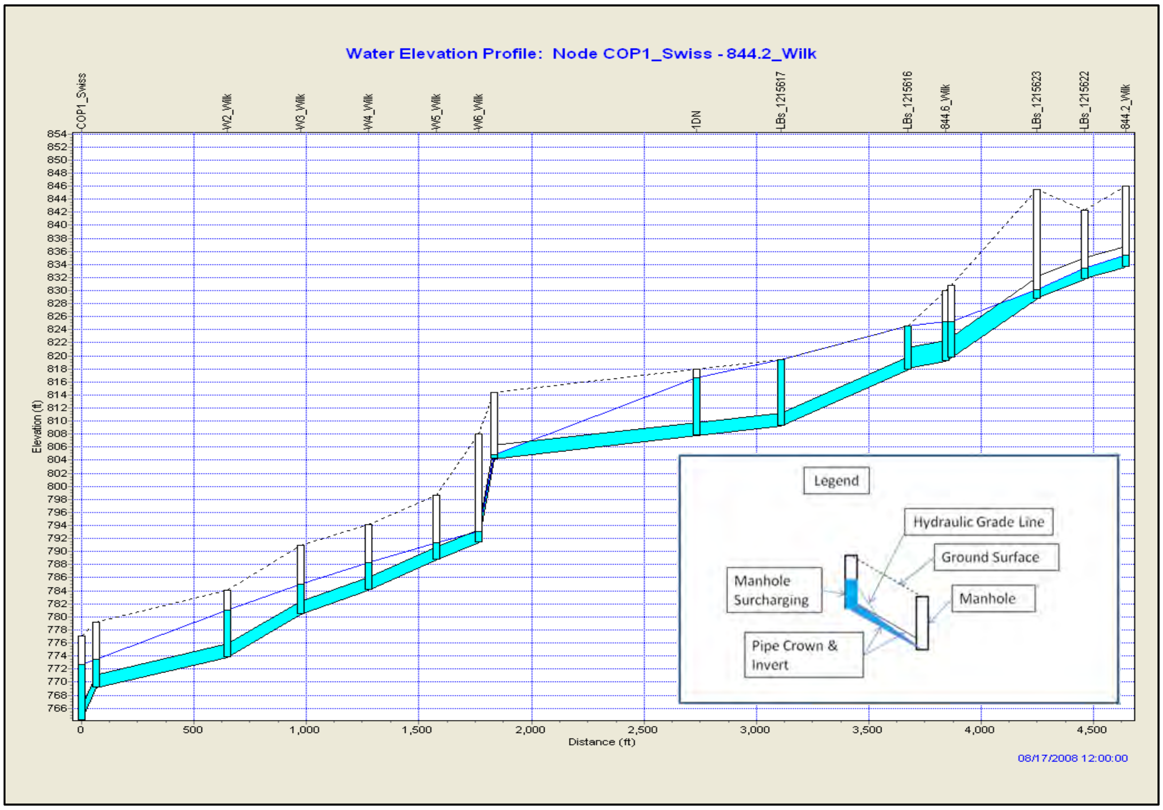


FIGURE M47-2-5E: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-FERN HOLLOW TRUNK SEWER

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

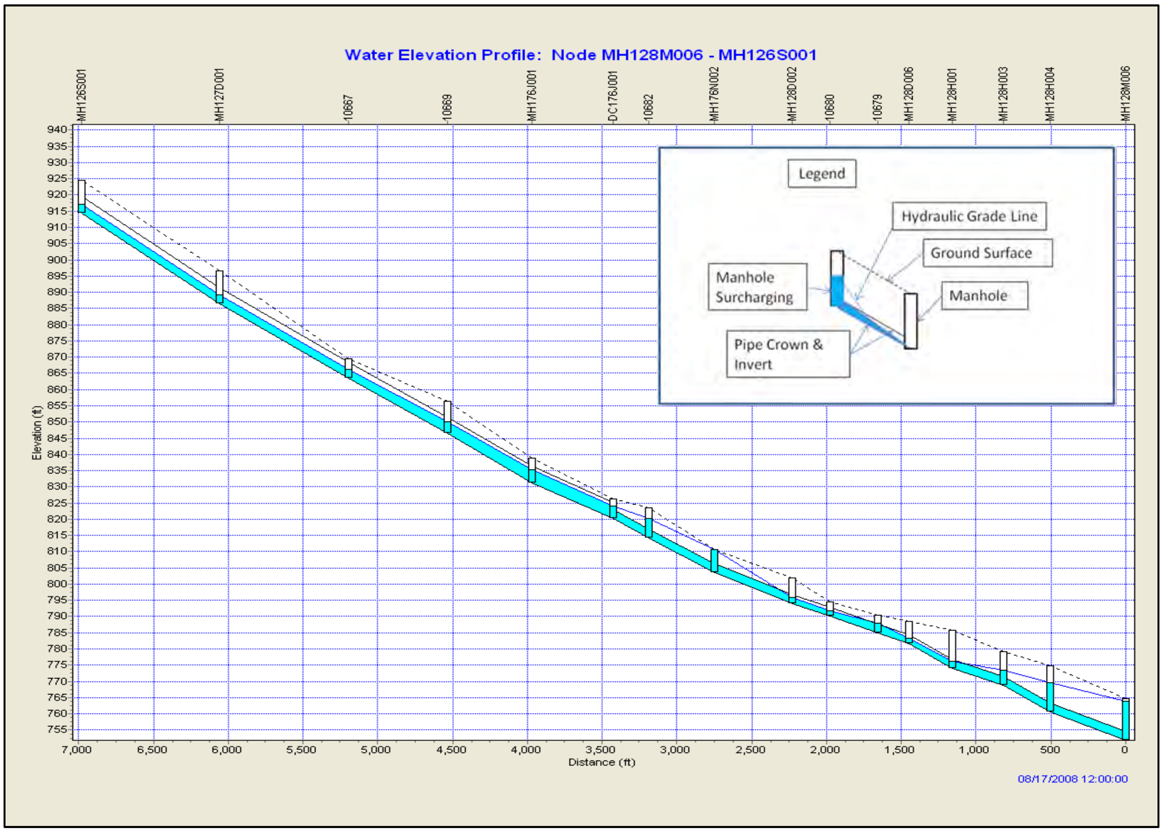


FIGURE M47-2-6A: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-NINE MILE RUN TRUNK SEWER

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

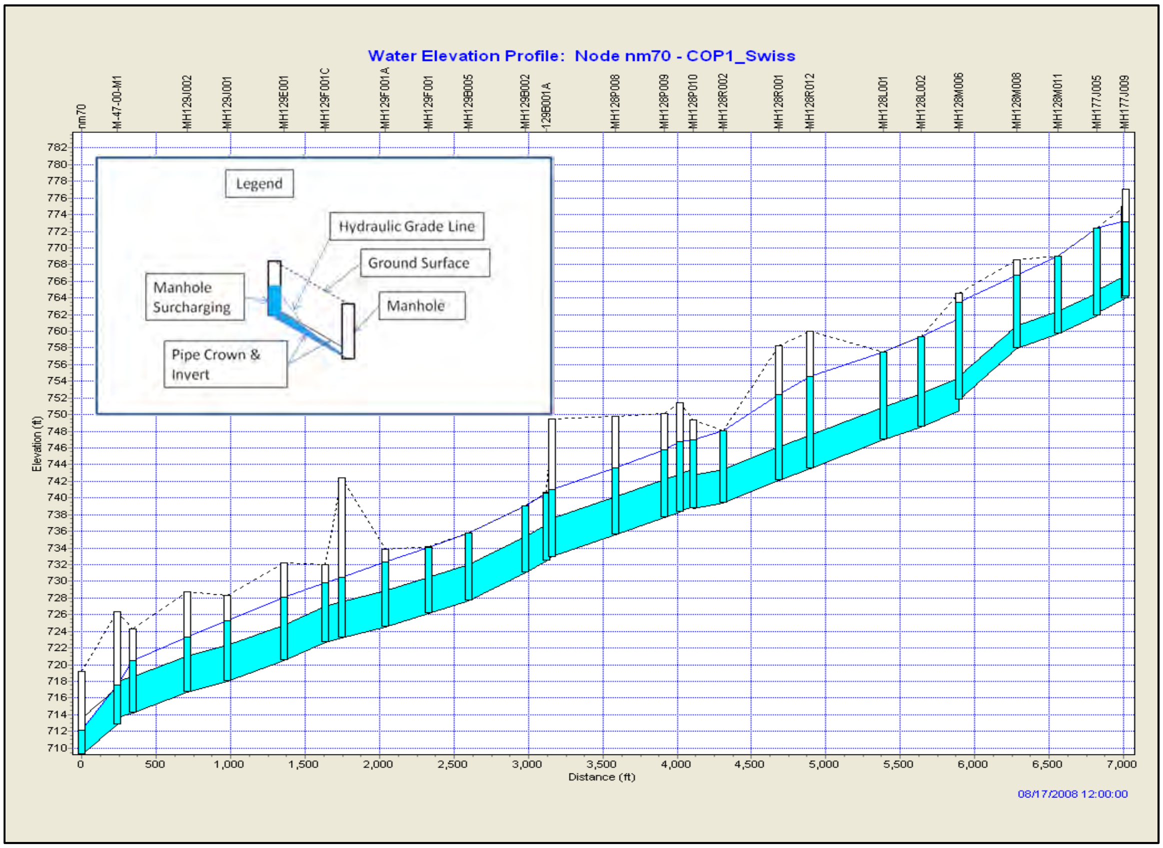


FIGURE M47-2-6B: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-SWISSVALE TRUNK SEWER

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

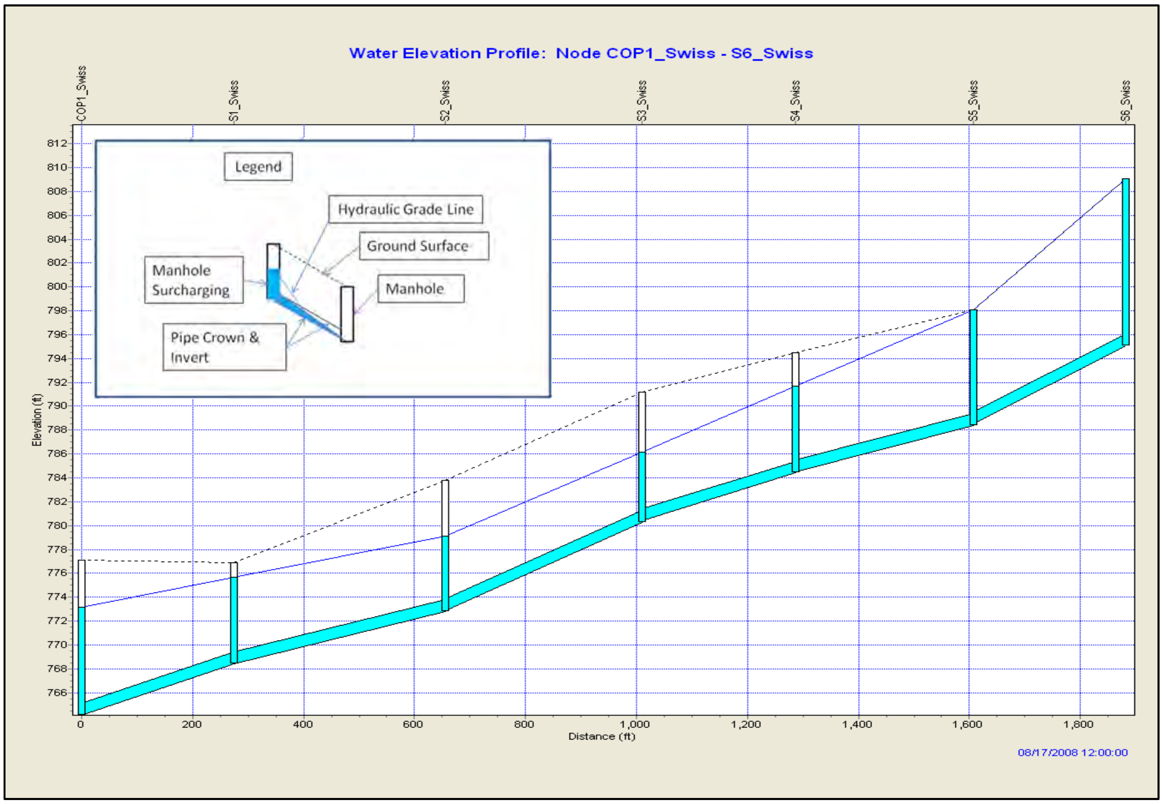


FIGURE M47-2-6C: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-EDGEWOOD TRUNK SEWER

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

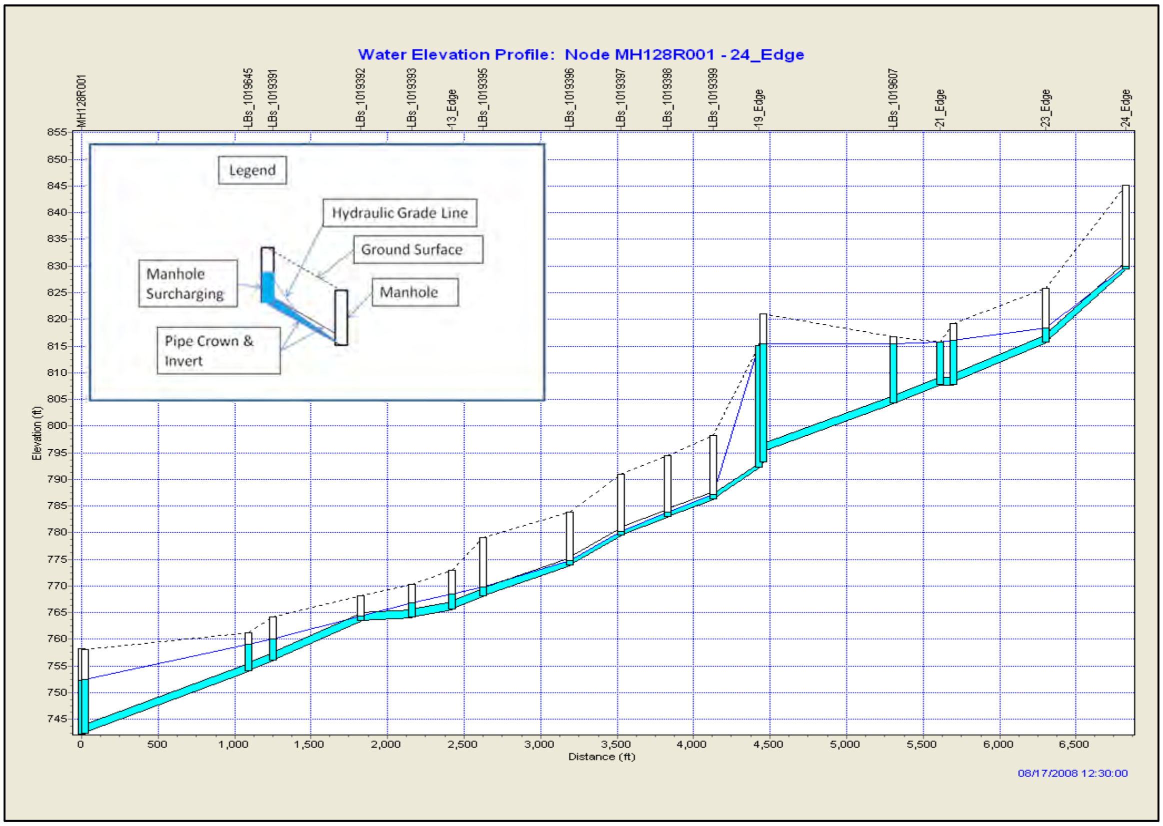


FIGURE M47-2-6D: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-WILKINSBURG TRUNK SEWER

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year

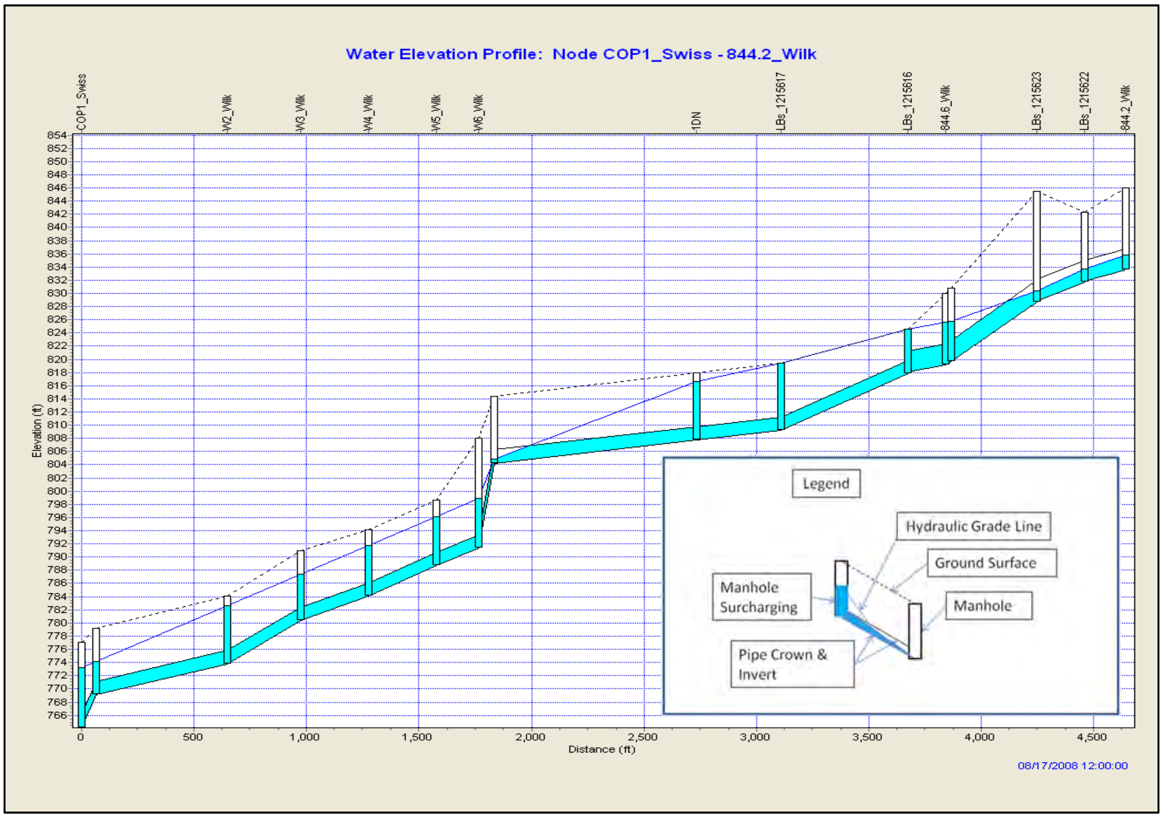
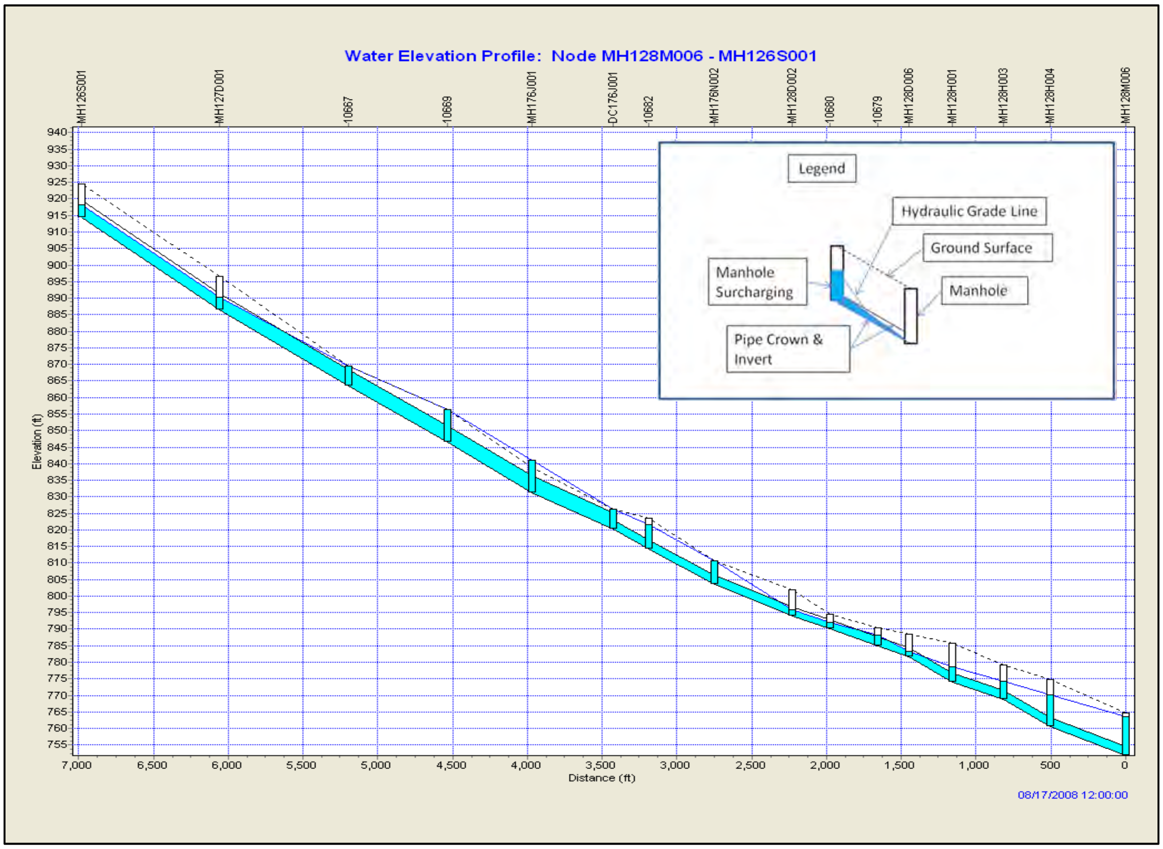


FIGURE M47-2-6E: M-47 SEWERSHED MAIN TRUNK SEWER PROFILE-FERN HOLLOW TRUNK SEWER

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the M-47 sewer system performed by PWSA produced the following computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table M47-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the M-47: Nine Mile Run sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. Two (2) of these outfalls are found within the M-47 or Nine Mile Run Sewershed, as shown in Table M47-3-1.

TABLE M47-3-1. WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE M-47: NINE MILE RUN SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF089D001	UM	M-47	Monongahela River	WWF[1]	N	Y
OF128R002	UM	M-47	Nine Mile Run	TSF[2]	N	N

As shown in the table, the two (2) PWSA owned outfalls discharges into either the Monongahela River or Nine Mile Run. These receiving waters are classified as warm water fisheries (WWF) or trout stocking fisheries (TSF) and currently do not meet their assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is

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[1] Warm Water Fishery
[2] Trout Stocking Fishery

calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.

- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

ALCOSAN Program.[3] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan*, *January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected

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[3] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling

CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the M-47 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the M-47 sewershed, Table M47-3-2 lists the untreated CSO statistics that were computed for each control level.

TABLE M47-3-2: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE M-47: NINE MILE RUN SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
PWSA CSO Outfall 128R002	0	0	4	13.2	10	17.3
DC128D001						
DC128D002						
DC128D003						
DC176J001						
DC176J002						
DC176J003						
Total Volume		**0**		**13.2**		**17.3**

As will be described later in this report, the M-47 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events) under of the typical year condition.

A range of control levels for the typical year were evaluated for transport of flows. PWSA plans to use the 4 overflows per year which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

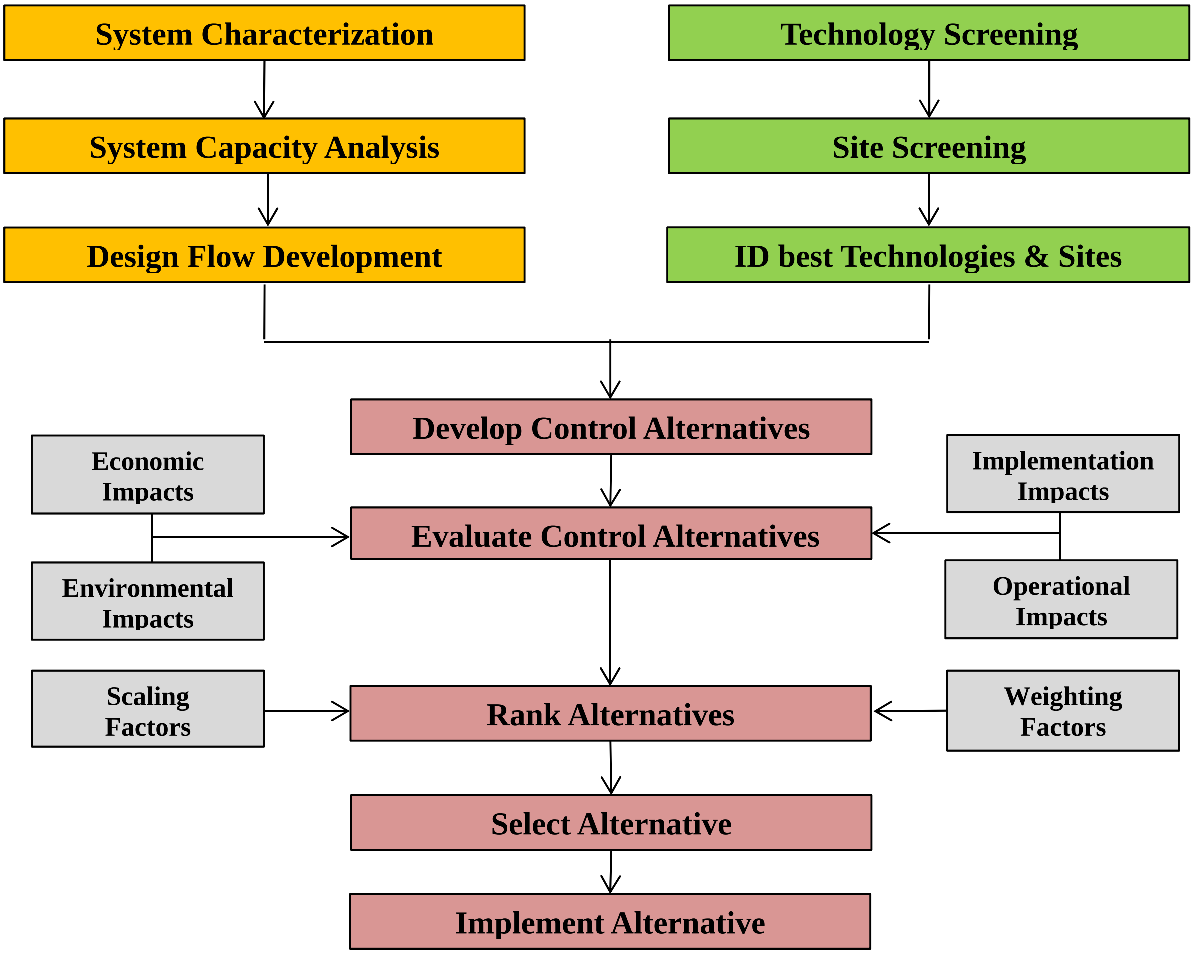
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure 4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE 4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered "feasible" for use in the M-47 sewershed are shown below in Table 4-1.

TABLE 4-1: M-47 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies was identified for the M-47 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table 4-2.

Contributing flows from the municipalities that are tributary to the M-47 sewershed, which include Braddock Hills Borough, Churchill Borough, Edgewood Borough, the Municipality of Penn Hills, Swissvale Borough and of Wilkinsburg Borough were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as waterways.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning "Objective Scores" to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

TABLE 4-2: M-47 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 128R002	CS4 128R002: Sewer separation	Complete sewer separation of tributary area.
	S2-128R002: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-128R002: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-128R002: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-128R002: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-128R002: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-128R002: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 129NM47	CS4 129NM47: Sewer separation	Complete sewer separation of tributary area.
	S2-129NM47: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-129NM47: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-129NM47: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-129NM47: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-129NM47: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-129NM47: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 089C001	No activations during the typical year.	No control required.
Outfall 129B001	No activations during the typical year.	No control required.
Regional Controls – M-47: Nine Mile Run Controls		
Outfalls 128R002, and 129B001	CS4-NMR Frick Park Region: Sewer Separation	Complete sewer separation of tributary areas.
	S2- NMR Frick Park Region: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4- NMR Frick Park Region: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-NMR Frick Park Region: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-NMR Frick Park Region: High Rate End of Pipe	A ballasted flocculation unit, with screening and disinfection.

CSO(s)	Control Alternative(s)	Description
	Treatment	
	T3- NMR Frick Park Region: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-NMR Frick Park Region: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfalls 129NM47, and 089C001	CS4-Nine Mile Run Region: Sewer Separation	Complete sewer separation of tributary areas.
	S2-Nine Mile Run Region: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-Nine Mile Run Region: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-Nine Mile Run Region: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-Nine Mile Run Region: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-Nine Mile Run Region: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-Nine Mile Run Region: Screening and Disinfection	A stand-alone screening and disinfection facility.
Sub-system Controls – Monongahela - Ohio Controls		
Outfalls 134A001, 184E001 AND 185H001, 030N001, and 032P001	MO-1: Tunnel Storage[2]	A 2.4 mile long tunnel collecting flow from M-28 to O-25. The Nine Mile Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 129NM47 and 089C001– Screening & Disinfection • 128R002, and 129B001- Sub-Surface Storage
	MO-2: Tunnel Storage[2]	A 2.9 mile long tunnel collecting flow from M-29 to O-25. The Nine Mile Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 129NM47 and 089C001– Screening & Disinfection • 128R002, and 129B001- Sub-Surface Storage
	MO-3: Tunnel Storage[2]	A 5.4 mile long tunnel collecting flow from M-40 to O-25. The Nine Mile Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 129NM47 and 089C001– Screening & Disinfection • 128R002, and 129B001- Sub-Surface Storage
	MO-4: Tunnel Storage[2]	A 6.1 mile long tunnel collecting flow from M-42 to O-25. The Nine

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

CSO(s)	Control Alternative(s)	Description
		Mile Run CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 129NM47 and 089C001– Screening & Disinfection • 128R002, and 129B001- Sub-Surface Storage
	MO-5: Tunnel Storage[2]	A 7.5 mile long tunnel collecting flow from M-47 to O-25. The NMR Frick Park Region CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 128R002, and 129B001- Sub-Surface Storage
	MO-6: Tunnel Storage[2]	A 5.0 mile long tunnel collecting flow from M-29 to O-25 and M-47. The NMR Frick Park Region CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 128R002, and 129B001- Sub-Surface Storage

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

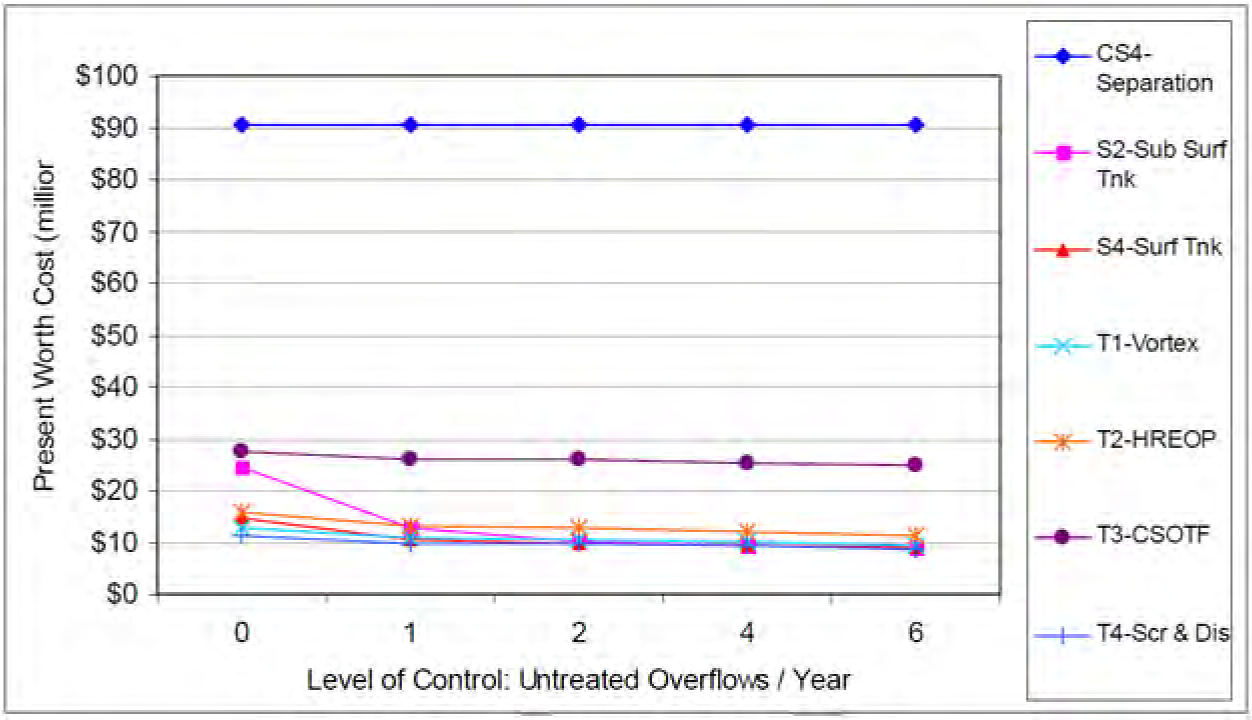
PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

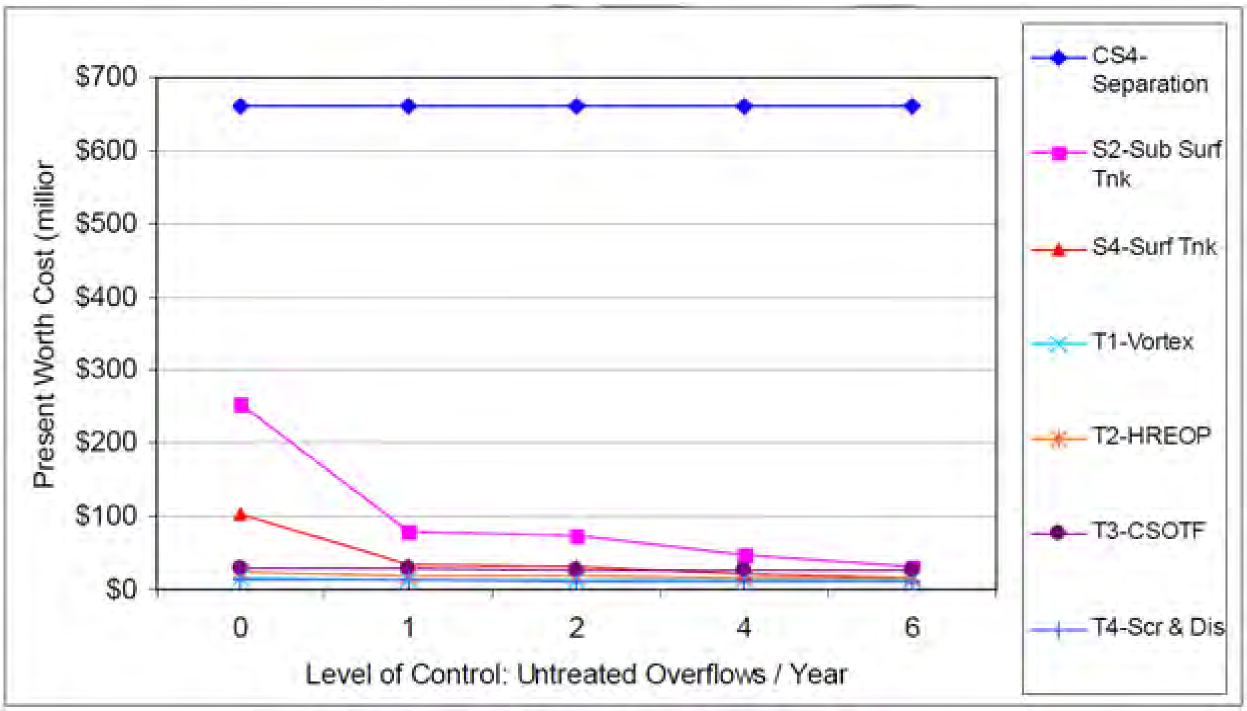
Outfall 128R002: Cost estimates were produced for outfall-specific control alternatives CS4 128R002: Sewer separation, S2-128R002: Sub-Surface Storage, S4-128R002: Surface Storage, T1-128R002: Suspended Solids Control, T2-128R002: High Rate End of Pipe Treatment, T3-128R002: CSO Treatment Facility, and T4-128R002: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2a illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2A: OUTFALL 128R002 ALTERNATIVE COSTS



Outfalls 129NM47: Cost estimates were produced for outfall-specific control alternatives CS4-129NM47: Sewer separation, S2-129NM47: Sub-Surface Storage, S4-129NM47: Surface Storage, T1-129NM47: Suspended Solids Control, T2-129NM47: High Rate End of Pipe Treatment, T3-129NM47: CSO Treatment Facility, and T4-129NM47: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2b illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2B: OUTFALLS 129NM47 ALTERNATIVE COSTS



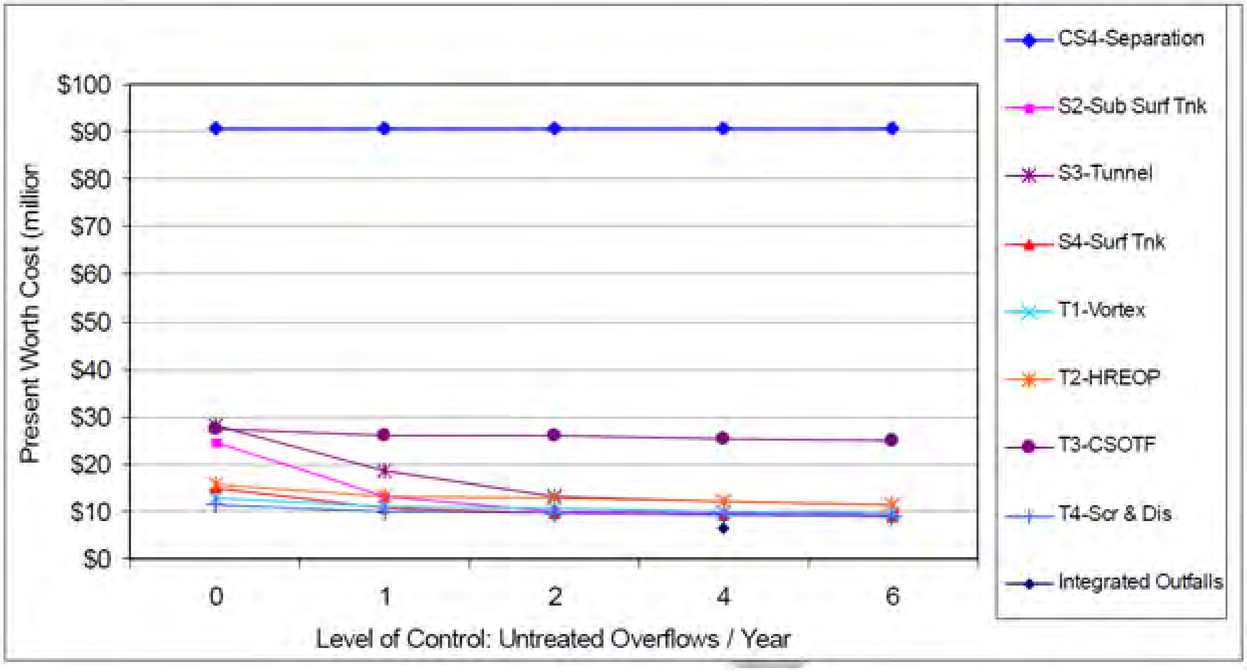
Outfall 089C001: Outfall 089C001 did not activate the typical year, and no control alternatives were required.

Outfall 129B001: Outfall 129B001 did not activate the typical year, and no control alternatives were required.

4.2.2 Regional Control Alternatives

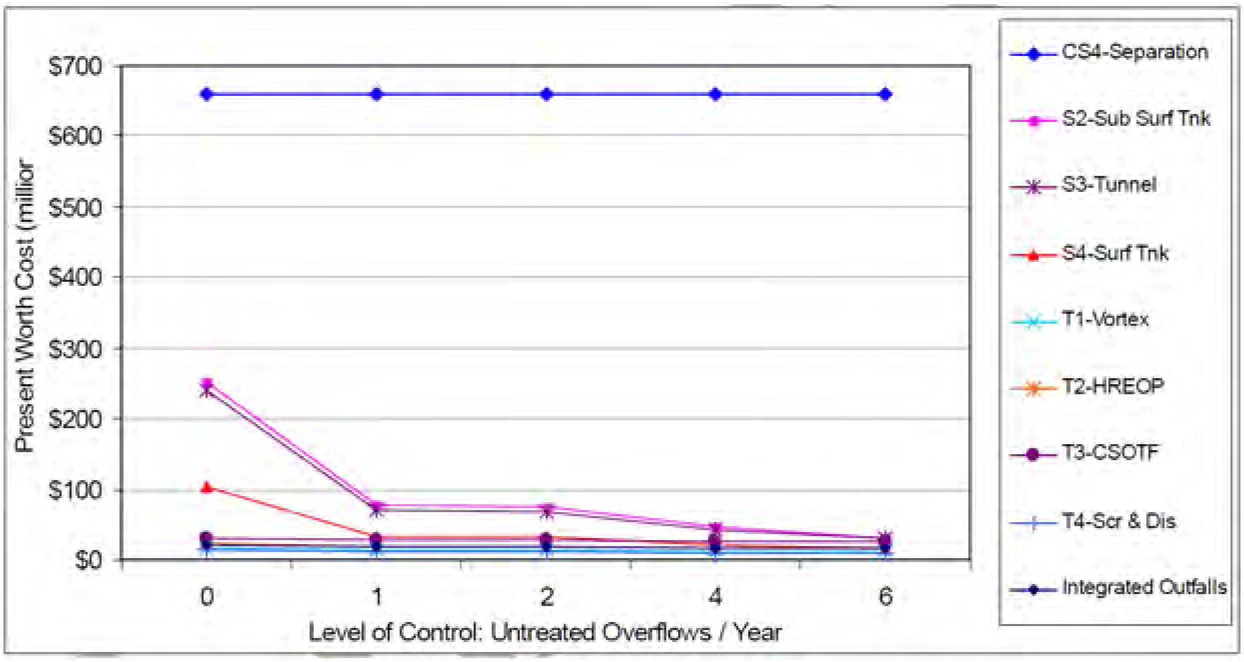
NMR (Nine Mile Run) Frick Park Region: Cost estimates were produced for regional control alternatives developed for the NMR Frick Park Region. *Figure 4*-3a illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-3A: NMR FRICK PARK REGION ALTERNATIVE COSTS



Nine Mile Run Region: Cost estimates were produced for regional control alternatives developed for the Nine Mile Region. Figure 4-3b: illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-3B: NINE MILE RUN REGION ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Monongahela- Ohio sub-system. Table 4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Monongahela- Ohio subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between “complete” sub-system alternatives. It remains PWSA’s assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE 4-3: MONONGAHELA OHIO SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
MO-1	478.2	4.4	529.3
MO-2	441.4	4.2	489.2
MO-3	420.7	3.9	464.9
MO-4	435.0	4.0	479.8
MO-5	458.5	4.2	505.8
MO-6	438.4	4.2	486.9

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining "Objective Scores" relative to each evaluation criteria.
- Applying "scaling" and "weighting" factors.
- Determining "Weighted Objective Scores" relative to each evaluation criteria.
- Ranking each alternative based on the sum of its "Weighted Objective Scores".

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table 4-4.

TABLE 4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

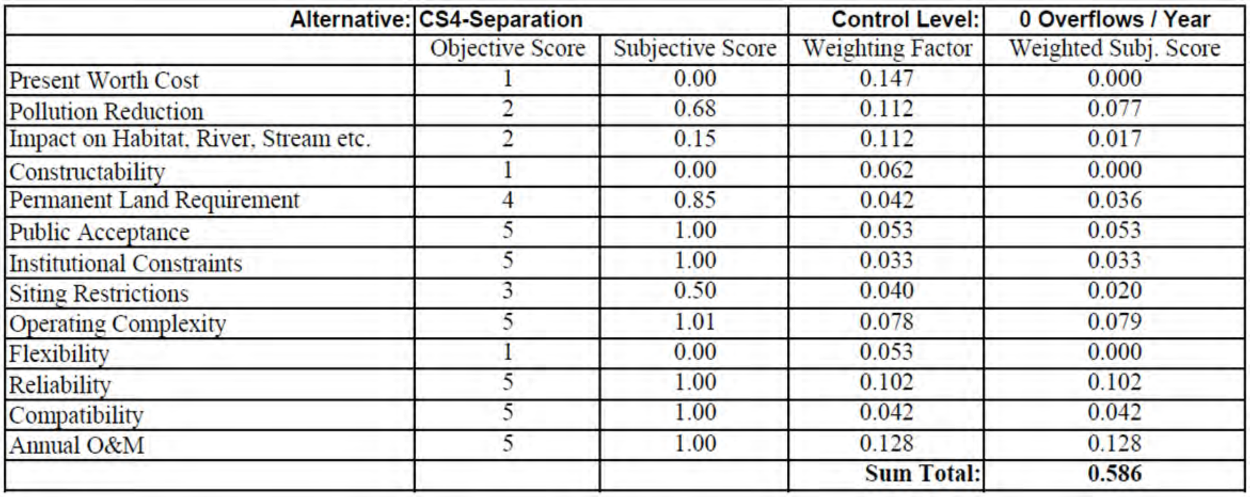
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in Table 4-5.

TABLE 4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	1.00

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 129NM47: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in Table 4-6.

TABLE 4-6: WEIGHTED SUBJECTIVE SCORING - CS4 129NM47: SEWER SEPARATION



Alternative:	CS4-Separation		Control Level:	0 Overflows / Year
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	1	0.00	0.147	0.000
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.112	0.017
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	5	1.00	0.033	0.033
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.586**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 128R002: The results of the control alternative evaluation process are shown in Figure 4-4a. It is recommended that the following alternatives be carried forward to the next level of analysis:

- T4-128R002: Screening & Disinfection. This alternative resulted in the highest score for control level of zero overflows per year.
- S2-128R002: Sub-surface Storage. This alternative resulted in the highest score for control level of 2, 4, and 6 overflows per year.
- S4-128R002: Surface Storage. This alternative resulted in the highest score for control level of 1 overflow per year.

Outfalls 129NM47: The results of the control alternative evaluation process are shown in Figure 4-4b. For all control levels, it is recommended that T4-129NM47: Screening and Disinfection be carried forward to the next level of analysis.

Outfall 089C001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This “no activation” outfall was not considered further in the alternatives analysis process.

Outfall 129B001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This “no activation” outfall was not considered further in the alternatives analysis process.

FIGURE 4-4A: ALTERNATIVE SCORING - OUTFALL 128R002

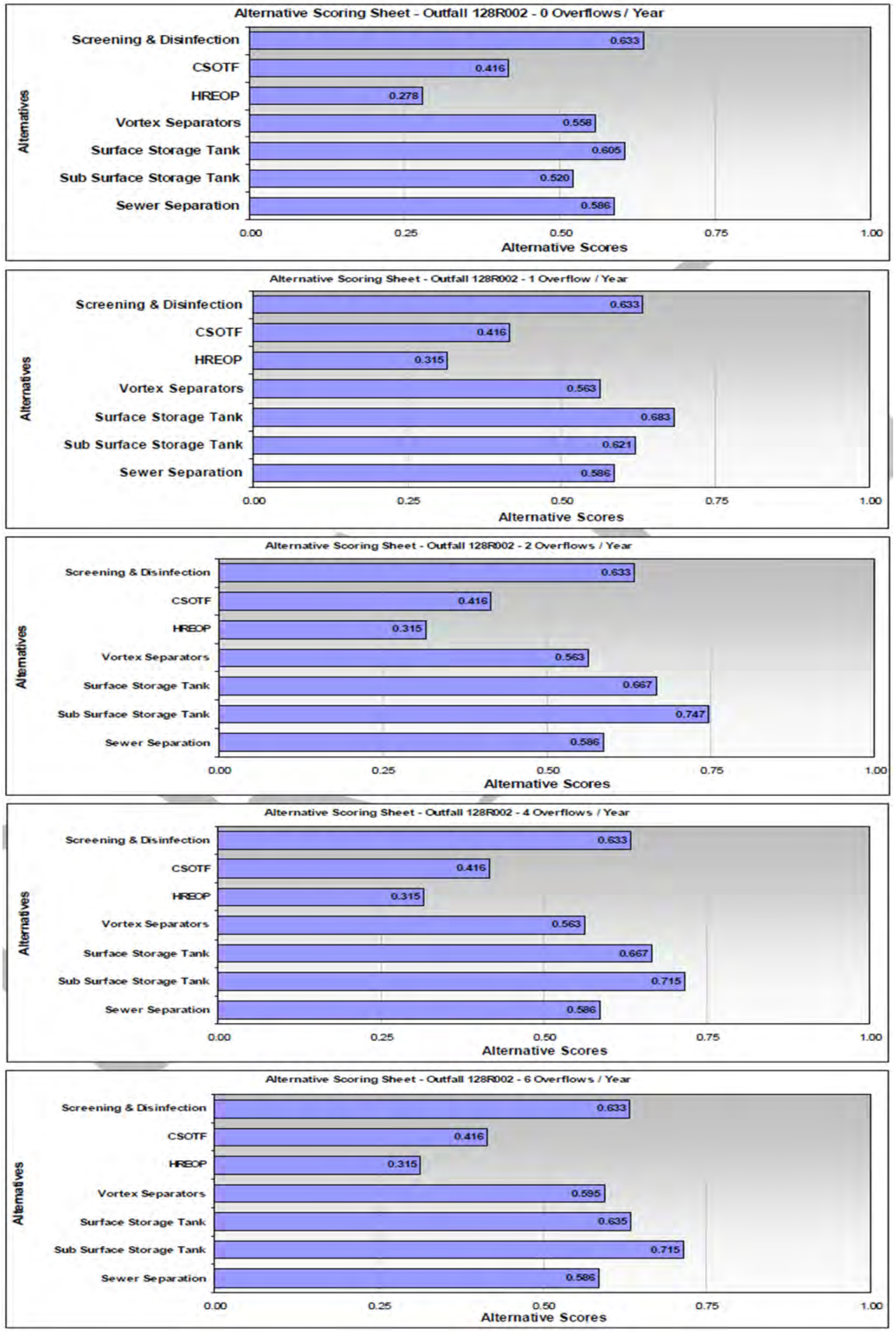
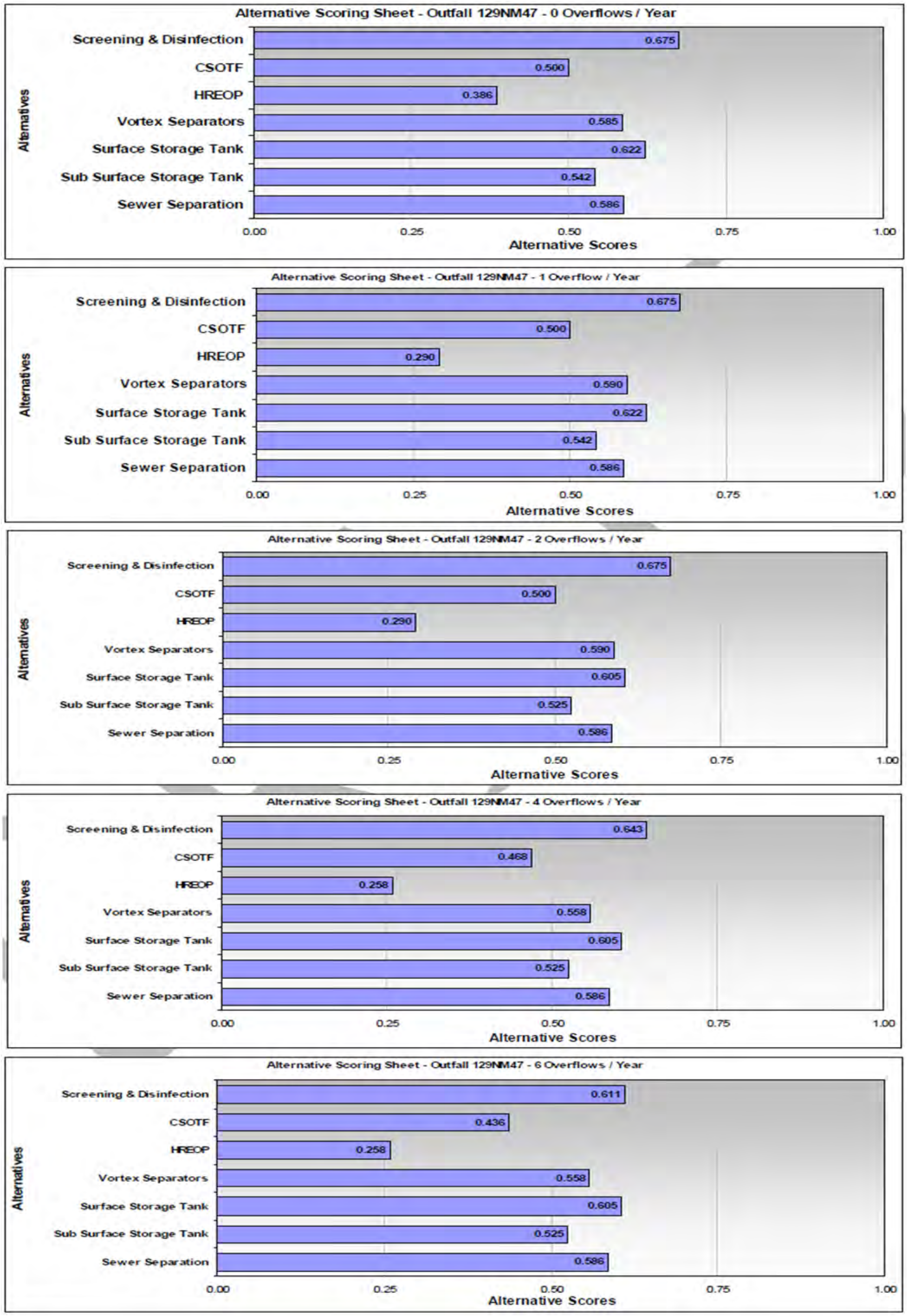


FIGURE 4-4B: ALTERNATIVE SCORING - OUTFALLS 129NM47



4.4.2 Regional Control Alternatives

NMR Frick Park Region: The results of the regional control alternative evaluation process are shown below in *Figure 4-5a.* It was recommended, for a control level of zero overflows per year, that *Alternative S3-NMR Frick Park Region: Tunnel Storage* be carried forward and re-evaluated during the system-wide alternatives analyses. For control levels of 1, 2, 4, and 6 overflows per year, it was recommended that *Alternative S2-NMR Frick Park Region: Sub-Surface Storage* be carried forward and re-evaluated during the system-wide alternatives analyses.

Nine Mile Run Region: The results of the regional control alternative evaluation process are shown below in *Figure 4-5b.* It was recommended, for a control level of zero overflows per year, that *Alternative S3-Nine Mile Run: Tunnel Storage* be carried forward and re-evaluated during the system-wide alternatives analyses. For control levels of 1, 2, 4, and 6 overflows per year, it was recommended that *Alternative S2-NMR Frick Park Region: Sub-Surface Storage* be carried forward and re-evaluated during the system-wide alternatives analyses.

4.4.3 Sub-System Control Alternatives

Monongahela - Ohio. The results of the sub-system control alternative evaluation process are shown below in Figure 4-6. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative MO-5: Tunnel Storage* be carried forward as the Monongahela - Ohio component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative MO-5: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative MO-5* included only those components required to deliver flows to the M-47 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the M-47 POC would become the responsibility of ALCOSAN.

FIGURE 4-5A: ALTERNATIVE SCORING – NMR FRICK PARK REGION

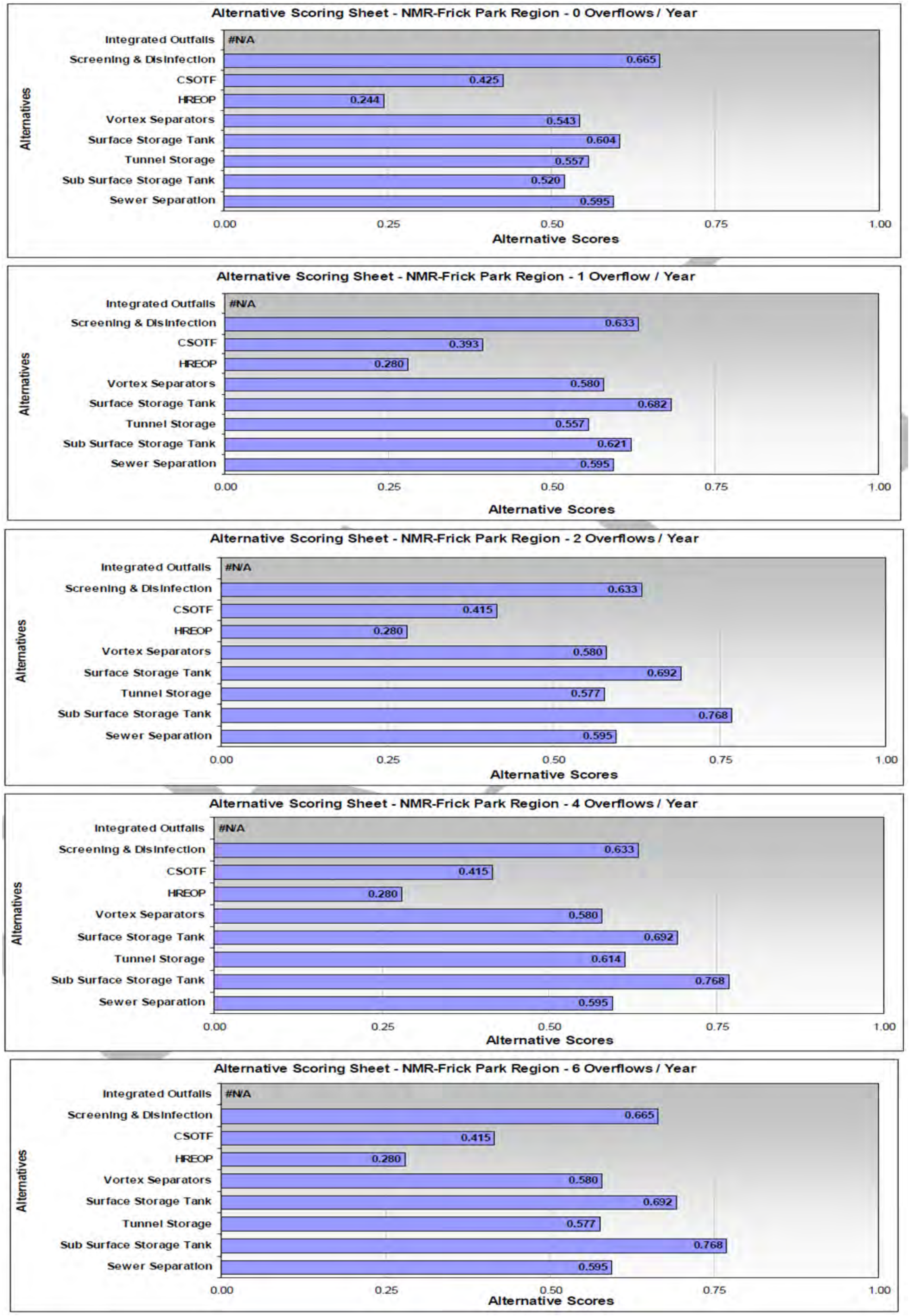


FIGURE 4-5B: ALTERNATIVE SCORING – NINE MILE RUN REGION

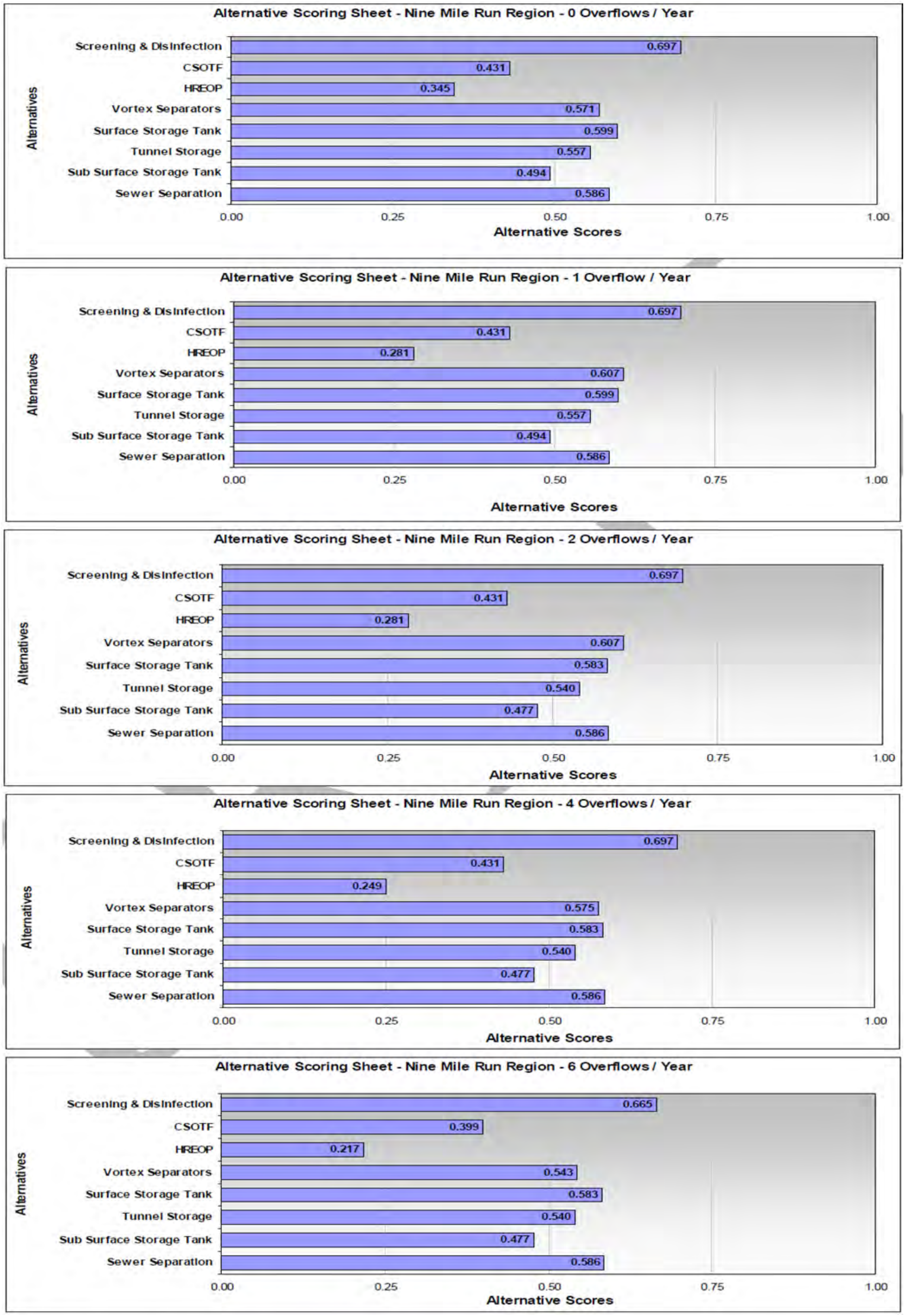
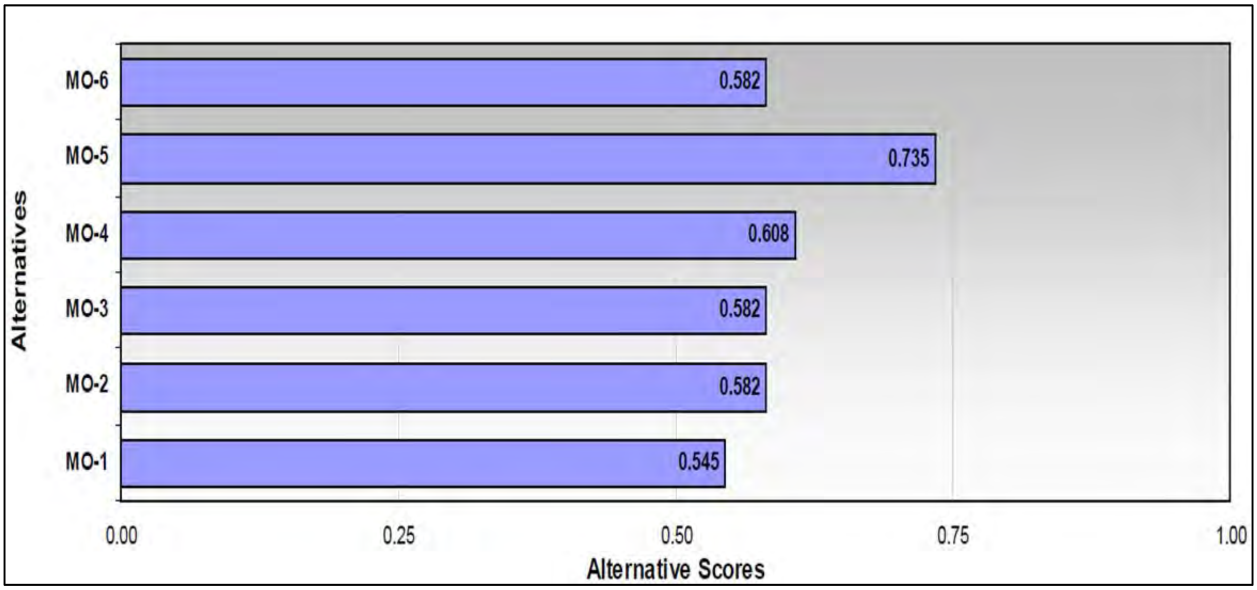


FIGURE 4-6: ALTERNATIVE SCORING – MONONGAHELA OHIO SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Nine Mile Run sewershed would best be accomplished by implementing *Alternative MO-5: Tunnel Storage*. Within the M-47 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the two PWSA permitted CSOs to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the M-47 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative MO-5* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-M47-C-0*, *POC-M47-C-4* and *POC-M47-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **M47 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.

- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the M-47 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities, with the exception of Churchill Borough and the Municipality of Penn Hills, did not indicate to the PWSA that they had plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows. Churchill has had preliminary discussions with Wilkinsburg Borough to combine two pump stations into one. The revision should not affect previous preliminary flow estimates reported for use in the model in M-47. The Municipality of Penn Hills had indicated that they have no plans to implement we weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results partially validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional wet weather storage to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the M-47 sewershed is four untreated overflows per year. The recommended control alternative for the M-47 Nine Mile Run sewershed has been designated as POC-M47-C-4. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **M47** The M-47 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **4** The selected level of control is four untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of four (4) untreated overflows per year, it is anticipated that any required increases in conveyance capacity will be accomplished by constructing parallel relief sewers as necessary to eliminate hydraulic overloading and avoid sewer surcharging. The lower reaches of the main trunk sewer will be constructed using tunneling techniques in order to minimize damage to the constructed wetlands and to address siting limitations. The components of alternative POC-M47-C-4 are summarized in Table M47-5-1.

TABLE M47-5-1: ALTERNATIVE POC-M47-C-4 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
M-47	DC129B001	129B001	C*	4
	DC128D001 DC128D002 DC128D003 DC176J001 DC176J002 DC176J003	128R002		

*To be achieved via additional conveyance piping and installation of a new regulator.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M

requirements, any stream removal projects that may be included, its integration with the ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-M47-C-0 and/or POC-M47-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were partially validated by the results of the analyses undertaken in support of the July, 2012 report. The Draft Feasibility Study recommended that control of the Fern Hollow CSO be accomplished using wet weather storage. The required storage tank site was located in a public park at the center of a recently constructed wetlands area. Initial discussions with stakeholders indicated that it would be extremely difficult to site and operate storage facilities at the required location. Consequently, the preferred CSO control method is to convey all required flows to the ALCOSAN interceptor system. This will be accomplished by constructing a new diversion chamber in the existing CSO outfall pipe. This chamber would divert flows from the CSO outfall to the trunk sewer for conveyance to ALCOSAN as necessary to achieve the required level of CSO control. To accomplish this, the PWSA and/or their tributary municipalities must:

- Construct a new diversion structure to achieve desired level(s) of control.
- Construct additional consolidation/relief piping to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

The upstream municipalities' provided PWSA with proposed improvements that consist of increasing trunk sewer capacity through new pipe construction and pipe bursting for the 2-year design storm conditions and a combination increasing trunk sewer capacity, through new pipe construction and pipe bursting, of a wet weather storage facility and upsized replacement sewers for the 10-year design storm conditions. PWSA incorporated these improvements into the model in order to size required conveyance facilities through the City to the ALCOSAN facilities. It is anticipated that the required increase in conveyance capacity in the PWSA facilities will be accomplished by constructing parallel relief sewers as necessary to eliminate hydraulic overloading and avoid sewer surcharging. The lower reaches of the main trunk sewer will be constructed using tunneling techniques in order to minimize damage to the constructed wetlands and to address siting limitations. Though no modifications are expected to the existing diversions chambers, DC129B001 will be closed because its tributary area is essentially separated, and a new diversion chamber is anticipated to be required to achieve the required diversion to the trunk/relief sewer.

Table M47-5-2 presents the required changes to each tributary area and CSO diversion chamber that are required to achieve the 0, 4, and 10-overflows per typical year levels of control. As is indicated in Table M47-5-2, existing flow control settings at the diversion chambers will not be changed and DC129B001 will be closed.

TABLE M47-5-2: POC-M47-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC128D001	No Change*	No Change	No Change	No Change
DC128D002	No Change*	No Change	No Change	No Change
DC128D003	No Change*	No Change	No Change	No Change
DC129B001	Closed	Closed	Closed	Closed
DC176J001	No Change*	No Change	No Change	No Change
DC176J002	No Change*	No Change	No Change	No Change
DC176J003	No Change*	No Change	No Change	No Change

*The installation of screening is planned for Outfall 128R002.

5.1.2 Consolidation Piping

The H&H model was employed to identify size and capacity improvements necessary to provide needed storage to control CSO discharges through a range of levels of control. The modeling was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer system, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the M-47 POC without significant manhole surcharging and flooding. These results primarily validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008).*

It was anticipated that the required increase in conveyance capacity would be achieved by constructing parallel relief sewers as necessary to eliminate hydraulic overloading and avoid sewer surcharging. The lower reaches of the main trunk sewer will be constructed using tunneling techniques in order to minimize damage to the constructed wetlands and to address siting limitations. Note that the upstream municipalities the Borough of Braddock Hills, Borough of Churchill, Borough of Edgewood, Municipality of Penn Hills, Borough of Swissvale and Borough of Wilkinsburg provided PWSA with proposed improvements to their conveyance systems. The upstream municipalities' improvements consist of constructing upsized replacement trunk sewers for the 2-year and 10-year design storm conditions and a combination of a wet weather storage facility and upsized replacement sewers. PWSA incorporated these improvements into the model in order to size required conveyance facilities through the City to the ALCOSAN facilities. Details of these upstream improvements are presented in Figure M47-5-2.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table M47-5-3 and in Figure M47-5-1.

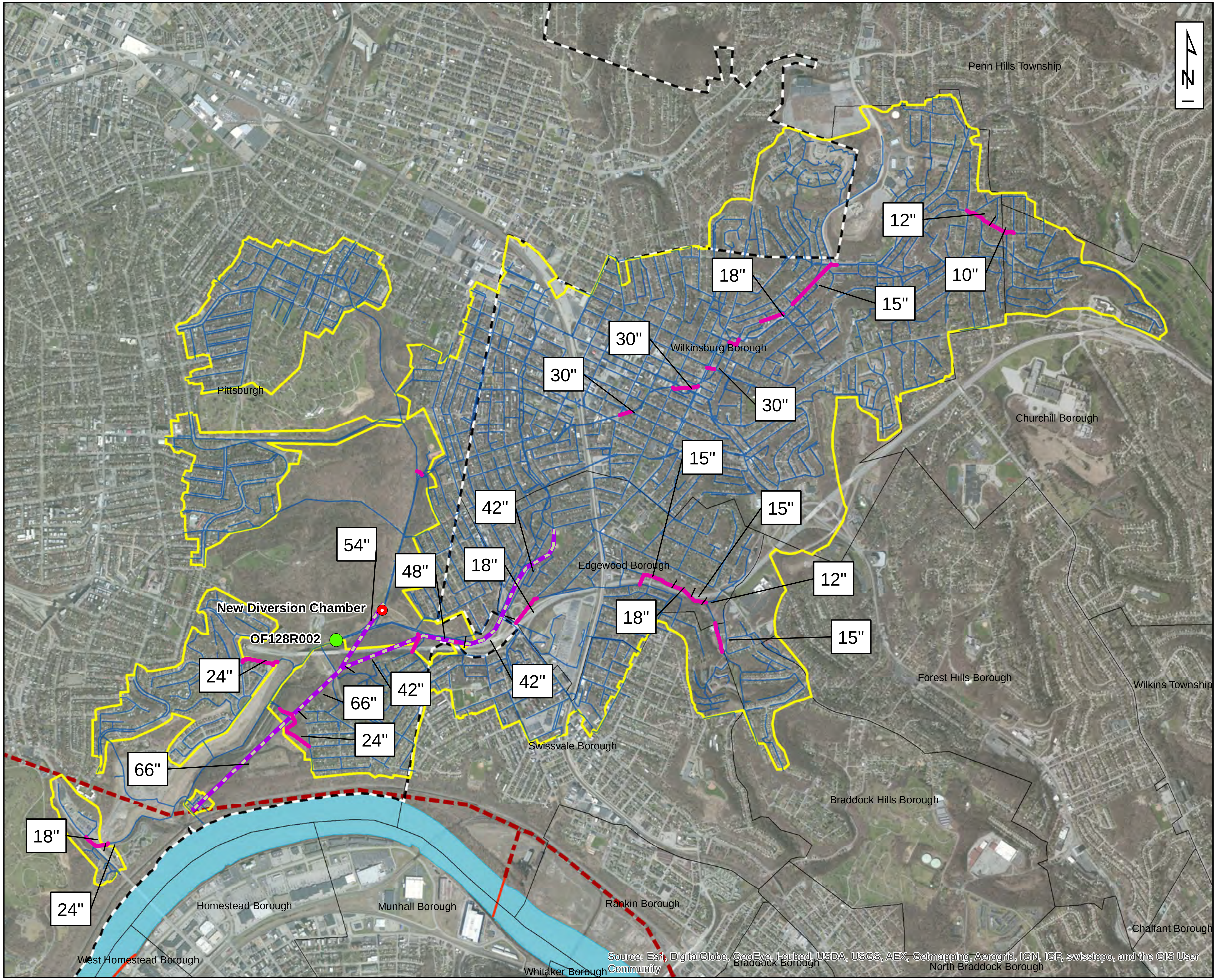
TABLE M47-5-3: POC-M47-C-4 CONSOLIDATION PIPING (2-YR DESIGN STORM)

Diameter (in)	Construction Method	Length (ft)
10	Open Cut	467
12	Open Cut	410
15	Open Cut	1,795
18	Open Cut	747
24	Open Cut	2,620
30	Open Cut	455
42	Open Cut	131
42	Trenchless	6,275
48	Trenchless	620
54	Trenchless	1,416
66	Trenchless	4,376
12	Pipe Burst	659
15	Pipe Burst	1,581
18	Pipe Burst	1,893
24	Pipe Burst	482
30	Pipe Burst	997

*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

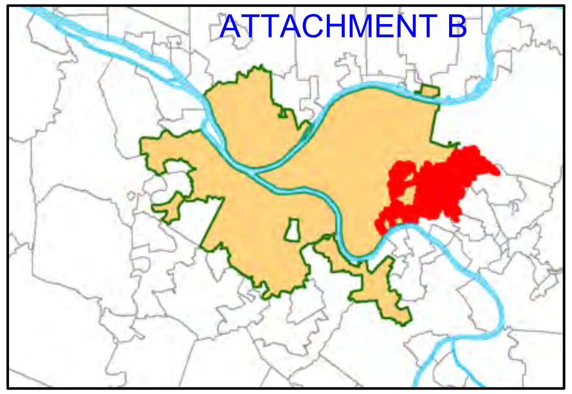
5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table M47-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 17.5 MG in the typical year.



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

◉ PWSA Diversion Structure Modification

● PWSA Sewer Outfall

— Relief/Consolidation Sewers

— Relief/Consolidation Sewers (Tunneled)

— Collector Sewer

☐ M-47 Sewershed Boundary

☐ PWSA Service Area Boundary

☐ Municipal Boundary

■ River

Existing ALCOSAN Interceptor

— Deep Tunnel

— Shallow Cut

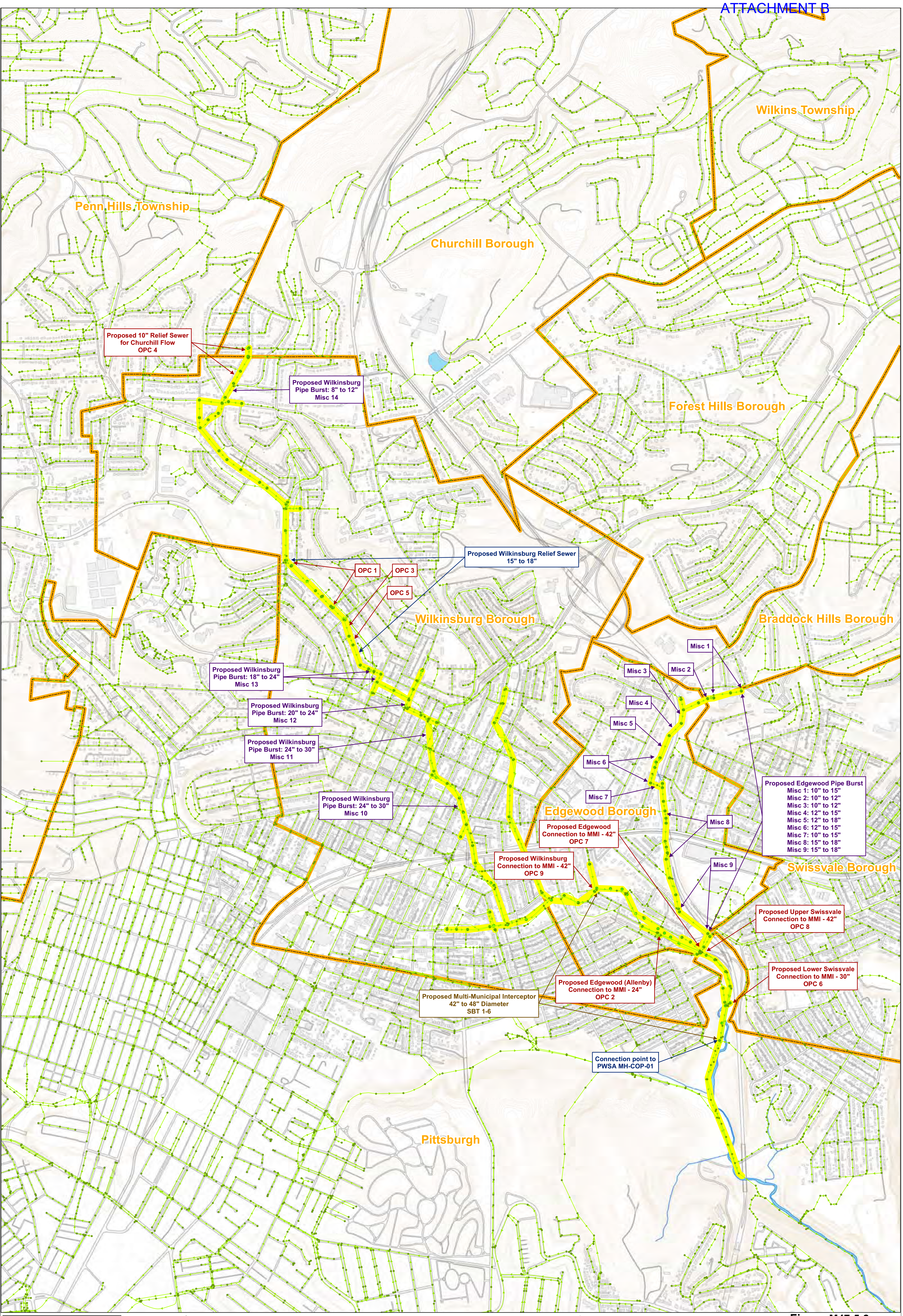
2,000 1,000 0 2,000 Feet

Figure M47-5-1: POC M47-C-4 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

ATTACHMENT B



Sources:
Landbase data provided by Allegheny County.
Sewer data provided by 3RWW.
Model data provided by ALCOSAN.

Lennon, Smith, Souleret
Engineering, Inc.
846 4th Avenue • Coraopolis, PA 15108
(412) 264-4400 Fax No. (412) 264-1200
E-Mail Address: Admin@LSSE.com

★	ALCOSAN Structures
━	ALCOSAN Inteceptor
●	Model Junctions
▬	Model Extents
▭	Municipal Boundaries

Model Extents Source:
Glenn Engineering NMR Alt Models

OPC = Open Cut Pipe
SBT = Short Bore Tunnel
Misc = Miscellaneous

Figure M47-5-2
Upper Municipalities
Ninemile Run Proposed
Multi-Municipal Interceptor
2-Year Summer Design Storm

Path: N:\PROJ\274\274-32\Reports\2013 Municipal Feasibility Study\Figures\Alt3_2Yr.mxd

TABLE M47-5-4: M-47 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Outfall	Control Alternative Name					
		POC-M47-C-0		POC-M47-C-4		POC-M47-C-10	
		No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)
DC128D001 DC128D002 DC128D003 DC176J001 DC176J002 DC176J003	128R002	0	0	4	13.2	10	17.3
Total Volume			**0**		**13.2**		**17.3**

5.1.4 Anticipated Flow Rates To The ALCOSAN POC

Additional consolidation/ relief piping will result in increased flow rates and volumes to the M-47 POC. Peak flow rates to the M-47 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-M47-C-0, POC-M47-C-4 and POC-M47-C-10 are presented in Figure M47-5-3. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the M-47 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table M47-5-5.

FIGURE M47-5-3: TYPICAL YEAR PEAK FLOW RATES TO THE M-47 POC

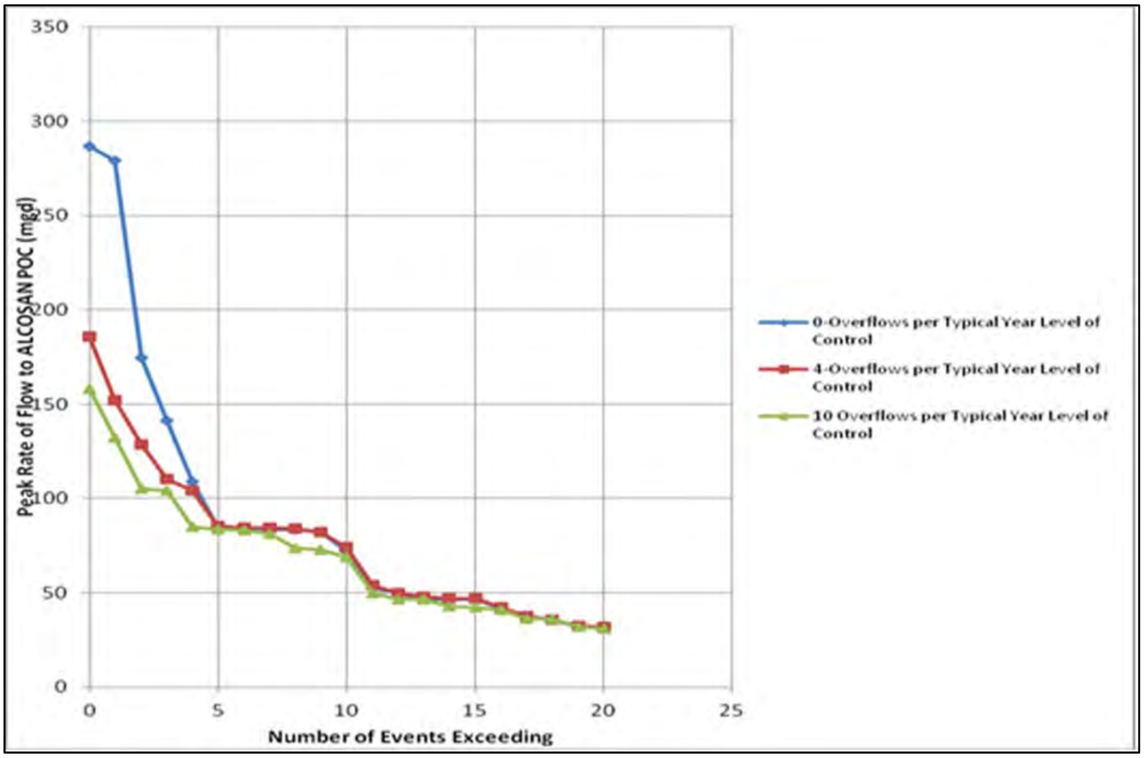


TABLE 5-5: M-47 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-M47-C-0	421.1	476.4	546.2	32.7	38.9	45.8
POC-M47-C-4	266.4	334.0	415.6	29.1	35.2	40.3
POC-M47-C-10	238.3	307.0	380.4	27.6	33.6	38.4

5.1.5 Recommended Control Alternative Integration

In the spring of 2013, 3 Rivers Wet Weather facilitated a series of meetings between the PWSA and the municipalities tributary to this sewershed. All associated parties in the POC sewershed have participated in these planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. Penn Hills has not voiced their agreement with the proposed cost allocations.

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. MOU updates can be found in Addendum M47-6-1.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-M47C-4 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through the construction of parallel relief sewers designed to convey flows associated with four overflows per typical year, under 2-year design storm conditions (4 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the M-47 sewershed, both before and after implementation of the recommended alternative:

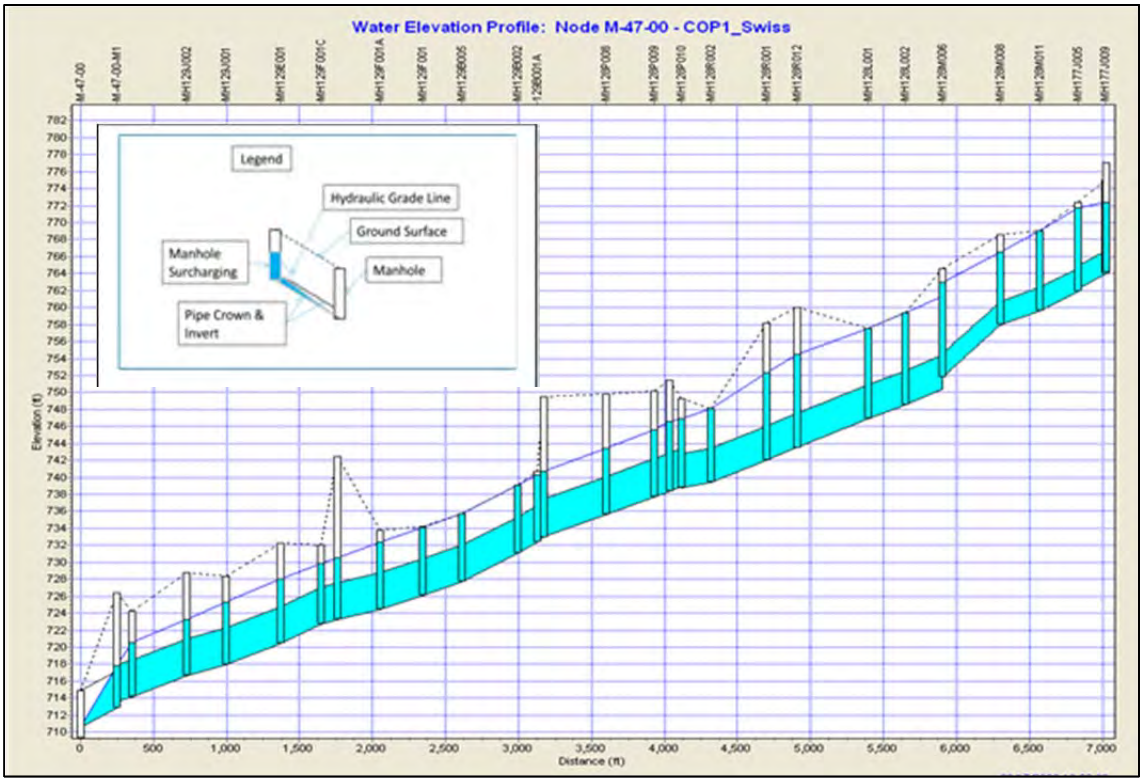
- Peak flow hydraulic grade line (HGL) of the trunk sewer system
- 2046 peak flows and volumes to the M-47 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figures 4a, 4b, 4c, 4d, and 4e from that report presented profiles of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. These figures are reproduced below as Figure M47-5-4a, Figure M47-5-4b, Figure M47-5-4c, Figure M47-5-4d, and Figure M47-5-4e. Under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging and manhole flooding occurs along the length of the trunk sewer.

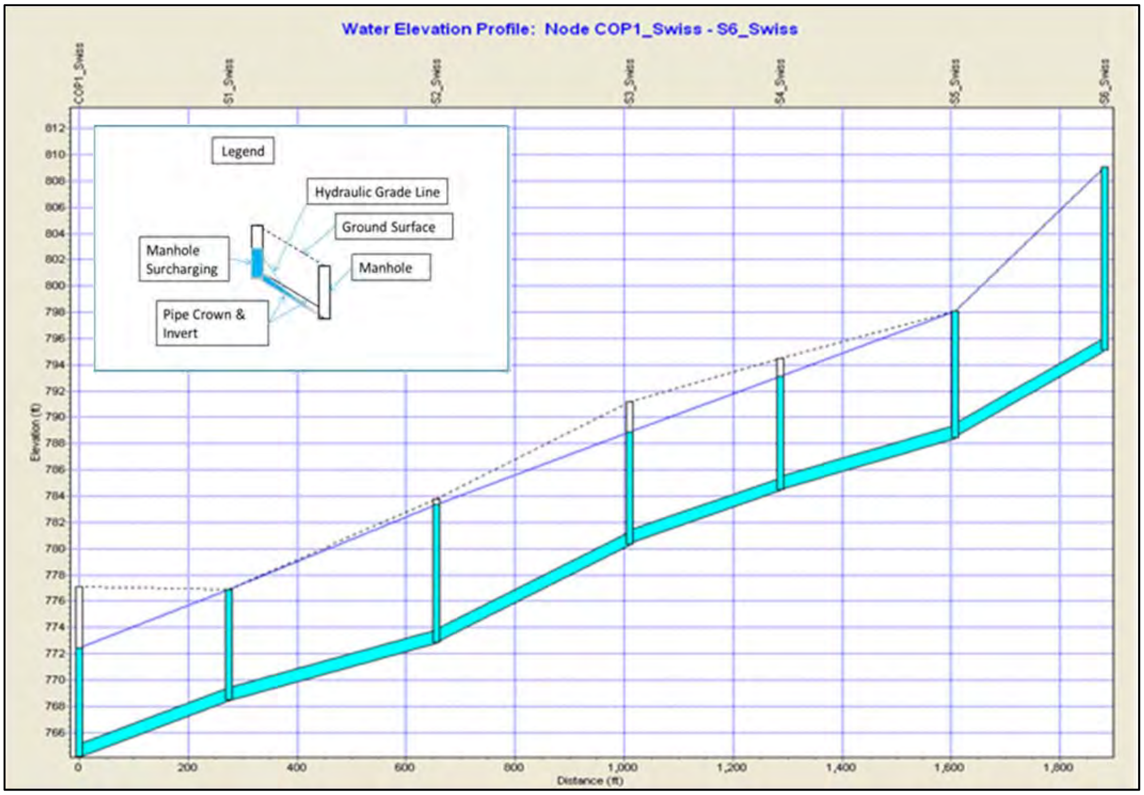
The HGL along the main trunk sewer following implementation of alternative POC-M47-C-4 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with four overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, additional conveyance capacity (4 OF/yr; 2-yr storm) will satisfactorily reduce manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE M47-5-4A: M-47 UPPER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



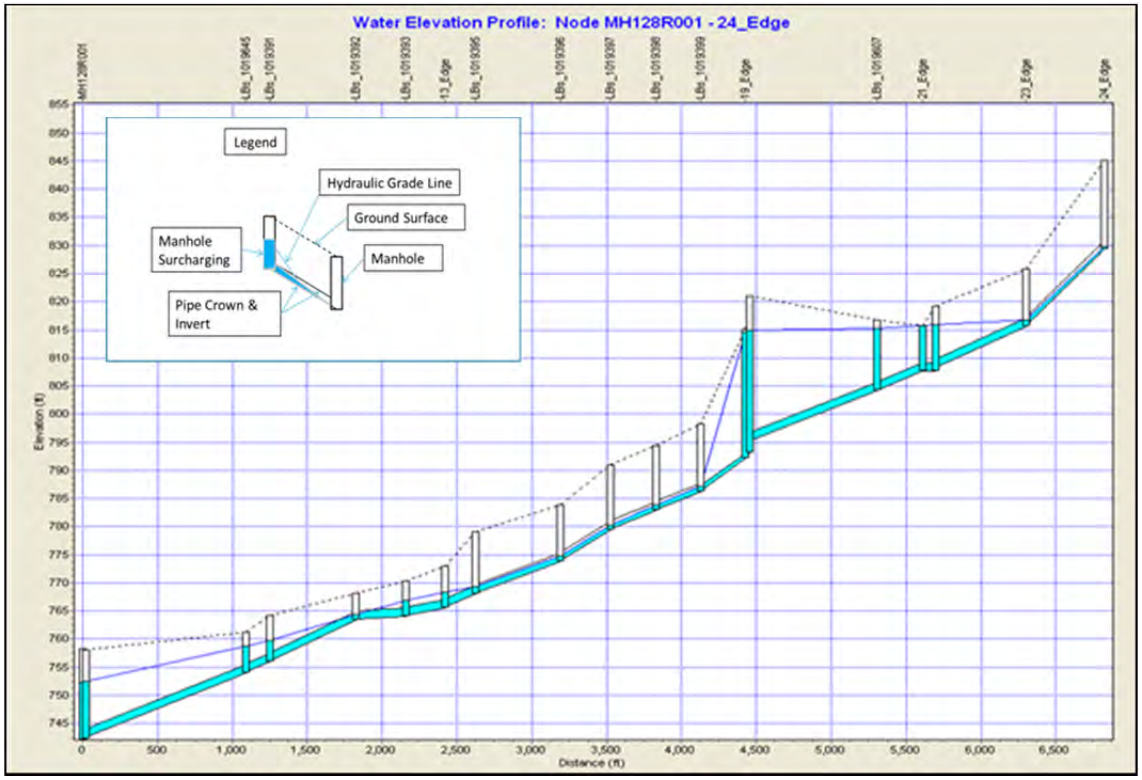
As is indicated in Figure M47-5-4a, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along the length of this trunk sewer under peak 2-year design storm conditions.

FIGURE M47-5-4B: M-47 LOWER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



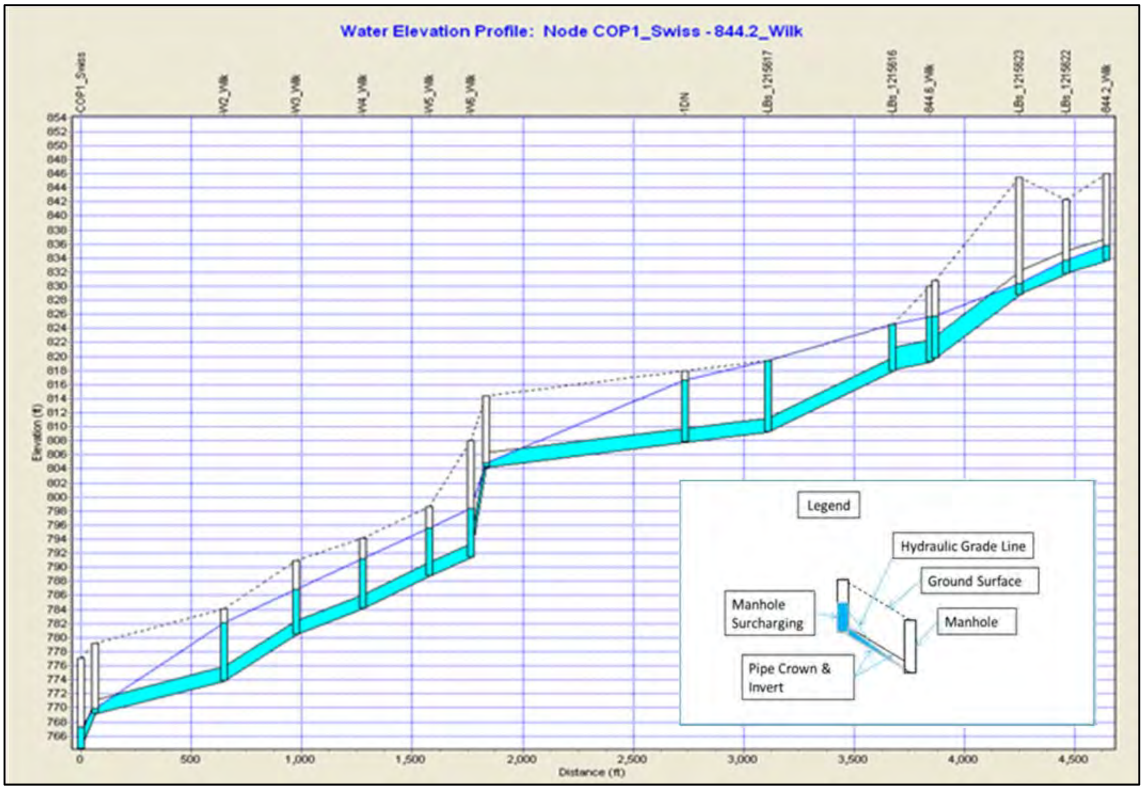
As is indicated in Figure M47-5-4b, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along the length of this trunk sewer under peak 2-year design storm conditions.

FIGURE M47-5-4C: M-47 WAGNER STREET TRUNK SEWER HGL (EXISTING CONDITIONS)



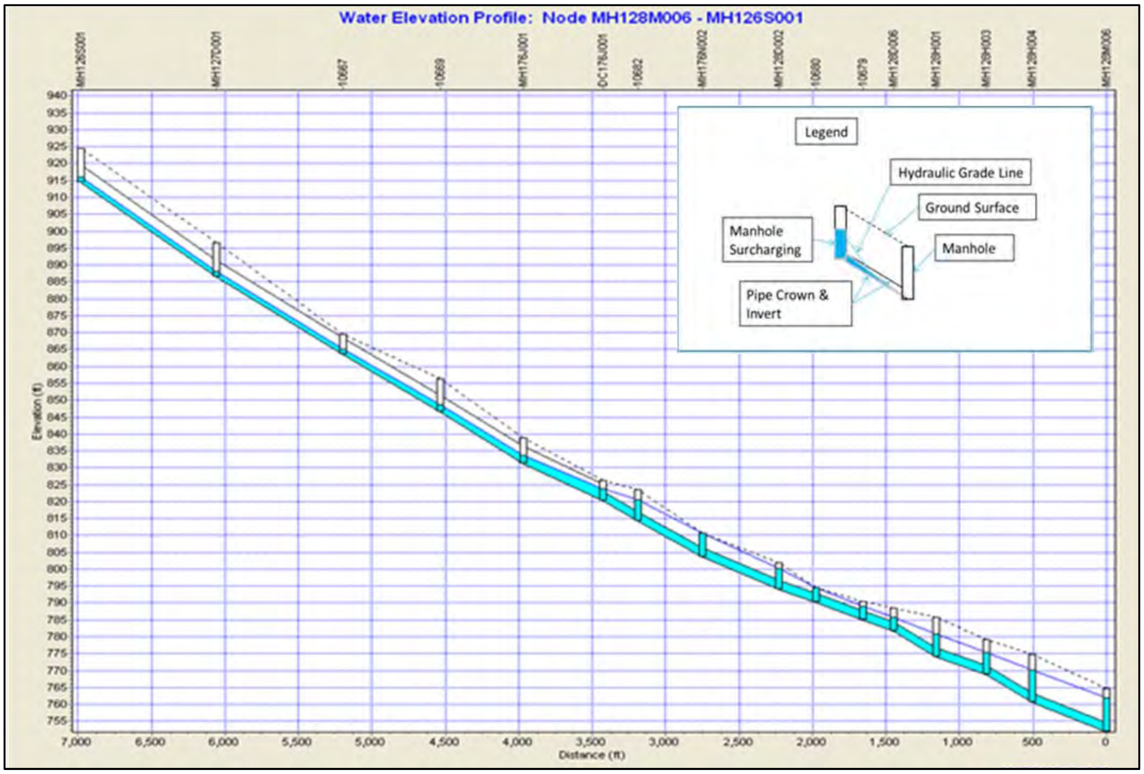
As is indicated in Figure M47-5-4c, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs at portions of this trunk sewer under peak 2-year design storm conditions.

FIGURE M47-5-4D: M-47 LOWER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure M47-5-4d, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs portions of this trunk sewer under peak 2-year design storm conditions.

FIGURE M47-5-4E: M-47 LOWER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure M47-5-4e, under the current system configuration, including existing CSO diversion chamber settings, manhole surcharging and possibly manhole flooding occurs along the lower portion of the trunk sewer under peak 2-year design storm conditions.

5.2.2 2046 Peak Flows and Volumes to M-47 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the

PWSA system. ALCOSAN made similar assumptions[1], and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves construction of a new diversion structure to achieve four overflows per typical year, as well as additional consolidation/relief piping to convey increased flows to the M-47 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the M-47 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances From ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year.

The control alternatives developed and evaluated by both ALCOSAN and PWSA, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the M-47 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from the Borough of Braddock Hills, Borough of Churchill, Borough of Edgewood, Municipality of Penn Hills, Borough of Swissvale and Borough of Wilkinsburg indicate that each of them plan to convey all their flows to the M-47 trunk sewer system for the duration of the planning period. As stated above, the upstream suburban municipalities provided PWSA with proposed improvements to their conveyance systems. The upstream municipalities' improvements consist of constructing upsized replacement trunk sewers for the 2-year and 10-year design storm conditions and a combination of a wet weather

---

[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

storage facility and upsized replacement sewers. PWSA incorporated these improvements into the model in order to size required conveyance facilities through the City to the ALCOSAN facilities.

TABLE M47-5-6: M-47 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

	Volume*		
Tributary Municipality	**Captured**	**Treated**	**Conveyed**
Braddock Hills Borough	N/A	N/A	All modeled flows
Churchill Borough	N/A	N/A	All modeled flows
Edgewood Borough	N/A	N/A	All modeled flows
Municipality of Penn Hills	N/A	N/A	All modeled flows
Swissvale Borough	N/A	N/A	All modeled flows
Wilkinsburg Borough	N/A	N/A	All modeled flows

*Following implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves installation of a new diversion structure to achieve four overflows per typical year, as well as increased conveyance piping to convey increased flows to the M-47 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

Nine Mile Run was fortunate to have been one of the sewersheds selected by 3 Rivers Wet Weather where an initial assessment of the potential for incorporation of GI methods and projects specifically for the reduction of flows from combined sewered areas in Nine Mile Run was performed. A brief write-up of the assessment along with accompanying exhibits/figures has been provided for reference as Attachment M47-5-2. The analysis concluded that there is great potential for the implementation of GI within the combined portion of the Nine Mile sewershed. It is intended that the analysis be built upon within the next several years to determine the feasibility of implementation of GI within the Nine Mile sewershed.

The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 o of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes consolidation / relief piping designed to control CSOs from the PWSA diversion structures to four overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the M-47 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-M47-C-4 are consolidation/relief piping, CSO screening facilities, and a new diversion structure. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment M47-5-1.

5.4.1 Consolidation Piping

In the M-47 sewershed, the method of providing required conveyance capacity was through the use of parallel relief sewers, tunnels, and pipes upsized using pipe bursting techniques to convey flow to the ALCOSAN interceptor. Relief sewers were added to areas of the system that had manhole flooding, or surcharging at any time during the 24-hour design storm events. Any improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewer.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft

- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street
- Other values included in the cost – Trench excavations and backfill, rock excavation, trench wall support, street opening, clearing and grubbing, street restoration, flow maintenance, traffic maintenance

5.4.2 CSO Screening Facilities

It was assumed that the outfall location 128R002 will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

A new diversion chamber is anticipated to be required to achieve the required diversions to the trunk sewer. It was assumed that a new diversion chamber, in a new location, would include more effective and improved methods of flow control and monitoring, improved access, etc. The unit cost associated with the new diversion structure was assumed to be $750,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $1,350,000.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure M47-5-5. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible “knee of the curve” is evident from this data.

These costs are also presented in a tabular format in Table M47-5-7.

The selected level of CSO control - 4 OF/yr - was determined based upon the costs anticipated and the expectation of meeting water quality standards. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-M47-C-4 are summarized in Table M47-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE M47-5-5: M-47 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

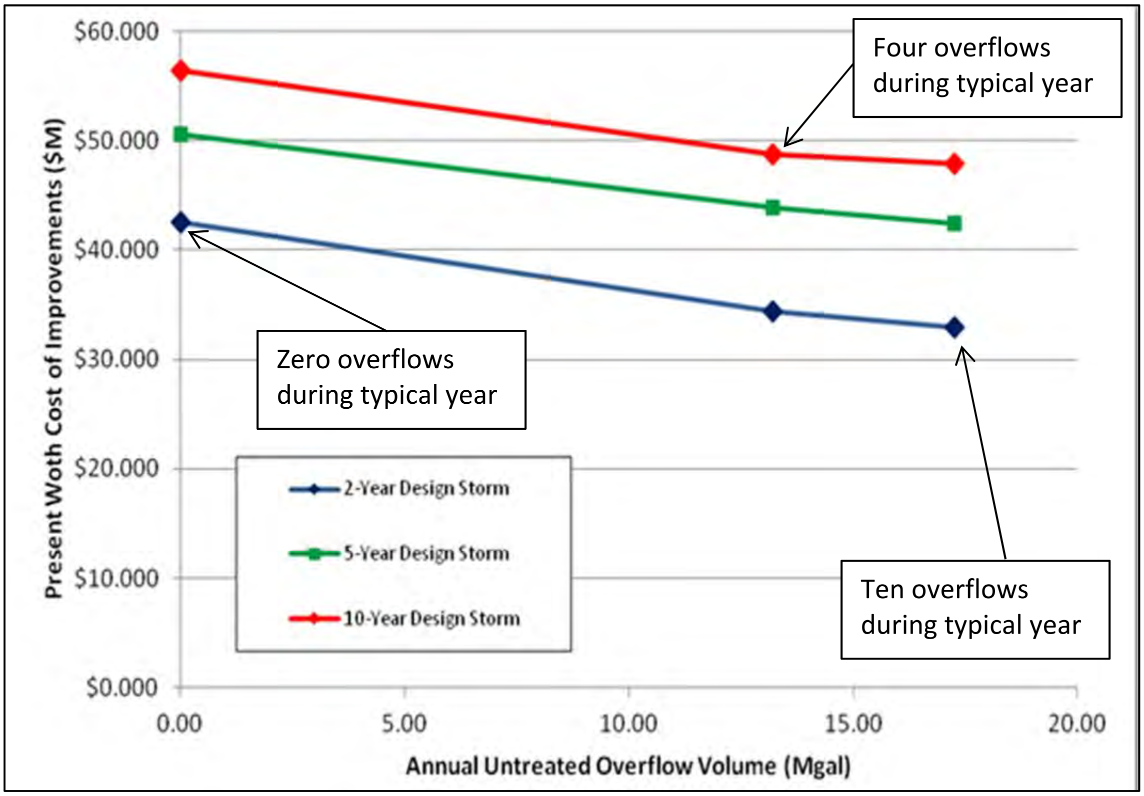


TABLE M47-5-7: M-47 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	**CSO Control**				
	Untreated CSO Volume (MG)	**CSO Control Level (OF/yr)**	**PW Capital Cost ($MM)**	**PW O&M Cost* ($MM)**	**TPW CSO Control ($MM)**
POC-M47-C-0	0	0	$42.1	$0.4	$42.5
POC-M47-C-4	13.2	4	$34.0	$0.4	$34.5
POC-M47-C-10	17.3	10	$32.5	$0.4	$32.9
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-M47-C-0	0	2-year	$0	$0	$0
POC-M47-C-4	0	2-year	$0	$0	$0
POC-M47-C-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE M47-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-M47-C-4

Capital Improvements	Size/Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Construct new diversion structure	4 OF/yr	$1.35	$1.35	$1.36
Add screening to Outfall 128R002	18.0 mgd	$0.45	$0.45	$0.46
Conveyance piping (Open cut)	10-in dia.	$0.15	$0.15	$0.16
Conveyance piping (Open cut)	12-in dia.	$0.31	$0.31	$0.32
Conveyance piping (Open cut)	15-in dia.	$1.35	$1.35	$1.40
Conveyance piping (Open cut)	18-in dia.	$0.69	$0.69	$0.70
Conveyance piping (Open cut)	24-in dia.	$2.19	$2.19	$2.25
Conveyance piping (Open cut)	30-in dia.	$0.41	$0.41	$0.42
Conveyance piping (Open cut)	42-in dia.	$0.23	$0.23	$0.24
Conveyance piping (Trenchless)	42-in dia.	$9.14	$9.14	$9.29
Conveyance piping (Trenchless)	48-in dia.	$1.05	$1.05	$1.07
Conveyance piping (Trenchless)	54-in dia.	$3.18	$3.18	$3.22
Conveyance piping (Trenchless)	66-in dia.	$9.36	$9.36	$9.46
Conveyance piping (Pipe burst)	12-in dia.	$0.54	$0.54	$0.54
Conveyance piping (Pipe burst)	15-in dia.	$1.14	$1.14	$1.14
Conveyance piping (Pipe burst)	18-in dia.	$1.36	$1.36	$1.36
Conveyance piping (Pipe burst)	24-in dia.	$0.35	$0.35	$0.35
Conveyance piping (Pipe burst)	30-in dia.	$0.72	$0.72	$0.72

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA and their tributary municipalities have agreed that the basis of allocation for future operation and maintenance costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the M-47 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan," consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new

wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC M-47 overflow is intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the “Selected Plan” to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the “Recommended Plan”. This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the “Selected Plan” is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

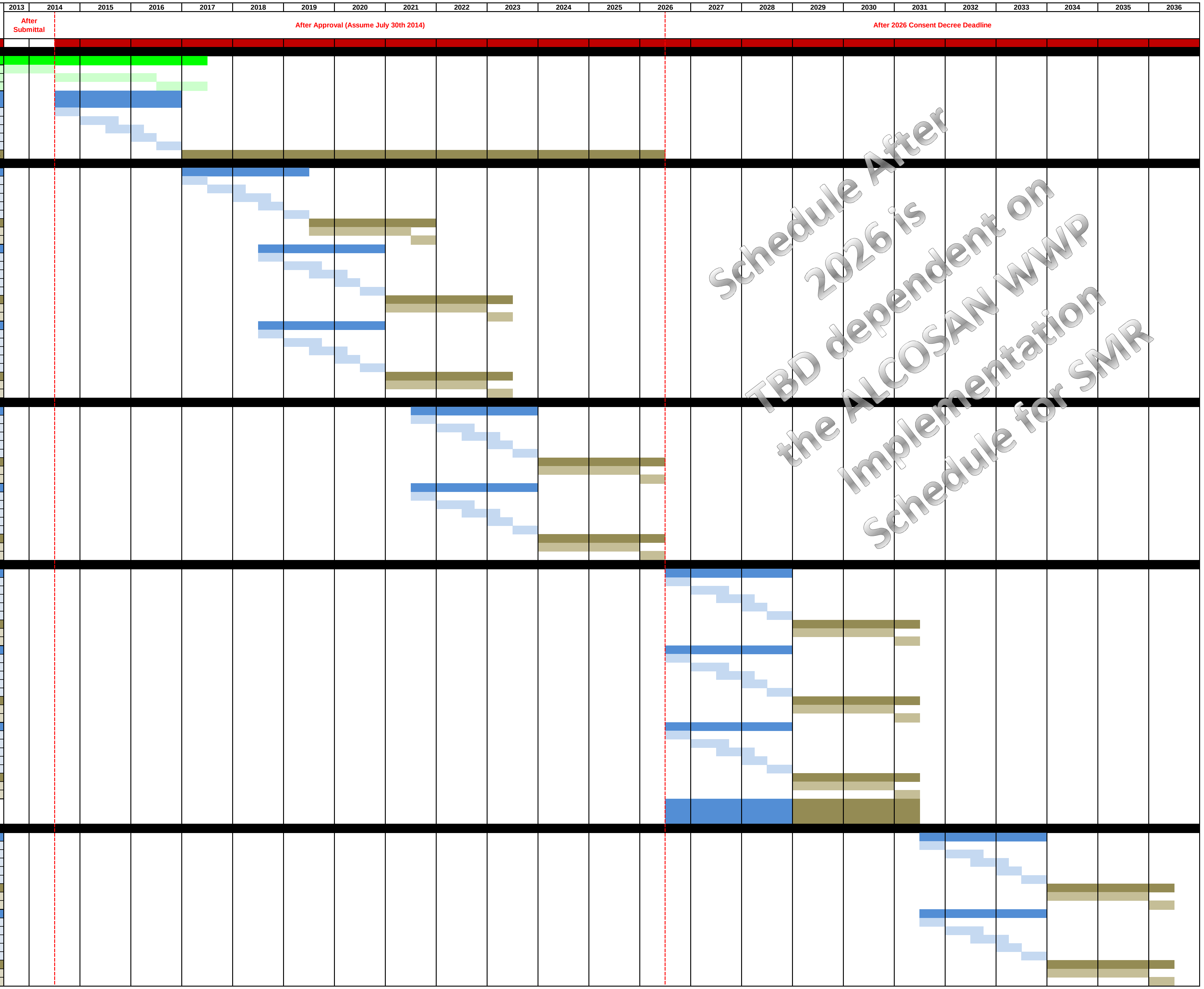
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it’s important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the Monongahela River tunnel segment, extending toward M-47, of regional plan is being implemented by 2026. Per PWSA's implementation schedule, M-47 is included in Phase 3 (mid-2023 to mid-2026) due to the preference to follow the design /construction of the ALCOSAN Monongahela River tunnel segment, as well as to apply considerations for balanced distribution of costs and resources throughout the duration of the implementation schedule.

ATTACHMENT B

FIGURE MH47-5-6: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the M-47 sewershed. These considerations include Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Braddock Hills Borough, Churchill Borough, Edgewood Borough, the Municipality of Penn Hills, Swissvale Borough, Wilkinsburg Borough, and the Pittsburgh Water and Sewer Authority. Other considerations regarding the M-47 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the “2-year design storm” for the municipal separate sanitary system portions and “4 OF/ typical year” for the PWSA’s combined system outside of Saw Mill Run where “0 OF/ typical year” is proposed.

A set of guiding principles were produced for use in developing cost allocation procedures. These principles form the basis of a DRAFT Memorandum of Understanding by and between Braddock Hills Borough, Churchill Borough, Edgewood Borough, the Municipality of Penn Hills, Swissvale Borough, Wilkinsburg Borough, and The Pittsburgh Water and Sewer Authority, and include:

- The major goal is to develop a fair and equitable cost allocation process.

- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.
- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.
- Cost allocations should be simple and easy to calculate in the future.
- The final cost allocation methodology should encourage efficiencies between municipalities.
- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.
- Unless agreed to by all parties, any existing contracts should not form the only basis for cost allocations.

6.1.1 Cost Sharing Concept and Method

Two distinctive categories of cost allocations will need to be addressed by the PWSA and their tributary municipalities: capital cost allocations and O&M cost allocations. A number of methods for capital cost allocation were considered, based on the following:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution
- Proportion of internal municipal costs

All of these approaches could be modified by the addition of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc. The following discussion describes each of these methodologies.

"Agreed Upon" Basis: This approach could be as simple as each party agreeing to a fixed share of each element of cost or all costs across the board. Negotiation of the

basis of the percent share is left to the discretion of the involved parties. Shares could be fixed for the term of the agreement, or they could be adjustable on a scheduled or otherwise agreed to basis. This approach is usually successful where there are existing agreements or a long history of collaboration between the affected parties.

Capacity Basis: Capacity based cost sharing is predicated on the design capacity of the shared facilities and the portion that is allocable to the various parties to the Agreement. For the types of facilities being evaluated, wet weather flow rate and volume would be the primary capacity parameters. A Design Engineer's Report, normally submitted as part of the construction permitting process, should clearly specify and set forth the flow rate and volumetric design basis, as well as the capacity needs associated with all municipal entities. This information can serve as the basis for pro rata distribution of cost elements such as Debt Service and initial costs. One issue that should be addressed is how and whether unused and/or excess capacity utilized by "others" will be subject to cost reimbursement.

Expected Annual Flow Contribution: This method would utilize estimated flow rates for a predetermined average year as the basis for the evaluation of cost allocations. This may work well for systems where a hybrid approach of wet weather flow rate and volume is desired.

Proportion of Internal Municipal Cost: This approach requires municipalities to evaluate their own internal projects. This evaluation would include outlining control alternatives and selecting the highest ranked alternative for their internal solution. The municipalities' share of the combined project becomes a "not-to-exceed" or proportional value of its internal cost to the total regional cost.

6.1.2 Evaluation and Selection of Capital Cost Allocation Methodology

Four sewersheds, including the M-47 POC sewershed, were selected by 3RWW and their PM Team as pilot sewersheds for cost allocation evaluations. Monthly meetings were held at which the meeting attendees selected the methodologies that they thought were appropriate, and the 3RWW/PM Team provided the necessary statistics for use in evaluating and selecting the best methodology.

Statistics intended to support the various allocation methodologies were developed and discussed with each POC participant. Over the course of several meetings, the major point of discussion was the identification of ways to ensure the allocation was

fair and equitable by assigning the costs proportionally to the cost-causative items. In addition, participants agreed with the idea that it would not be fair for downstream municipalities pay for upstream sections of the project, given that they did not contribute flows directly into that sewer.

Following these discussions, the first decision regarded the need to use peak wet weather flows as the basis for the cost allocation. The PM Team evaluated three main types of peak flow based analysis:

Percentage of Flow at POC: In this approach, the total flows at the POC and at each connection point tributary to the POC are obtained from the H&H Model. The flow rate for each connection point is then divided by the total POC flow to obtain its ratio. This represents the connection point's portion of the total cost of the regional project. It should be noted that portions of the project dedicated to a single municipality would be subtracted from the total cost of the regional project.

Percentage by Length of Use: In this approach, the distance from the POC is used as a "weighing factor" in the cost allocation calculation.

Segmental: In this approach, areas that are tributary to a project or a portion of a project would divide the cost based on peak wet weather flow rates from each tributary area.

In all of the cost allocation procedures, the calibrated ALCOSAN H&H Model was the accepted tool for determining peak flow rates. In some cases where two or more municipalities were combined into one loading point, the agreement was to use the model to affect the required split through RTK and area adjustments (if separate) and area adjustment (if combined).

6.1.3 Operation & Maintenance Cost Allocation

In the development of O&M cost allocation methods, it is important to define what constitutes O&M. The following is a general list of those items considered for each POC sewershed:

- Sewer Inspection
- CCTV and cleaning
- Utilities and power requirements for pump stations and storage basins

- Chemical costs for CSO facilities
- Minor repair and rehabilitation
- Staff salaries, wages and fringe benefits
- Replacement costs (sewers and structures - 100 years; mechanical equipment – 25 years)
- SSO Response Plan

The next step was to categorize these expenses into at least groups – those items impacted by peak flow (such as CCTV and sewer cleaning) and those items impacted by volume of wastewater (such as storage basins). Once categorized, various methodologies for O&M cost allocation could be investigated. A number of approaches to O&M cost allocation were considered, and three of those chosen for capital cost allocation were also chosen for O&M cost allocations:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution

As was the case for the capital cost allocation methods, each of these approaches can be modified by the application of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc.

6.1.4 Selected Capital Cost Allocation Method

The selected method of capital cost allocation between the PWSA and their tributary municipalities is based upon the use of peak wet weather flows, as determined using the segmental approach.

Using this approach, areas of each municipality tributary to a section of new consolidation / conveyance piping would divide the cost based on peak wet weather flow rates from each municipal tributary area. The calibrated ALCOSAN H&H Model was the accepted tool for use in determining those peak flow rates.

For the purposes of this Feasibility Study, alternative POC-M47-C-4 has been divided into six (6) segments. All of these segments receive flows from one or more tributary municipalities, and are subject to the allocation of capital costs. Three of these segments convey flows generated solely by the tributary areas. General locations of the six (6) inter-municipal segments of the recommended alternative are illustrated in Figure M47-6-1.

It is anticipated that the conceptual capital cost allocation estimates for each segment will be based on the municipal peak wet weather flow percentages shown in Table M47-6-1.

TABLE M47-6-1: MUNICIPAL PEAK WET WEATHER FLOW PERCENTAGES

Segment	Percentage (%)						
	PWSA	Braddock Hills	Churchill	Edgewood	Penn Hills	Swissvale	Wilkinsburg
1	81.44	0.13	0.18	2.82	0.006	5.99	9.43
2	5.07	0.64	0.94	14.43	0.03	30.64	48.24
3	9.34	0	1.73	0	0.06	0	88.87
4	0	4.09	0	91.82	0	4.09	0
5	0	0	96.63	0	3.37	0	0
6	0	50.00	0	0	0	50.00	0

If work is done by a municipality to reduce flow below the flows currently predicted and the municipality wants to revise these percentages, that municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties prior to the commencement of the design.

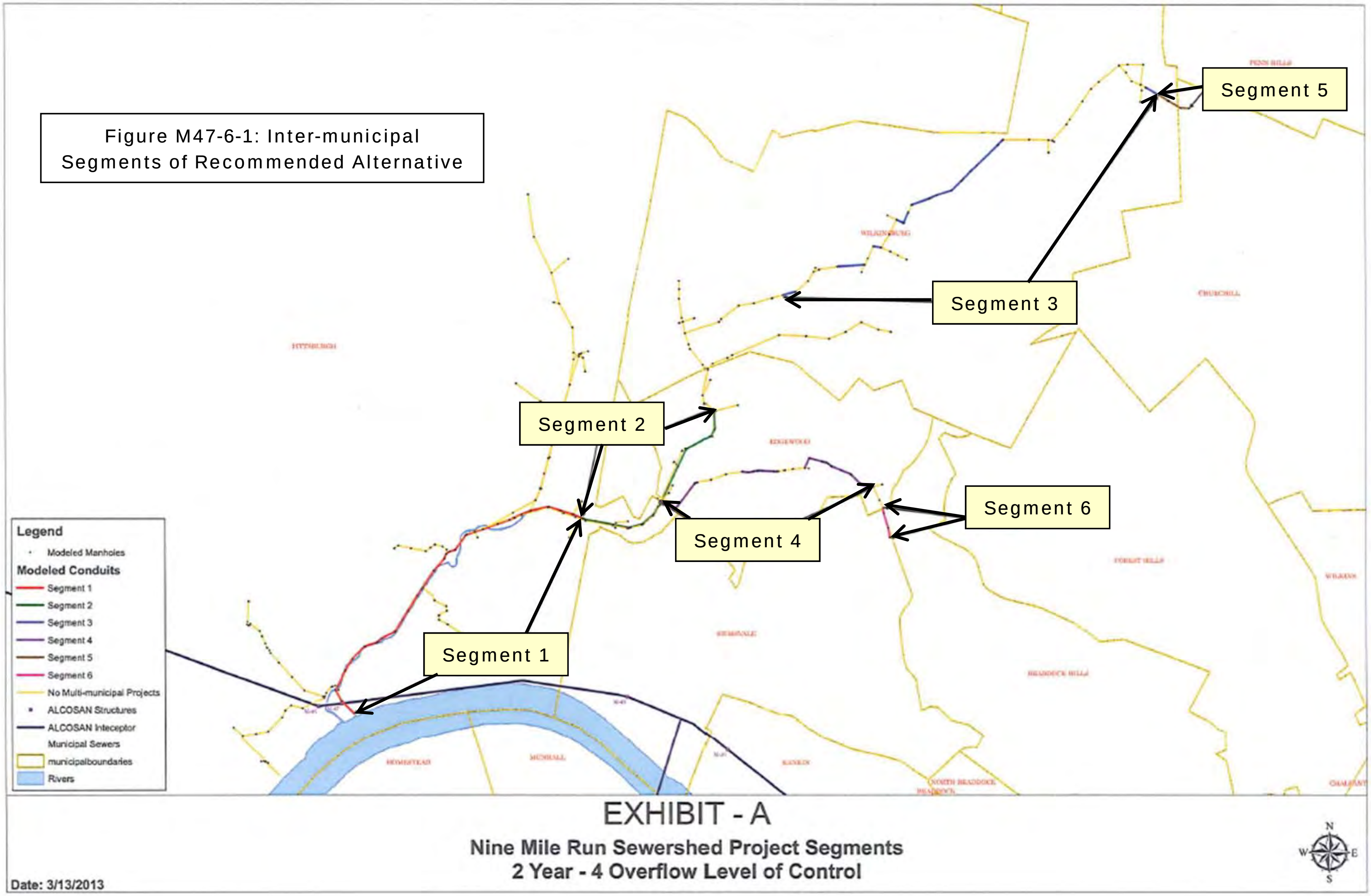


Figure M47-6-1: Inter-municipal Segments of Recommended Alternative

EXHIBIT - A

Nine Mile Run Sewershed Project Segments
2 Year - 4 Overflow Level of Control

Date: 3/13/2013

6.1.5 Selected O&M Cost Allocation Method

For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

One of the early steps taken to facilitate the development of up-to-date and relevant MOUs and/or inter-municipal agreements was to determine whether or not there were any existing, applicable MOUs or service agreements. 3RWW, working with the University of Pittsburgh, collected many of the existing agreements. The FSWG also formed an inter-municipal agreements subcommittee to review those existing agreements, develop an agreement outline for use by the municipalities, and prepare draft agendas for use in multi-municipal meetings.

The various inter-municipal agreements that have been compiled by 3RWW were reviewed for the purpose of summarizing the provisions that are relevant to allowable flow contributions. The results of this review are presented below. All specific references to “sanitary sewers”, “sanitary sewage” or other characterizations of the tributary sewer systems were extracted and presented below. In addition, specific information regarding cost sharing arrangements was also extracted from the agreements and is presented below.

1. In an agreement dated August 8, 1919, the City of Pittsburgh and Wilkinsburg Borough reached an agreement. Relevant terms of that agreement are as follows:
   - Provides for “an interchange of facilities for sewerage connections between the said municipalities”;
   - “Either municipality, party to this agreement, shall have the right to make connections with the sewerage system of the other party to this agreement subject to the terms and conditions provided in this agreement”;
   - Application for the right to make such connections shall “contain a statement giving full information as to sizes and lengths of sewers to be connected, kind of system, area drained, estimated present and future population, and such additional information as may be reasonably required by the party of the other part.”

- "Permission to make connections to the existing sewers of the City or Borough, respectively, shall be granted only when the representatives of the City or Borough conclude that the sewerage system to which the connections will be made will have an adequate capacity for the additional drainage, and that said system will not be injuriously affected thereby."
- "The rights to connect any sewerage system of either municipality with the sewerage system of the other municipality by may terminated by the City of Pittsburgh or Wilkinsburg upon giving six month notice in writing. Upon receipt of such notice of termination, the City or Borough shall proceed to disconnect the said sewers and make such other arrangements or provisions as may be required by the special circumstances in each case."

2. In an agreement dated May 15, 1933, the City of Pittsburgh, Swissvale Borough reached an agreement. Relevant terms of that agreement are as follows:
   - The City of Pittsburgh grants the Borough of Swissvale the right to construct an 18" sewer through a portion of Frick Park from the City/Borough line at Braddock Avenue to connect with the existing Nine Mile Run Trunk Sewer southwest of Trevanion Avenue and no cost to the City of Pittsburgh.
   - Swissvale pays the City $9,422.45 with 6% interest four annual installments.
   - Swissvale will "from time to time as they accrue pay to the City of Pittsburgh its pro rata share, which is 6.6% of the costs of maintenance and repairs to the Nine Mile Run Trunk Sewer, from a point southwest of Trevanion Avenue to the Monongahela River."

3. In an agreement dated May 15, 1933, the City of Pittsburgh, Swissvale Borough reached an agreement. Relevant terms of that agreement are as follows:
   - City permits the township to discharge storm and sanitary drainage from an area of 39.3 acres (East Crossroads Center) into the Exley Way branch of the Nine Mile Run Trunk Sewer.
   - Township pays the City $800.

It should be emphasized that the agreements listed above are not anticipated to be used as the inter-municipal agreements for this project. The draft MOU developed per the following subsections would serve as an initial understanding of what would form a new future agreement between the municipalities.

6.2.1 Development of MOU and Inter-Municipal Agreements

When more than one municipality is involved in the design, construction and operation of wet weather control facilities, it is intended that they will develop inter-municipal agreements to outline their mutual understanding of the project as well as their municipal, customer and legal responsibilities. These responsibilities include, but are not limited to, joint permitting, joint ownership, joint cost sharing, and who will operate and maintain the facility on a long term basis.

In addition, it is the PWSA's position that any agreements or MOUs should contain provisions for periodic review and amendment as necessary by the respective parties and their solicitors.

6.2.2 MOU and Inter-Municipal Agreements

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

In summary, the draft MOU states that, for the purpose of submitting the feasibility study, the municipalities agree that the preliminary estimated total cost to be expended on the inter-municipal segments of the recommended alternative, as shown in Figure M47-6-1, is in the range of $27,045,000 to $32,500,000. This cost represents the cost associated with the elements of the required improvements in the sewershed that provide multi-municipal service (i.e. convey or otherwise handle flows generated by more than one municipality). Each municipality shall have the right to void the MOU if the total cost exceeds $40,000,000. The draft MOU also states that the municipalities agree that the basis of allocation for costs of each segment is based on percentage of peak flow contributed to each segment at the time of the MOU, multiplied by the preliminary estimated total cost of each segment agreed to by the municipalities that will share in such costs.

It is intended that an agreement will be entered into by all parties after an implementation order has been issued by the PADEP and/or the ACHD. Such an order would indicate that the cost to each party would be based on the cost of each segment, to be adjusted for changes in costs made during construction.

The draft MOU further states that, for the purpose of submitting the Feasibility Study, the municipalities agree, with the exception of the Municipality of Penn Hills, that the preliminary estimate of the percentage and amount of the total cost of implementation of the recommended alternative for each municipality will be as indicated below:

- Braddock Hills Borough 1.8% ($474,000)
- Churchill Borough 1.9% ($507,000)
- Edgewood Borough 14.5% ($3,918,000)
- Municipality of Penn Hills 0.1% ($18,000)
- Swissvale Borough 11.9% ($3,218,000)
- Wilkinsburg Borough 27.5% ($7,451,000)
- The Pittsburgh Water and Sewer Authority 42.4% ($11,459,000)

It is noted that these costs represent the allocated costs for joint conveyance facilities. These costs do not include additional costs that may be associated with other recommended improvements in the sewershed within individual municipalities. The draft MOU is provided in Attachment M47-6-1. Also, signed copies of the MOU, if provided by the municipality, would be provided in Addendum M47-6-1. It should be noted that the municipality of Penn Hills has not agreed to the methodology used to propose projects or with the cost allocations. The Municipality of Penn Hills is of the opinion that they are responsible for $0 per existing cost sharing agreements.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended M-47 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after M-47 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

Phase I	2013 through 2017
Phase II	2017 through 2023
Phase III	2021 through 2026
Phase IV	TBD
Phase V	TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure M47-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the M-47 shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

6.3.2 Joint Municipal Planning and Implementation

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. The draft MOU contains provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

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[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

All associated parties in the POC sewershed have participated in planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. Signature pages of executed MOUs or other expressions of agreement as provided by the municipalities are attached as Addendum M47-6-1 to this POC report.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$27,050,000; of this, a range of $27,050,000 to $32,500,000 would be part of the inter-municipal agreement.

- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance

- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table M47-6-2. The projected costs per household includes the “normal” current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE M47-6-2: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638
Braddock Hill Borough	$87	Not Available	Not Available
Churchill Borough	$470	$1,273	Not Available
Edgewood Borough[4]	$583	$1,416	Not Available
Municipality of Penn Hills	$702	$1,414	Not Available
Swissvale Borough	Not Available	$560	Not Available
Wilkinsburg Borough	Not Available	$654	Not Available

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure M47-6-2.

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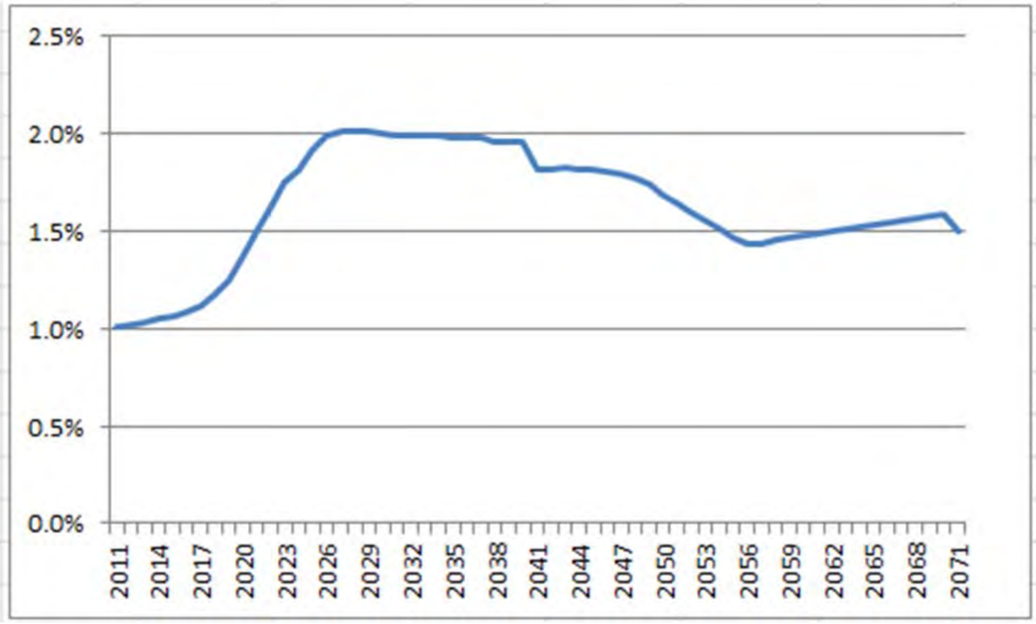
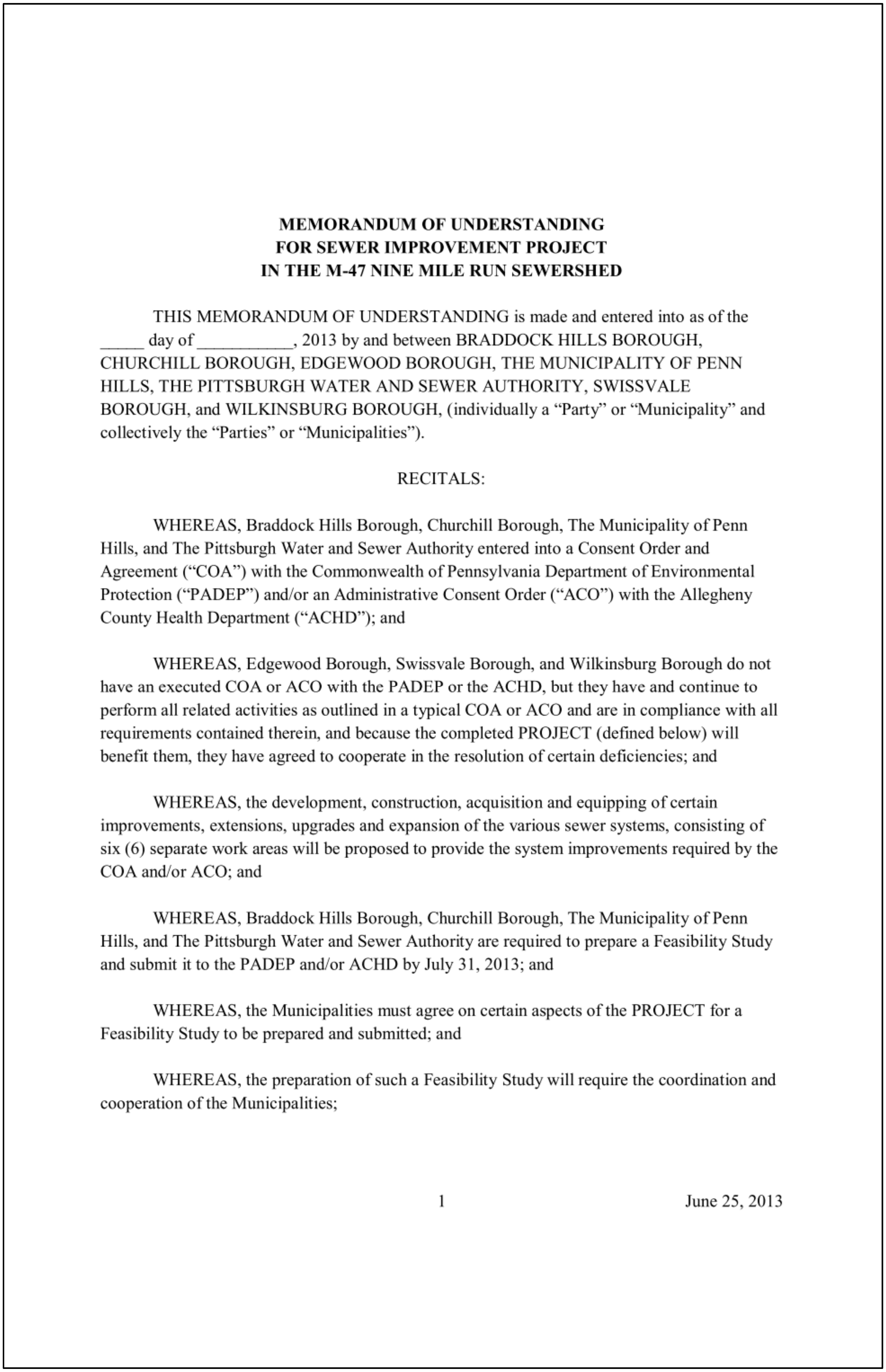
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.
[4] Estimated based on 3RWW Analysis in FSWG Document 029, with the exception of 15,000 gallons per quarter, in lieu of 13,000 gallons per quarter.

FIGURE M47-6-2 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.



MEMORANDUM OF UNDERSTANDING
FOR SEWER IMPROVEMENT PROJECT
IN THE M-47 NINE MILE RUN SEWERSHED

THIS MEMORANDUM OF UNDERSTANDING is made and entered into as of the _____ day of ___________, 2013 by and between BRADDOCK HILLS BOROUGH, CHURCHILL BOROUGH, EDGEWOOD BOROUGH, THE MUNICIPALITY OF PENN HILLS, THE PITTSBURGH WATER AND SEWER AUTHORITY, SWISSVALE BOROUGH, and WILKINSBURG BOROUGH, (individually a “Party” or “Municipality” and collectively the “Parties” or “Municipalities”).

RECITALS:

WHEREAS, Braddock Hills Borough, Churchill Borough, The Municipality of Penn Hills, and The Pittsburgh Water and Sewer Authority entered into a Consent Order and Agreement (“COA”) with the Commonwealth of Pennsylvania Department of Environmental Protection (“PADEP”) and/or an Administrative Consent Order (“ACO”) with the Allegheny County Health Department (“ACHD”); and

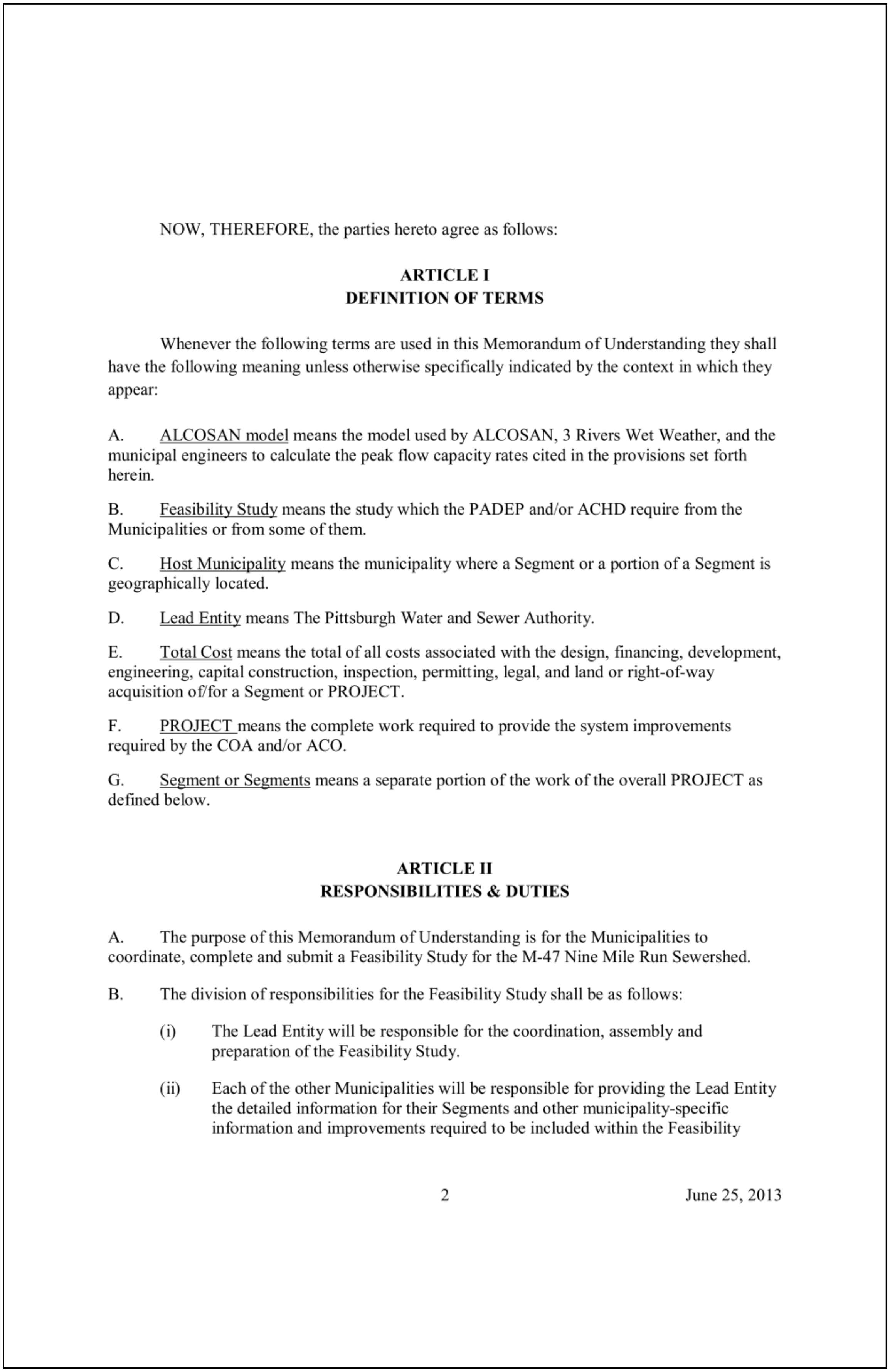
WHEREAS, Edgewood Borough, Swissvale Borough, and Wilkinsburg Borough do not have an executed COA or ACO with the PADEP or the ACHD, but they have and continue to perform all related activities as outlined in a typical COA or ACO and are in compliance with all requirements contained therein, and because the completed PROJECT (defined below) will benefit them, they have agreed to cooperate in the resolution of certain deficiencies; and

WHEREAS, the development, construction, acquisition and equipping of certain improvements, extensions, upgrades and expansion of the various sewer systems, consisting of six (6) separate work areas will be proposed to provide the system improvements required by the COA and/or ACO; and

WHEREAS, Braddock Hills Borough, Churchill Borough, The Municipality of Penn Hills, and The Pittsburgh Water and Sewer Authority are required to prepare a Feasibility Study and submit it to the PADEP and/or ACHD by July 31, 2013; and

WHEREAS, the Municipalities must agree on certain aspects of the PROJECT for a Feasibility Study to be prepared and submitted; and

WHEREAS, the preparation of such a Feasibility Study will require the coordination and cooperation of the Municipalities;



NOW, THEREFORE, the parties hereto agree as follows:

ARTICLE I
DEFINITION OF TERMS

Whenever the following terms are used in this Memorandum of Understanding they shall have the following meaning unless otherwise specifically indicated by the context in which they appear:

A. ALCOSAN model means the model used by ALCOSAN, 3 Rivers Wet Weather, and the municipal engineers to calculate the peak flow capacity rates cited in the provisions set forth herein.

B. Feasibility Study means the study which the PADEP and/or ACHD require from the Municipalities or from some of them.

C. Host Municipality means the municipality where a Segment or a portion of a Segment is geographically located.

D. Lead Entity means The Pittsburgh Water and Sewer Authority.

E. Total Cost means the total of all costs associated with the design, financing, development, engineering, capital construction, inspection, permitting, legal, and land or right-of-way acquisition of/for a Segment or PROJECT.

F. PROJECT means the complete work required to provide the system improvements required by the COA and/or ACO.

G. Segment or Segments means a separate portion of the work of the overall PROJECT as defined below.

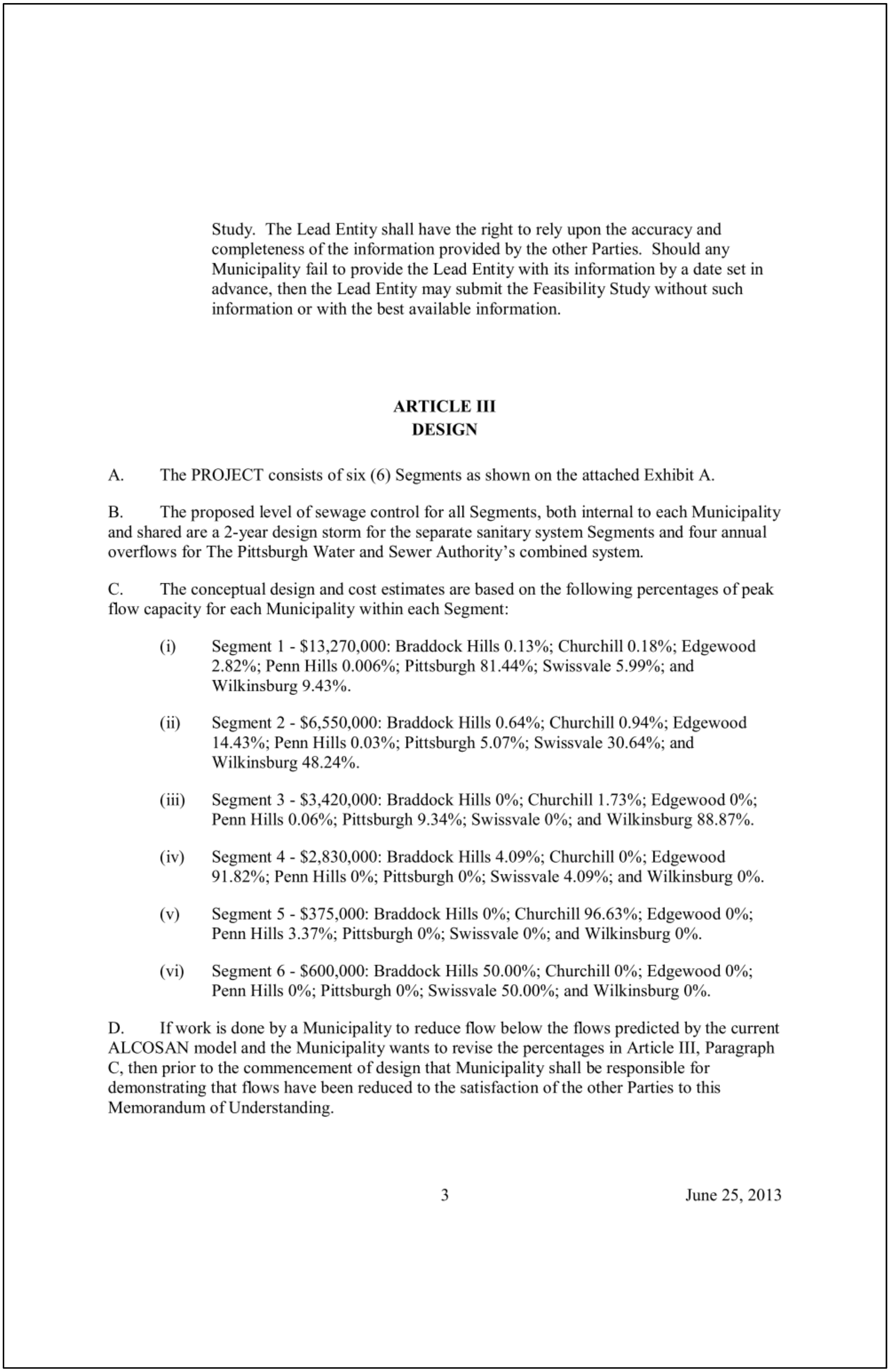
ARTICLE II
RESPONSIBILITIES & DUTIES

A. The purpose of this Memorandum of Understanding is for the Municipalities to coordinate, complete and submit a Feasibility Study for the M-47 Nine Mile Run Sewershed.

B. The division of responsibilities for the Feasibility Study shall be as follows:

   (i) The Lead Entity will be responsible for the coordination, assembly and preparation of the Feasibility Study.

   (ii) Each of the other Municipalities will be responsible for providing the Lead Entity the detailed information for their Segments and other municipality-specific information and improvements required to be included within the Feasibility



Study. The Lead Entity shall have the right to rely upon the accuracy and completeness of the information provided by the other Parties. Should any Municipality fail to provide the Lead Entity with its information by a date set in advance, then the Lead Entity may submit the Feasibility Study without such information or with the best available information.

ARTICLE III
DESIGN

A. The PROJECT consists of six (6) Segments as shown on the attached Exhibit A.

B. The proposed level of sewage control for all Segments, both internal to each Municipality and shared are a 2-year design storm for the separate sanitary system Segments and four annual overflows for The Pittsburgh Water and Sewer Authority's combined system.

C. The conceptual design and cost estimates are based on the following percentages of peak flow capacity for each Municipality within each Segment:

(i) Segment 1 - $13,270,000: Braddock Hills 0.13%; Churchill 0.18%; Edgewood 2.82%; Penn Hills 0.006%; Pittsburgh 81.44%; Swissvale 5.99%; and Wilkinsburg 9.43%.

(ii) Segment 2 - $6,550,000: Braddock Hills 0.64%; Churchill 0.94%; Edgewood 14.43%; Penn Hills 0.03%; Pittsburgh 5.07%; Swissvale 30.64%; and Wilkinsburg 48.24%.

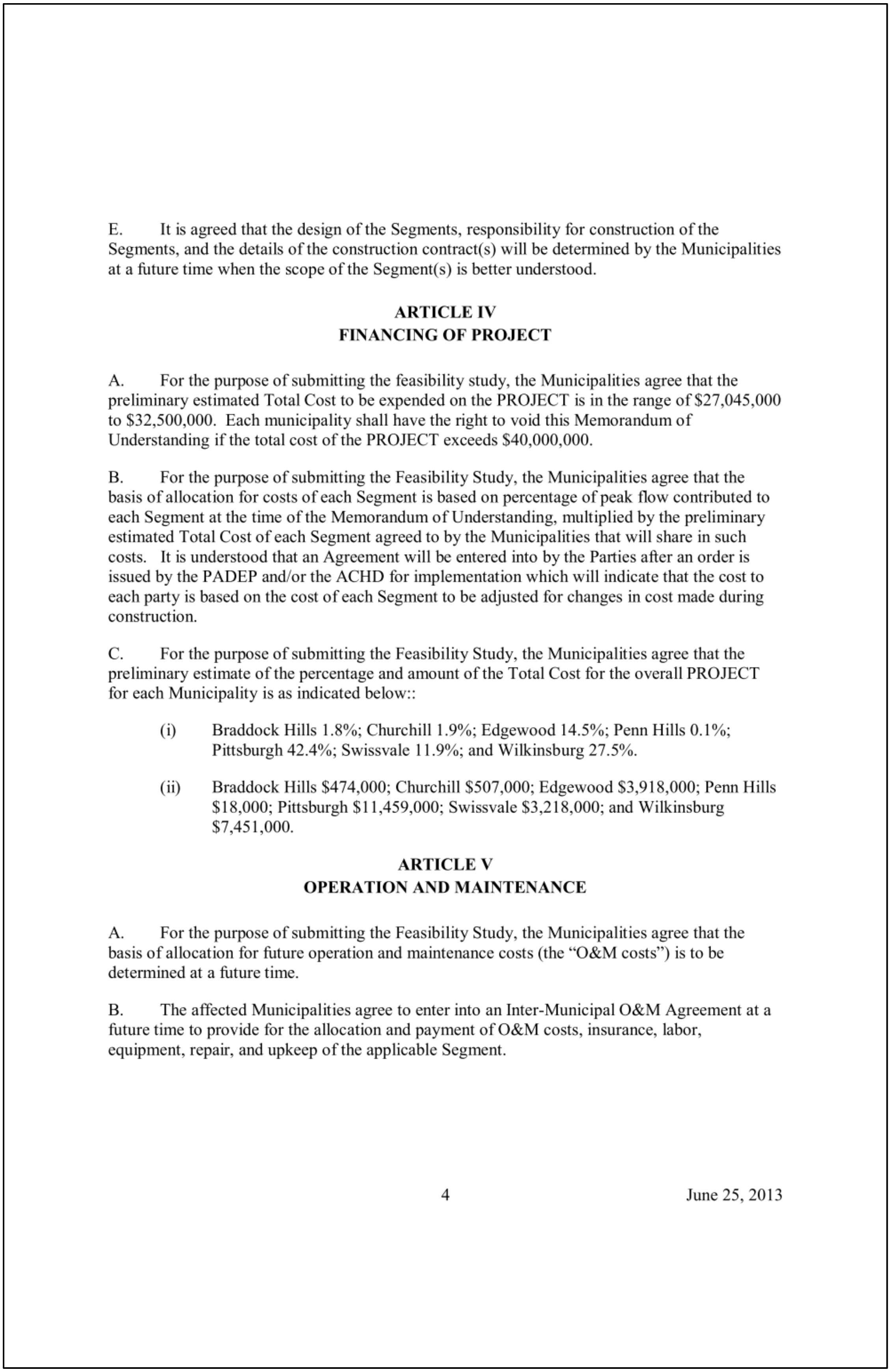
(iii) Segment 3 - $3,420,000: Braddock Hills 0%; Churchill 1.73%; Edgewood 0%; Penn Hills 0.06%; Pittsburgh 9.34%; Swissvale 0%; and Wilkinsburg 88.87%.

(iv) Segment 4 - $2,830,000: Braddock Hills 4.09%; Churchill 0%; Edgewood 91.82%; Penn Hills 0%; Pittsburgh 0%; Swissvale 4.09%; and Wilkinsburg 0%.

(v) Segment 5 - $375,000: Braddock Hills 0%; Churchill 96.63%; Edgewood 0%; Penn Hills 3.37%; Pittsburgh 0%; Swissvale 0%; and Wilkinsburg 0%.

(vi) Segment 6 - $600,000: Braddock Hills 50.00%; Churchill 0%; Edgewood 0%; Penn Hills 0%; Pittsburgh 0%; Swissvale 50.00%; and Wilkinsburg 0%.

D. If work is done by a Municipality to reduce flow below the flows predicted by the current ALCOSAN model and the Municipality wants to revise the percentages in Article III, Paragraph C, then prior to the commencement of design that Municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties to this Memorandum of Understanding.



E. It is agreed that the design of the Segments, responsibility for construction of the Segments, and the details of the construction contract(s) will be determined by the Municipalities at a future time when the scope of the Segment(s) is better understood.

ARTICLE IV
FINANCING OF PROJECT

A. For the purpose of submitting the feasibility study, the Municipalities agree that the preliminary estimated Total Cost to be expended on the PROJECT is in the range of $27,045,000 to $32,500,000. Each municipality shall have the right to void this Memorandum of Understanding if the total cost of the PROJECT exceeds $40,000,000.

B. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for costs of each Segment is based on percentage of peak flow contributed to each Segment at the time of the Memorandum of Understanding, multiplied by the preliminary estimated Total Cost of each Segment agreed to by the Municipalities that will share in such costs. It is understood that an Agreement will be entered into by the Parties after an order is issued by the PADEP and/or the ACHD for implementation which will indicate that the cost to each party is based on the cost of each Segment to be adjusted for changes in cost made during construction.

C. For the purpose of submitting the Feasibility Study, the Municipalities agree that the preliminary estimate of the percentage and amount of the Total Cost for the overall PROJECT for each Municipality is as indicated below::

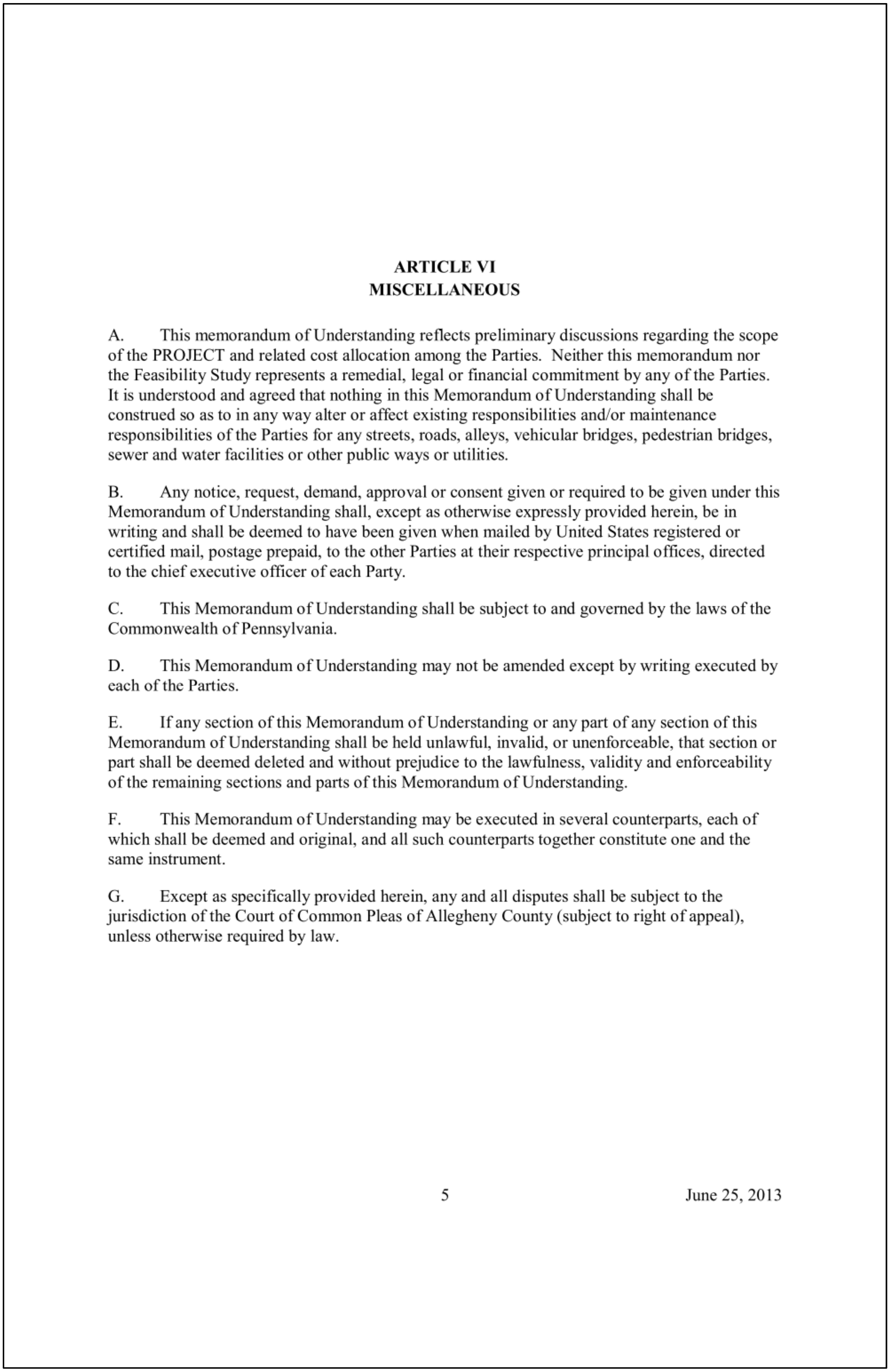
(i) Braddock Hills 1.8%; Churchill 1.9%; Edgewood 14.5%; Penn Hills 0.1%; Pittsburgh 42.4%; Swissvale 11.9%; and Wilkinsburg 27.5%.

(ii) Braddock Hills $474,000; Churchill $507,000; Edgewood $3,918,000; Penn Hills $18,000; Pittsburgh $11,459,000; Swissvale $3,218,000; and Wilkinsburg $7,451,000.

ARTICLE V
OPERATION AND MAINTENANCE

A. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for future operation and maintenance costs (the “O&M costs”) is to be determined at a future time.

B. The affected Municipalities agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the applicable Segment.



ARTICLE VI
MISCELLANEOUS

A. This memorandum of Understanding reflects preliminary discussions regarding the scope of the PROJECT and related cost allocation among the Parties. Neither this memorandum nor the Feasibility Study represents a remedial, legal or financial commitment by any of the Parties. It is understood and agreed that nothing in this Memorandum of Understanding shall be construed so as to in any way alter or affect existing responsibilities and/or maintenance responsibilities of the Parties for any streets, roads, alleys, vehicular bridges, pedestrian bridges, sewer and water facilities or other public ways or utilities.

B. Any notice, request, demand, approval or consent given or required to be given under this Memorandum of Understanding shall, except as otherwise expressly provided herein, be in writing and shall be deemed to have been given when mailed by United States registered or certified mail, postage prepaid, to the other Parties at their respective principal offices, directed to the chief executive officer of each Party.

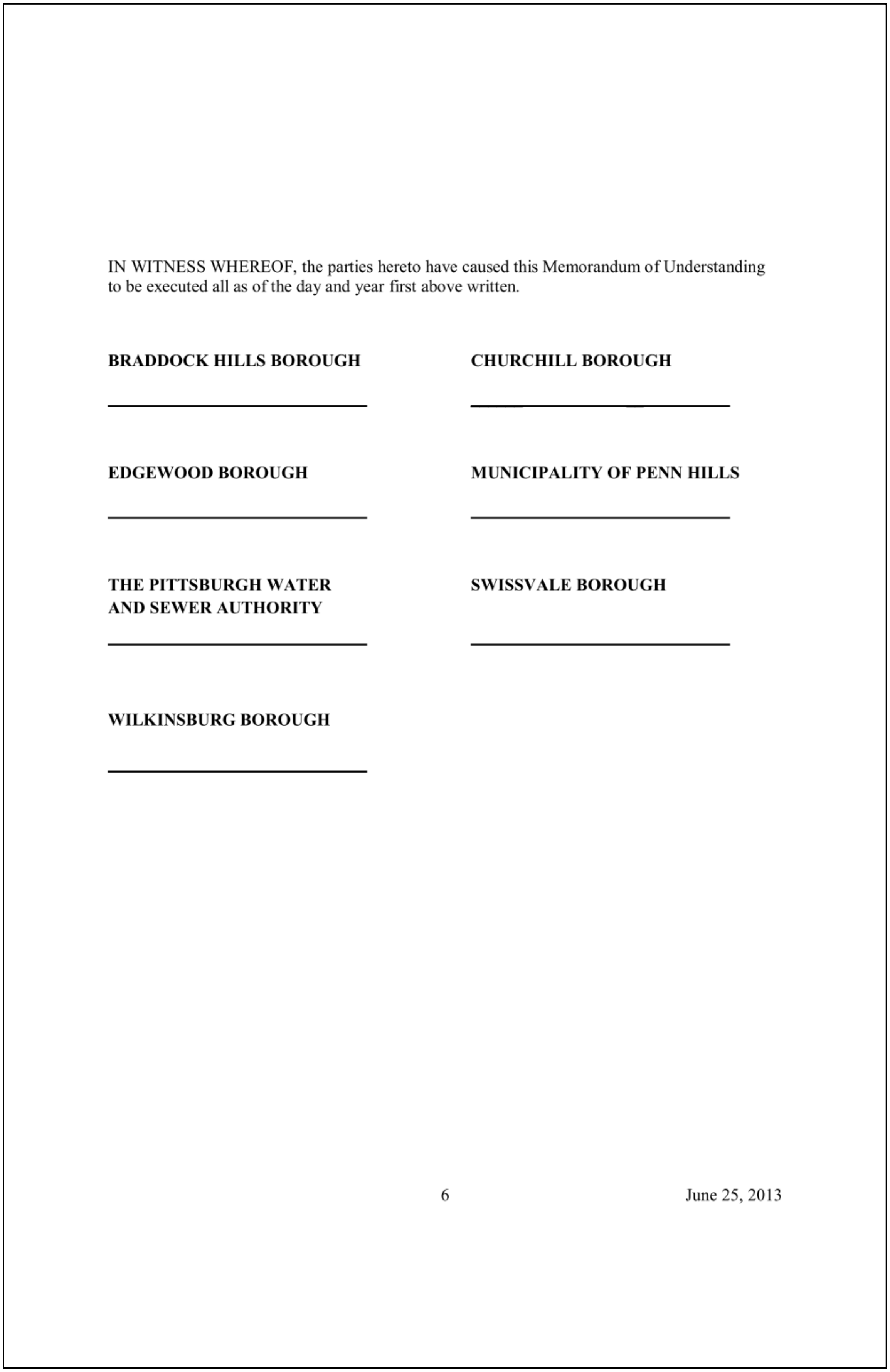
C. This Memorandum of Understanding shall be subject to and governed by the laws of the Commonwealth of Pennsylvania.

D. This Memorandum of Understanding may not be amended except by writing executed by each of the Parties.

E. If any section of this Memorandum of Understanding or any part of any section of this Memorandum of Understanding shall be held unlawful, invalid, or unenforceable, that section or part shall be deemed deleted and without prejudice to the lawfulness, validity and enforceability of the remaining sections and parts of this Memorandum of Understanding.

F. This Memorandum of Understanding may be executed in several counterparts, each of which shall be deemed and original, and all such counterparts together constitute one and the same instrument.

G. Except as specifically provided herein, any and all disputes shall be subject to the jurisdiction of the Court of Common Pleas of Allegheny County (subject to right of appeal), unless otherwise required by law.



IN WITNESS WHEREOF, the parties hereto have caused this Memorandum of Understanding to be executed all as of the day and year first above written.

BRADDOCK HILLS BOROUGH

____

CHURCHILL BOROUGH

____

EDGEWOOD BOROUGH

____

MUNICIPALITY OF PENN HILLS

____

**THE PITTSBURGH WATER
AND SEWER AUTHORITY**

____

SWISSVALE BOROUGH

____

WILKINSBURG BOROUGH

____

EXHIBIT - A

Nine Mile Run Sewershed Project Segments
2 Year - 4 Overflow Level of Control

Date: 3/13/2013

7.0 STAKEHOLDER INVOLVEMENT

Stakeholder meetings titled POC Sewershed Coordination Meetings, facilitated by 3RWW, were held during the site and technology selection and alternative development processes. These meetings facilitated cooperation, information exchange and consensus building between the PWSA, its stakeholders and tributary municipalities essential to the development of the PWSA Feasibility Study Report and supporting POC-based feasibility studies. For the meetings listed in Table 7-1, POC M-47 was the focus of the discussion and representatives from municipalities' tributary to the Nine Mile Run sewershed were in attendance. Meeting topics included source reduction and green infrastructure, alternatives analysis, affordability and implementation schedule, and cost allocation. Other stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

The Wet Weather Feasibility Study Coordination Meeting, led by the PWSA, facilitated stakeholder participation between the PWSA and Edgewood Borough, Municipality of Penn Hills, Swissvale Borough and Wilkinsburg Borough communities tributary to the Nine Mile Run watershed. The purpose of this meeting was to coordinate the development of planning information specific to the multi-municipal sewershed, reach a consensus agreement on the recommended improvements and receive authorization to submit the results.

TABLE 7-1: NINE MILE RUN M-47 POC MEETINGS

Title/Purpose	Date	Time	Location
POC Sewershed Coordination	1/24/12	9:00 AM	PWSA Office
POC Sewershed Coordination	2/28/12	1:30 PM	PWSA Office
WW Feasibility Study Coordination	3/27/12	2:15 PM	PWSA Office
POC Sewershed Coordination	3/29/12	1:30 PM	PWSA Office
POC Sewershed Coordination	4/26/12	1:30 PM	PWSA Office
POC Sewershed Coordination	5/31/12	9:30 AM	PWSA Office
POC Sewershed Coordination	9/11/12	9:30 AM	PWSA Office
POC Sewershed Coordination	10/10/12	9:30 AM	PWSA Office
POC Sewershed Coordination	11/14/12	9:30 AM	PWSA Office
POC Sewershed Coordination	12/19/12	9:30 AM	PWSA Office
POC Sewershed Coordination	2/12/13	9:30 AM	PWSA Office
POC Sewershed Coordination	3/12/13	9:30 AM	PWSA Office

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
MH-11: MCCARTNEY RUN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's tributary communities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh and Ingram Borough. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.

- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.

- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.

- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.

- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.

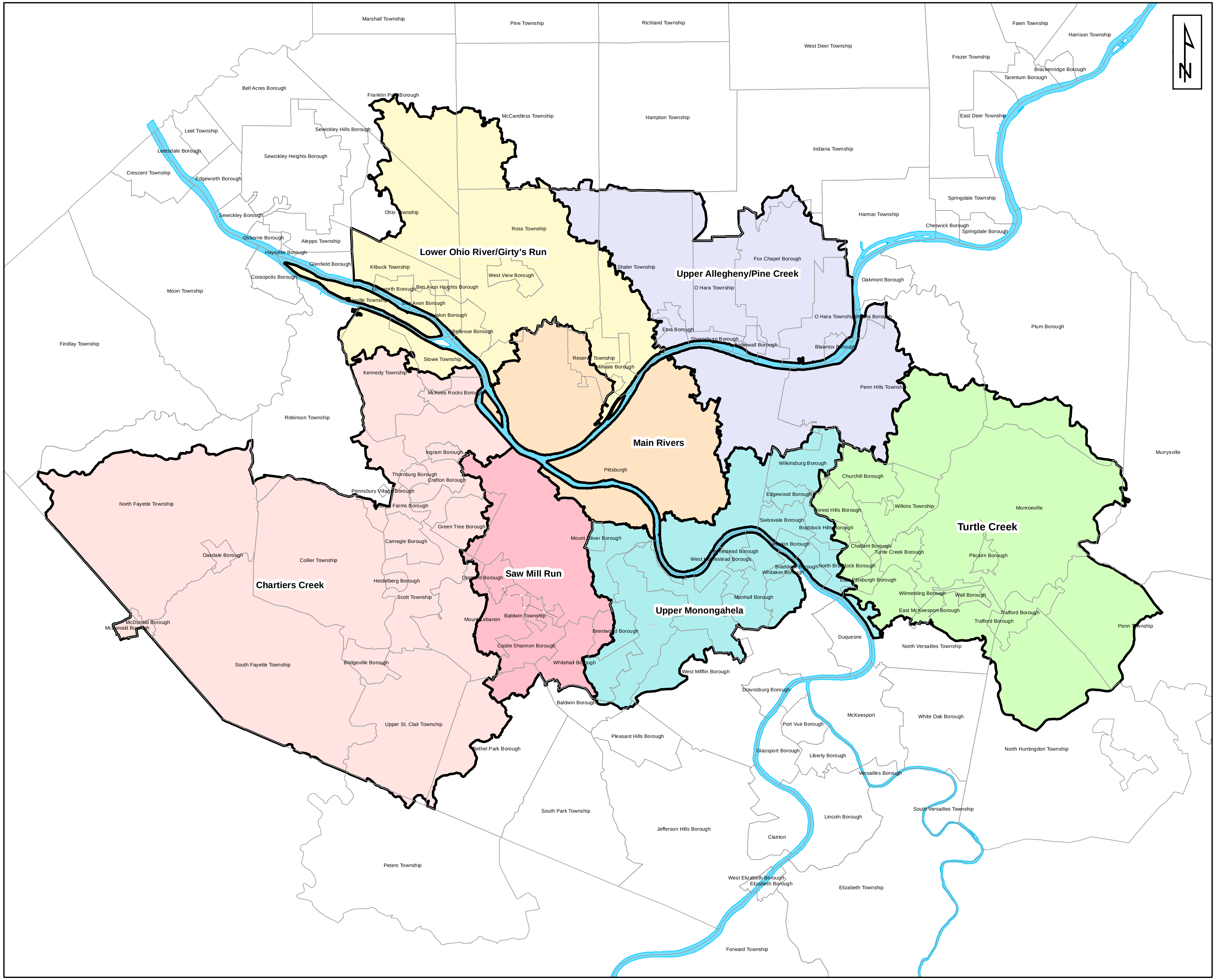
- Section 7.0 describes how stakeholders were included in the development of the plan.

1.2 EXISTING SYSTEM DESCRIPTION

This POC FS Report addresses POC MH-11, also known as McCartney Run. The MH-11 sewershed is located in the Saw Mill Run Planning Basin. The Saw Mill Run basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: MH-11 McCartney Run Existing Facilities Map*. The MH-11 sewershed is served by one main trunk sewer that connects directly into the ALCOSAN Saw Mill Run Interceptor at the intersection of McCartney and Wabash Streets without an overflow at the connection. The flows are conveyed through the ALCOSAN Saw Mill Run Interceptor to ALCOSAN diversion chamber O-14 at the Ohio River. There are two parallel lines in the McCartney Run Sewershed. One line is a “Primary Overflow/ Storm System” and the other is the “Major Trunk Line”. The Major Trunk Line runs parallel to McCartney Street and then towards intersection of Noblestown Road and Obey Street, then follows Noblestown Road. This pipe is constructed of 12-inch and 15-inch diameter vitrified clay pipe. The Primary Overflow/ Storm System is an overflow pipe that starts at the ALCOSAN Sawmill Run Interceptor as an 84-inch diameter reinforced concrete pipe. This system runs parallel to the Main Trunk Line and ranges in size from 84 inches to 42 inches in diameter.

There are six PWSA CSO diversion chambers in the sewershed that overflow to Saw Mill Run at two permitted CSOs. The MH-11 sewershed encompasses approximately 595 acres. The sewershed is made up of 502 acres of the City of Pittsburgh and approximately 2 acres of Ingram Borough. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to MH-11* for specific information on this POC.



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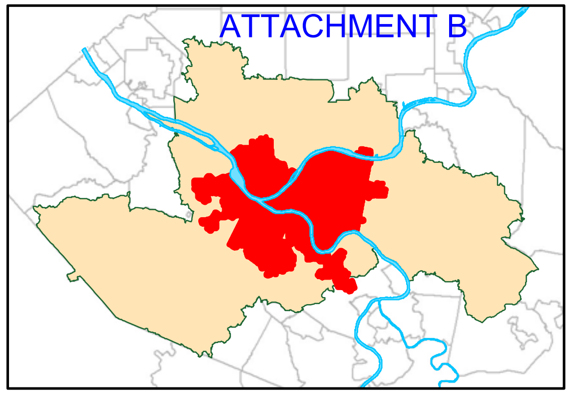

ALCOSAN Service Area Overview

Legend

- ☐ Municipal Boundary
- ▨ Chartiers Creek
- ▨ Lower Ohio River / Girty's Run
- ▨ Main Rivers
- ▨ Saw Mill Run
- ▨ Turtle Creek
- ▨ Upper Allegheny / Pine Creek
- ▨ Upper Monongahela
- ▨ River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

PWSA
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Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd

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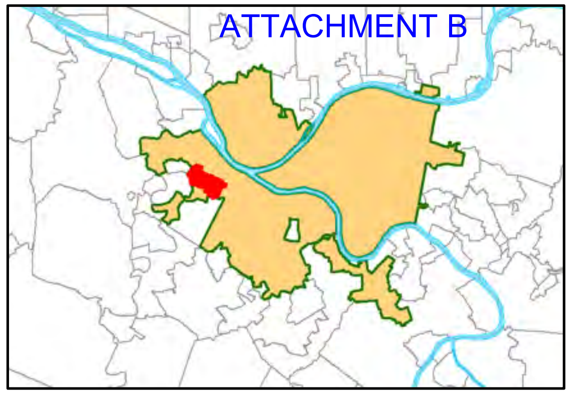


PWSA Service Area Overview

Legend

- ● PWSA CSO Diversion Structure
- Trunk Sewer
- Collector Sewer
- ☐ MH-11 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- ■ River

Existing ALCOSAN Interceptor

- Deep Tunnel
- Shallow Cut

Figure 1 - 2: MH-11
McCartney Run
Existing Facilities

July 2013

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR AREA TRIBUTARY TO MH-11

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY	
	City of Pittsburgh	Ingram Borough
Tributary Area (Acres)	502	2
Population	3,137	0
Combined		
Inch-Miles	191	2
Linear Feet	63,946	1,061
Inch-Miles/Acre	0.38	1
Separate		
Inch-Miles	0.8	0
Linear Feet	544	0
Inch-Miles/Acre	0.01	0

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows from the upstream PWSA diversion structures tie directly into the Saw Mill Run interceptor with no overflow structure. The Saw Mill Run interceptor conveys those flows to ALCOSAN diversion structure O-14.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to MH-11*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO MH-11

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
N/A	DC019J001 DC019K001 DC019L001 DC019S001 DC040M001 DC040M002	CSO019M001	Green Tree Road and McCartney Street	Saw Mill Run

As shown in *Table 1-3: MH-11 Sewershed Typical Year Overflow Statistics*, during the typical year these six structures overflow between zero and 58 times. Overflow volumes range from zero gallons to 350,000 gallons per event, and from zero to 590,000 gallons annually, on a structure by structure basis. Annual overflow volume for this sewershed is 2.12 million gallons.

TABLE 1-3: MH-11 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC019J001	0	N/A	N/A	N/A	N/A	N/A	N/A	0.0
DC019K001	58	8.9	0.7	0.2	0.1	0.01	0.01	0.5
DC019L001	3	1.8	N/A	N/A	0.1	N/A	N/A	0.1
DC019S001	16	1.2	1.2	0.1	0.1	0.02	0.01	0.4
DC040M001	2	20.7	N/A	N/A	0.4	N/A	N/A	0.6
DC040M002	8	16.1	0.7	N/A	0.3	0.01	N/A	0.5
Total Annual Volume								**2.12**

1.2.1 Diversion Structure Sketches

The following sketches of the MH-11 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 019J001
NPDES #: NA
Type: Orifice
Flow Divider: N
Sewershed: McCartney Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	TC	NA	NA	
Invert:	916.13	NA	NA	ft
Slope:	54.5	NA	NA	%

Weir

Crest:	916.59	ft
Length:	4.25	ft

Effluent Sewers (non-overflow)

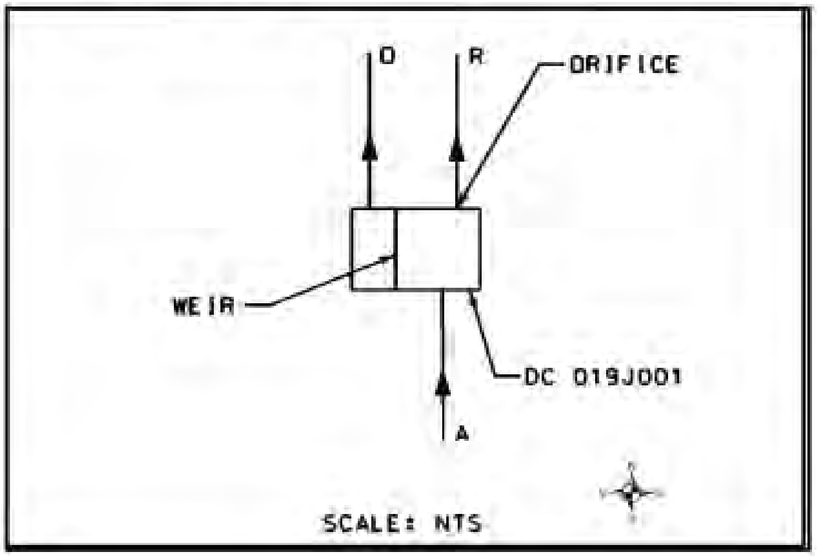
	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	915.21	NA	NA	ft
Slope:	44.06	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	912.38	ft
Slope:	9.83	%

Orifice

	U	V	W	
Invert:	915.21	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	1.25	NA	NA	ft
Opening Width:	NA	NA	NA	ft



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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 019J001

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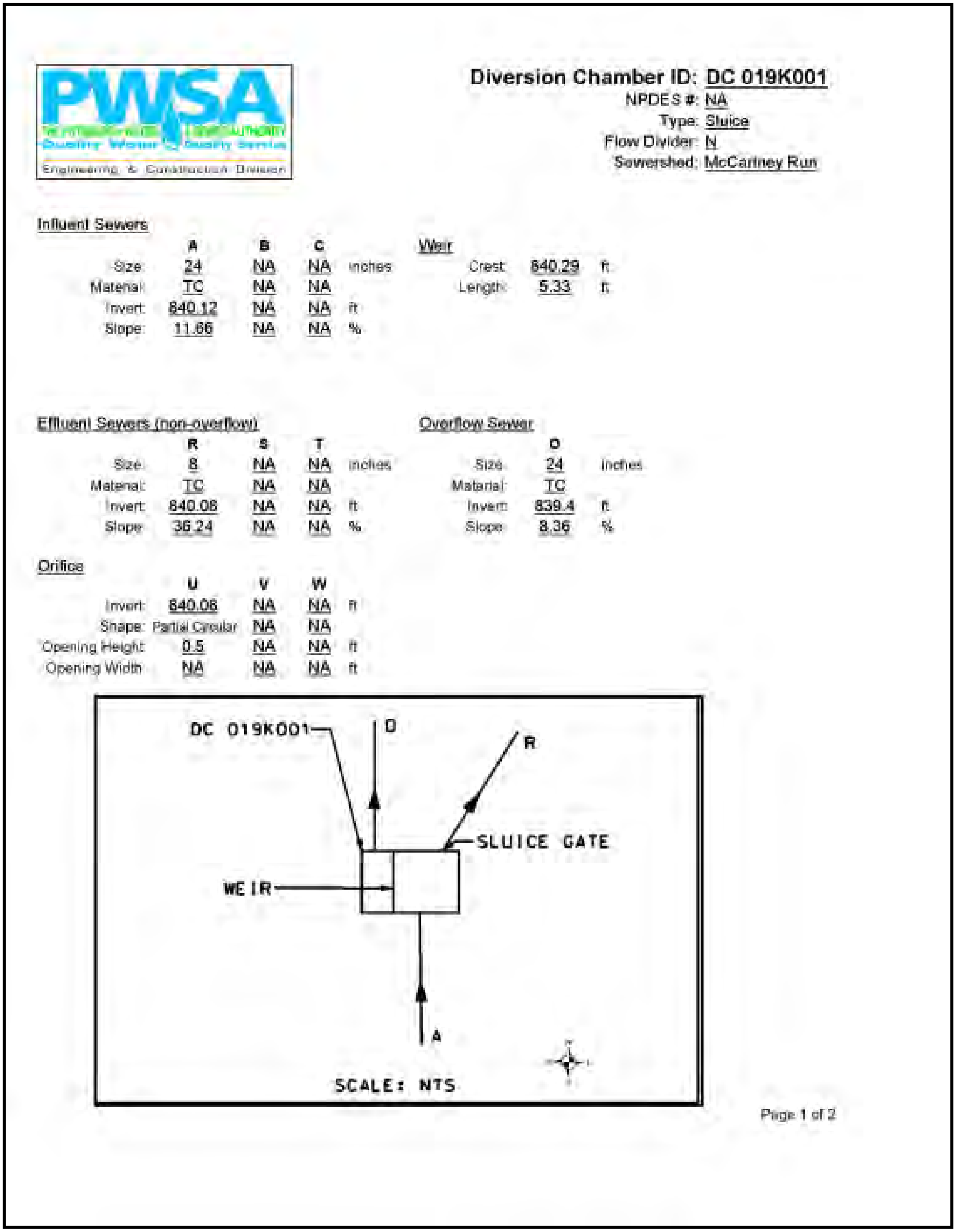

PWSA
The Pittsburgh Water & Sewer Authority
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 019K001
NPDES #: NA
Type: Sluice
Flow Divider: N
Sewershed: McCartney Run

Influent Sewers

	A	B	C	
Size:	24	NA	NA	inches
Material:	TC	NA	NA	
Invert:	840.12	NA	NA	ft
Slope:	11.66	NA	NA	%

Weir

Crest:	840.29	ft
Length:	5.33	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	840.08	NA	NA	ft
Slope:	36.24	NA	NA	%

Overflow Sewer

	O	
Size:	24	inches
Material:	TC	
Invert:	839.4	ft
Slope:	8.36	%

Orifice

	U	V	W	
Invert:	840.08	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.5	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 019K001

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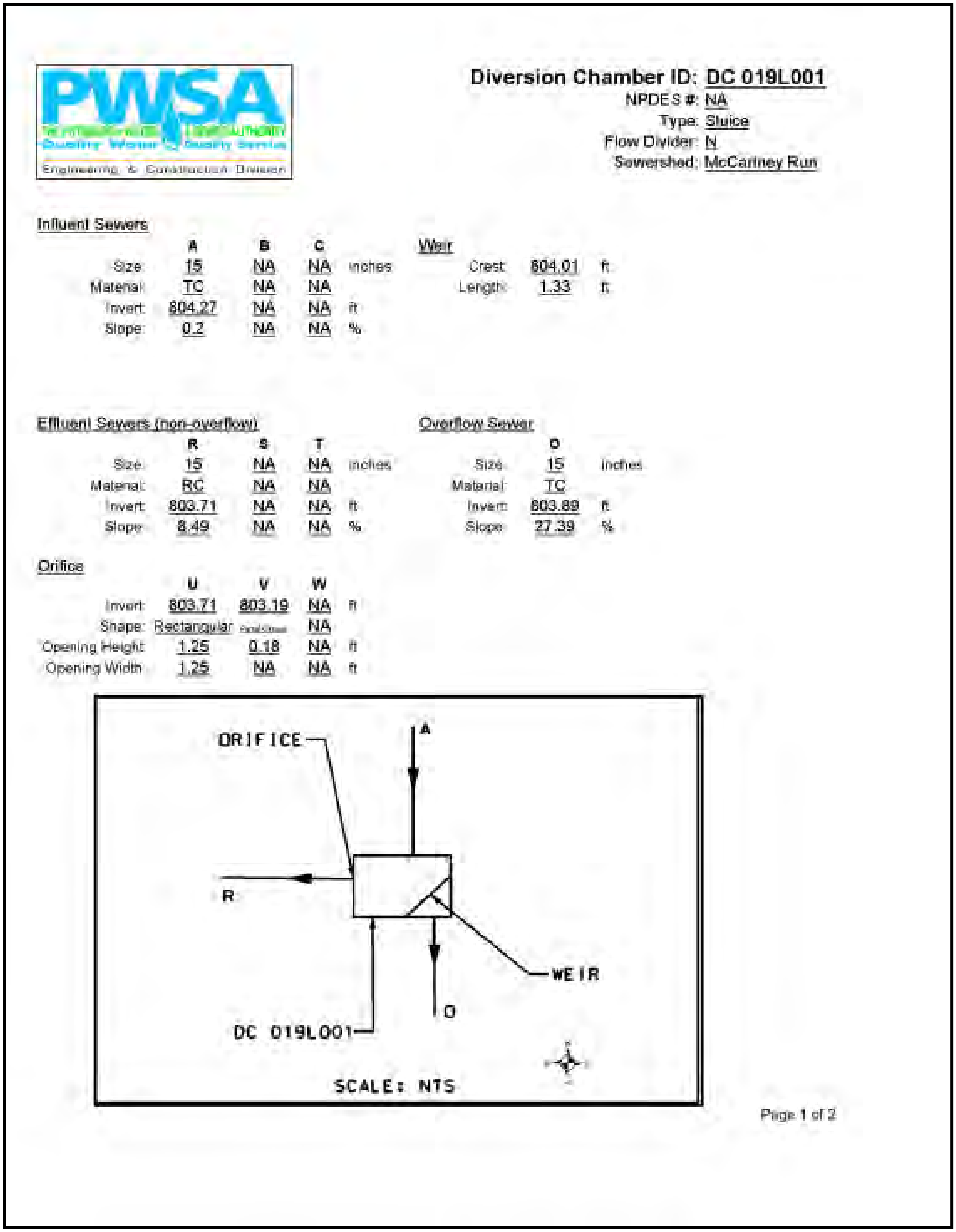

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 019L001
NPDES #: NA
Type: Sluice
Flow Divider: N
Sewershed: McCartney Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	TC	NA	NA	
Invert:	804.27	NA	NA	ft
Slope:	0.2	NA	NA	%

Weir

Crest:	804.01	ft
Length:	1.33	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	15	NA	NA	inches
Material:	RC	NA	NA	
Invert:	803.71	NA	NA	ft
Slope:	8.49	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	803.89	ft
Slope:	27.39	%

Orifice

	U	V	W	
Invert:	803.71	803.19	NA	ft
Shape:	Rectangular	[illegible]	NA	
Opening Height:	1.25	0.18	NA	ft
Opening Width:	1.25	NA	NA	ft

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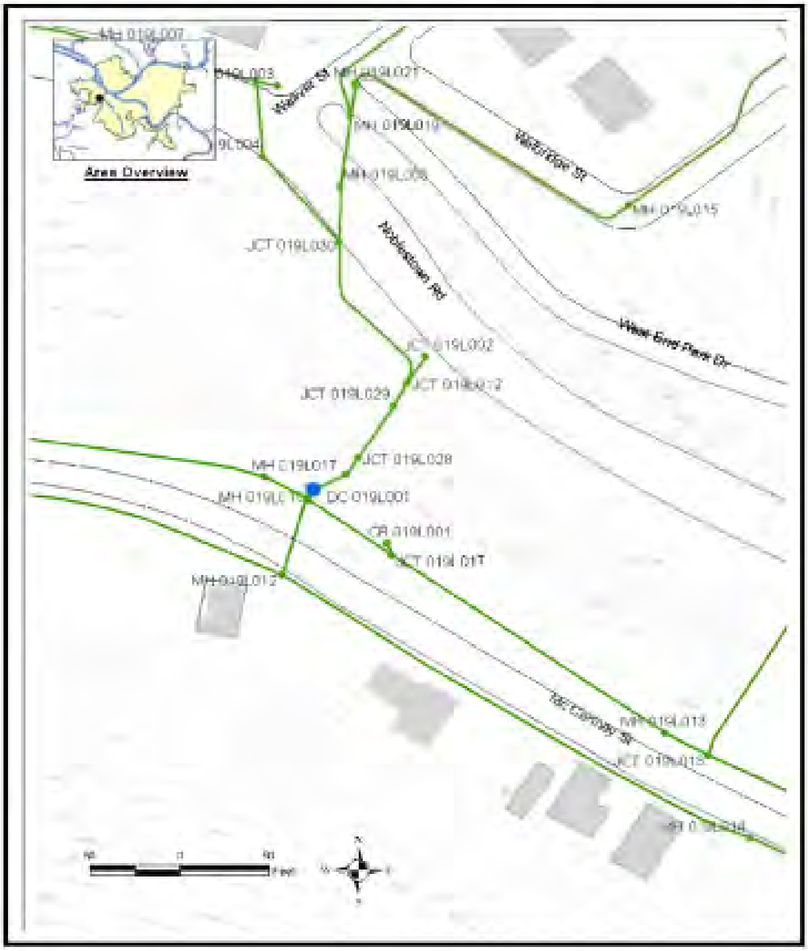
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 019L001



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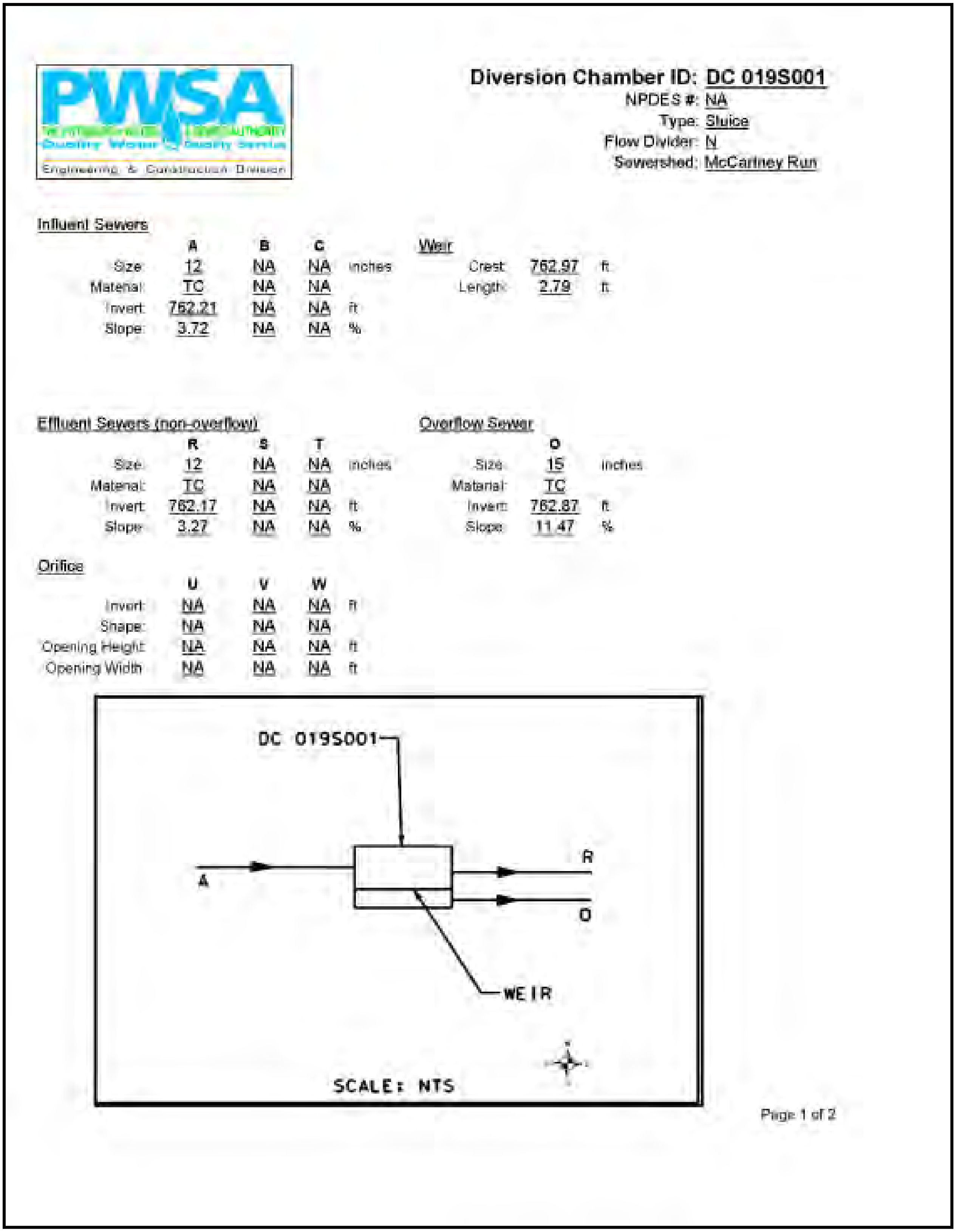

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 019S001
NPDES #: NA
Type: Sluice
Flow Divider: N
Sewershed: McCartney Run

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	762.21	NA	NA	ft
Slope:	3.72	NA	NA	%

Weir

Crest:	762.97	ft
Length:	2.79	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	762.17	NA	NA	ft
Slope:	3.27	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	762.87	ft
Slope:	11.47	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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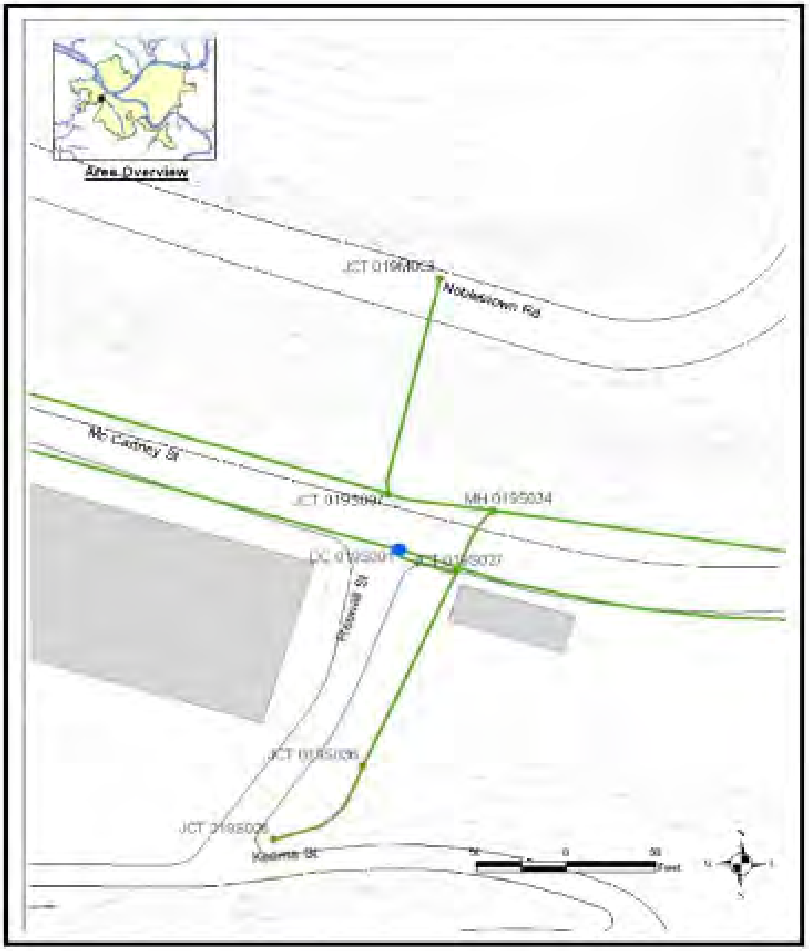
Engineering & Construction Division

Diversion Chamber ID: DC 019S001



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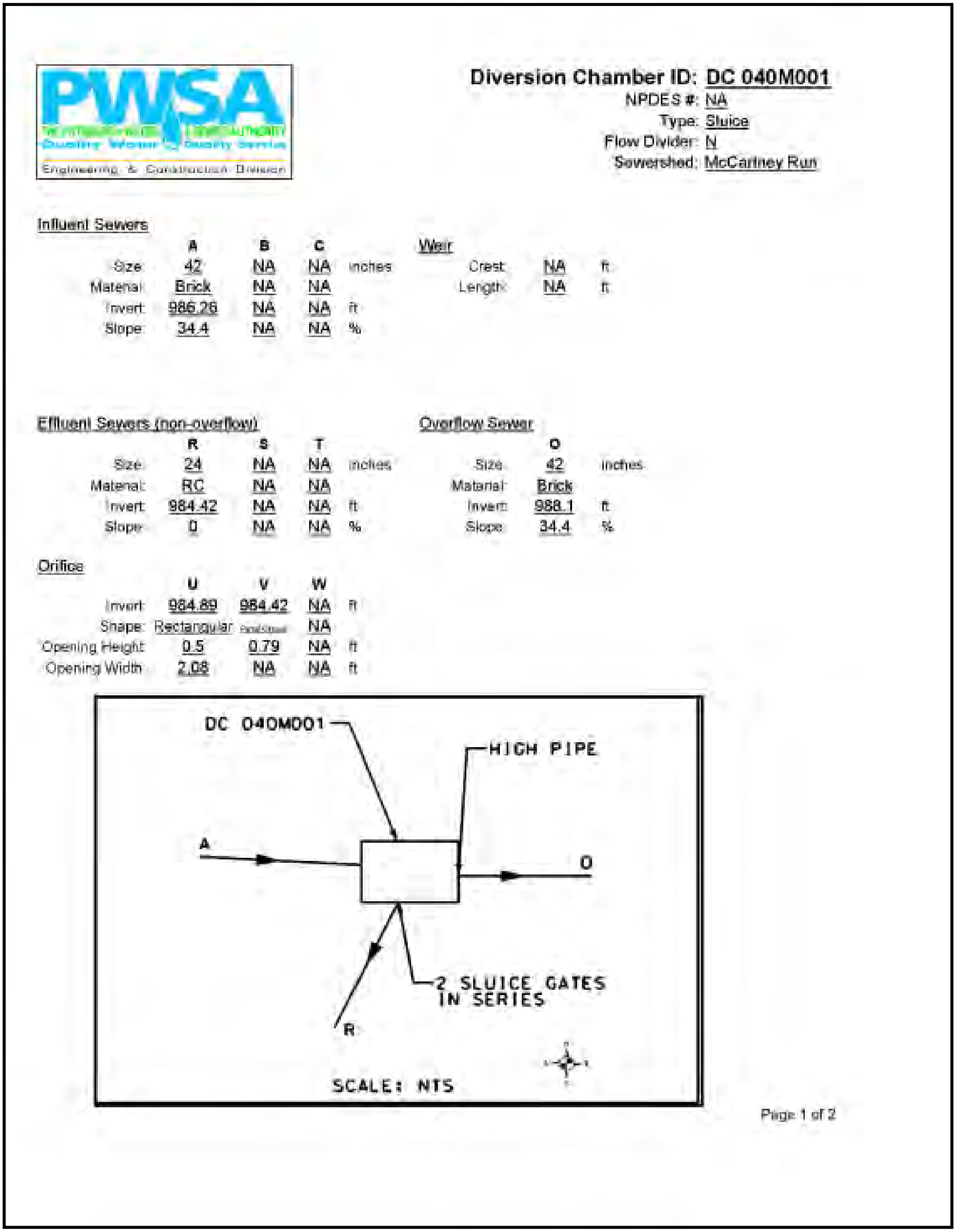

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 040M001
NPDES #: NA
Type: Sluice
Flow Divider: N
Sewershed: McCartney Run

Influent Sewers

	A	B	C	
Size:	42	NA	NA	inches
Material:	Brick	NA	NA	
Invert:	986.26	NA	NA	ft
Slope:	34.4	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	24	NA	NA	inches
Material:	RC	NA	NA	
Invert:	984.42	NA	NA	ft
Slope:	0	NA	NA	%

Overflow Sewer

	O	
Size:	42	inches
Material:	Brick	
Invert:	988.1	ft
Slope:	34.4	%

Orifice

	U	V	W	
Invert:	984.89	984.42	NA	ft
Shape:	Rectangular	[illegible]	NA	
Opening Height:	0.5	0.79	NA	ft
Opening Width:	2.08	NA	NA	ft

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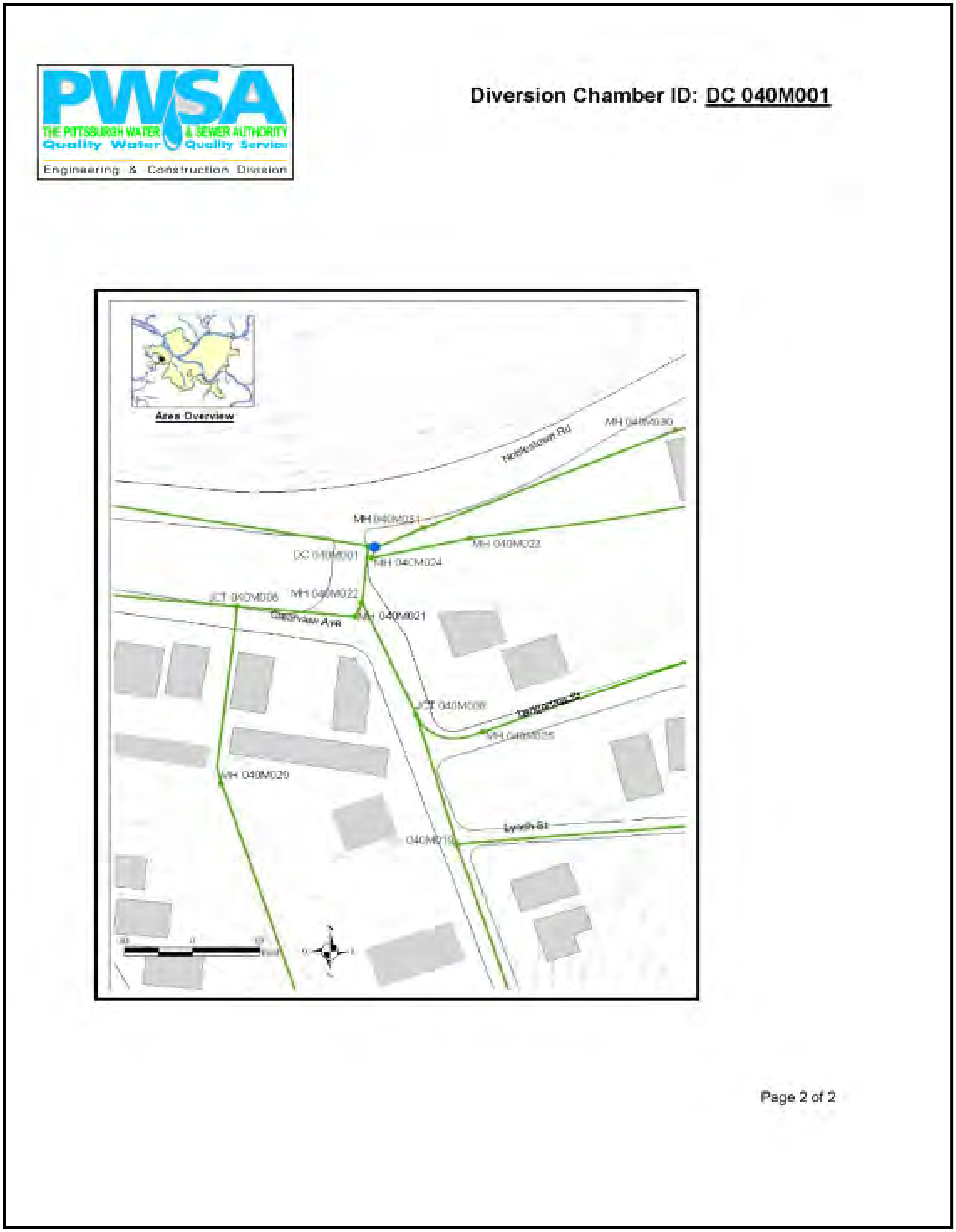

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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 040M001

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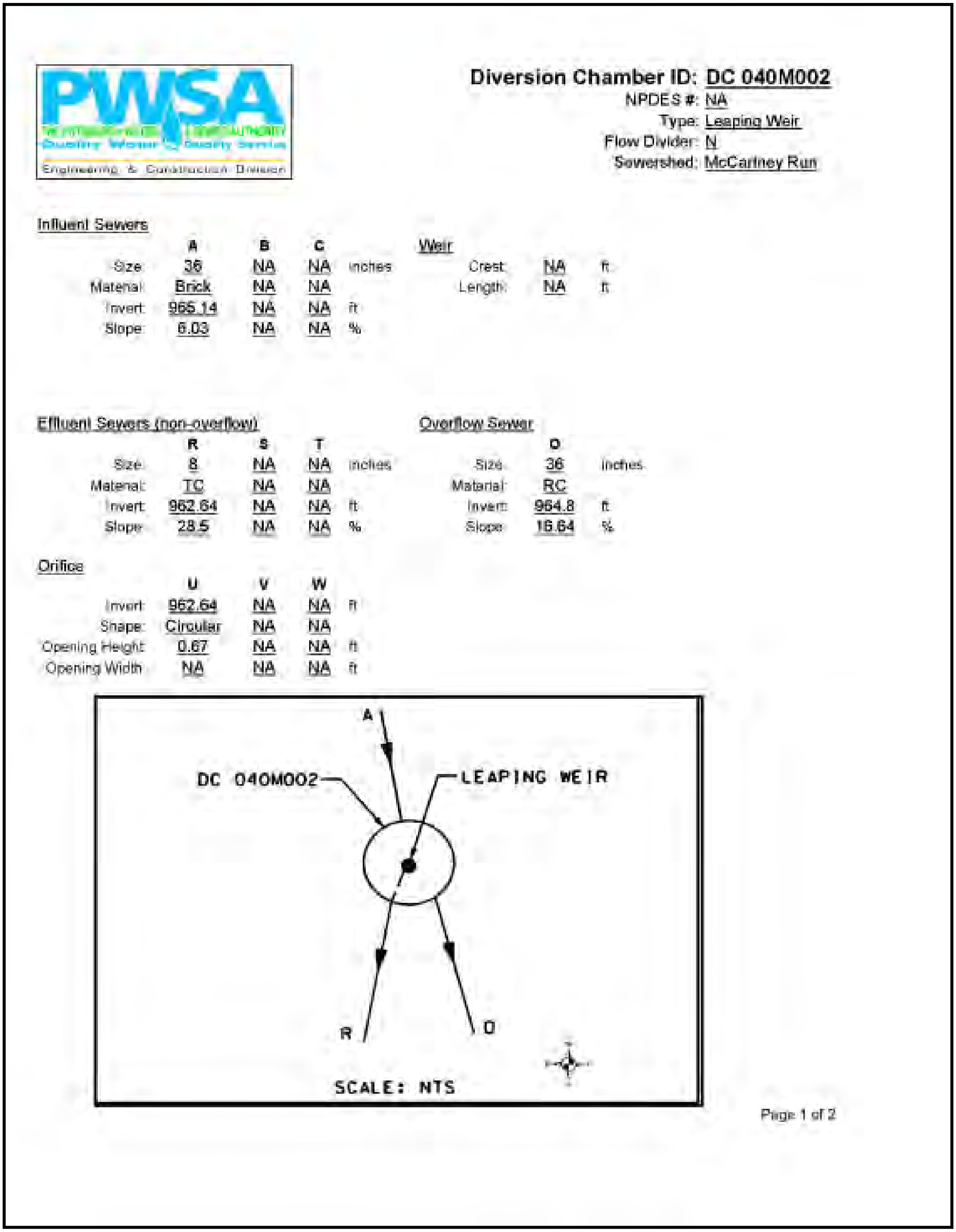

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 040M002
NPDES #: NA
Type: Leaping Weir
Flow Divider: N
Sewershed: McCartney Run

Influent Sewers

	A	B	C	
Size:	36	NA	NA	inches
Material:	Brick	NA	NA	
Invert:	965.14	NA	NA	ft
Slope:	6.03	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	962.64	NA	NA	ft
Slope:	28.5	NA	NA	%

Overflow Sewer

	O	
Size:	36	inches
Material:	RC	
Invert:	964.8	ft
Slope:	16.64	%

Orifice

	U	V	W	
Invert:	962.64	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	0.67	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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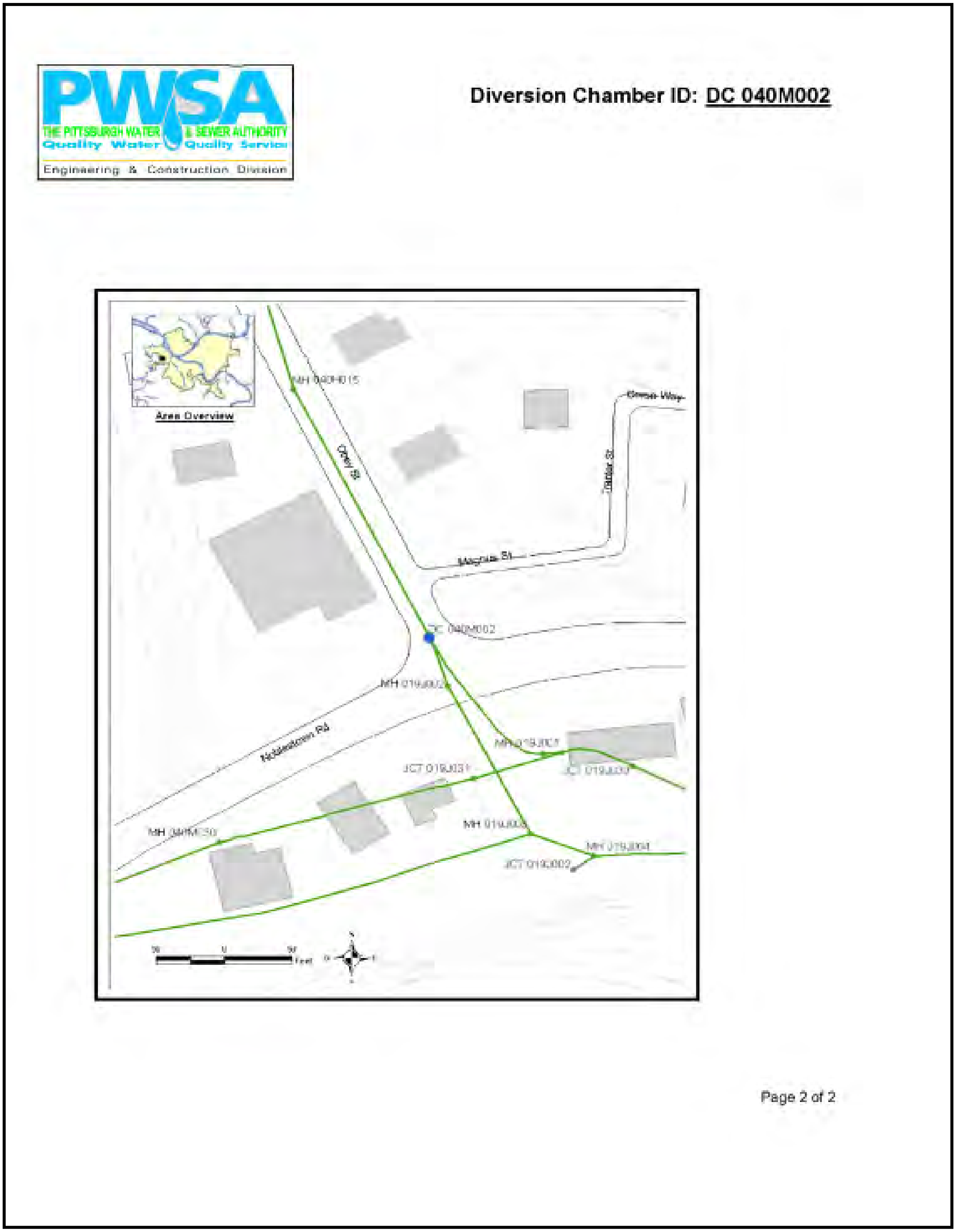

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Engineering & Construction Division

Diversion Chamber ID: DC 040M002

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2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC MH-11: McCartney Run through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Saw Mill Run Basin Planners (SMR_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system tributary to MH-11, and the Future Baseline overflow frequency and volumes for MH-11.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN’s wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN’s Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The

flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. One (1) flow meters located within the MH-11 sewershed were used in the RCS-FMP. Details on the one (1) RCS-FMP flow monitors installed within the MH-11 sewershed are found in Table MH11-2-1.

TABLE MH11-2-1: MH-11 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Term[1]
MH-11-M4	City of Pittsburgh	L

[1]L=Long Term: 1-year minimum to 21-month maximum.

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[1]The flow monitor information in this table is from a file titled “Summary of Program Monitors by Name, Type and Dates.xls”. This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled “Summary and Report of Flow Monitoring June 2009”.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).
- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.
- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.
- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the S-15 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the MH-11 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.
- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The average daily flows, GWI ratio, and GWI per inch-mile of sewer for each flow monitor within the MH-11 sewershed are listed in Table MH11-2-2. The GWI ratio is an estimated amount of the DWF that can be associated with GWI compared to the DWF peaking factor (i.e. Average Daily Maximum Flow vs. Average Daily Minimum Flow). A relatively high GWI ratio of up to 0.8 is shown.

TABLE MH11-2-2: MH-11 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

Flow Monitor[1]	Average Daily Flow (ADF)		DWF Peaking Factor (ADF Max/ ADF Min)	GWI Ratio (min/avg)
	(mgd)	(gpcpd)		
MH-11-M4	0.6	191	1.5	0.8

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that

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[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Saw Mill Run Planning Basin – Table 2.3.

corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table MH11-2-3.

TABLE MH11-2-3: MH-11 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-11	0.82	0.82	0.0%

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event. RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for MH-11 are presented in Table MH11-2-4.

TABLE MH11-2-4: MH-11 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-11	3.5	3.5	0.0%

---

[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.4
[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.5

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure MH11-2-1 present the computed hydraulic profiles of the existing MH-11 main trunk sewer system under projected 2-year design storm peak flow conditions. As is indicated in the figures, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along a significant portion of the trunk sewer.

Figure MH11-2-2 present the computed hydraulic profiles of the existing McCartney Run main trunk sewer system under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along the length of the trunk sewer.

Figure MH11-2-3 present the computed hydraulic profiles of the existing McCartney Run main trunk sewer system under projected 10-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along the length of the trunk sewer.

Computed flow hydrographs for each of the design storms at POC MH-11 are presented in Figure MH11-2-4. It is noted that the peak flows reaching the POC are truncated due to extensive manhole surcharging and manhole flooding.

FIGURE MH11-2-1: MH-11 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

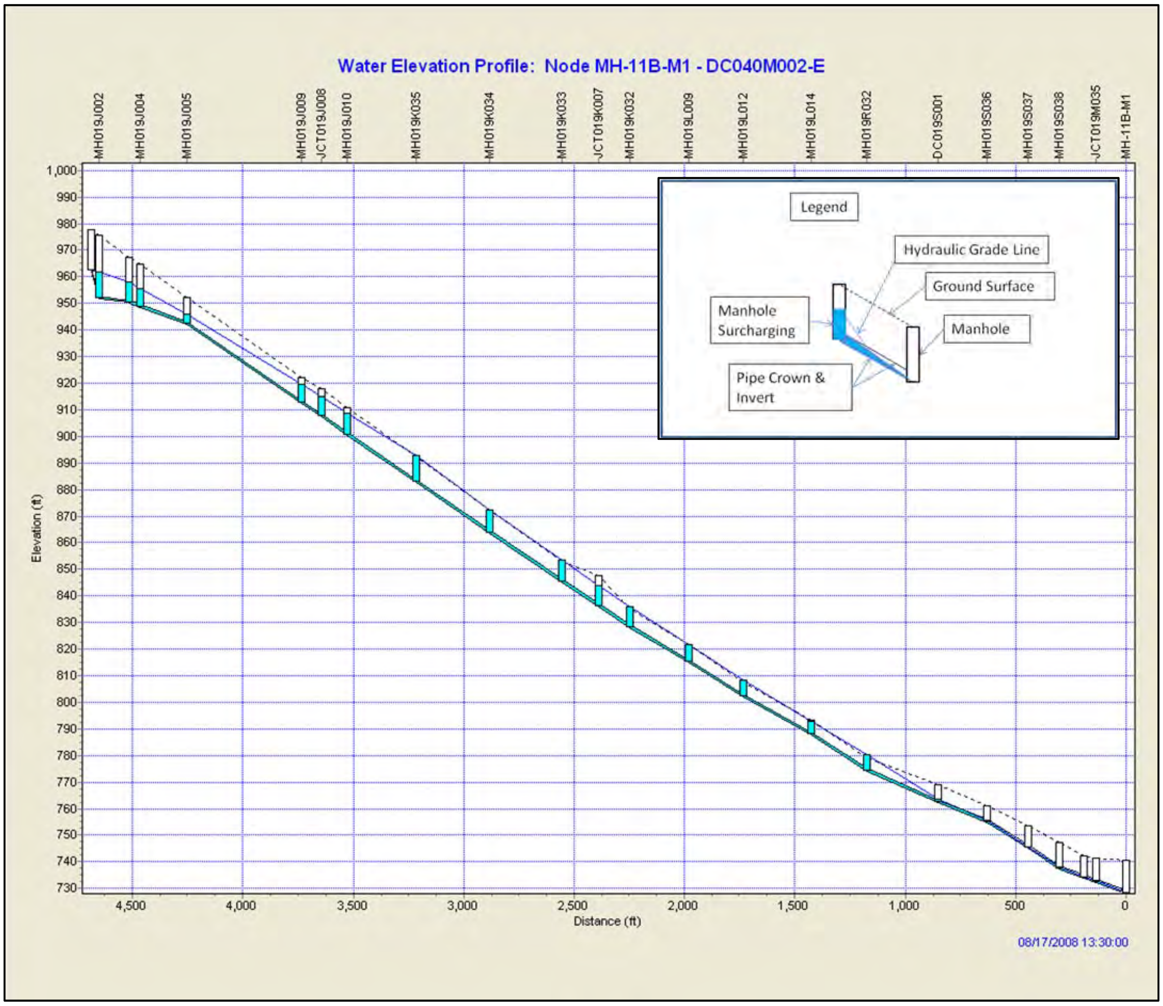


FIGURE MH11-2-2: MH-11 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

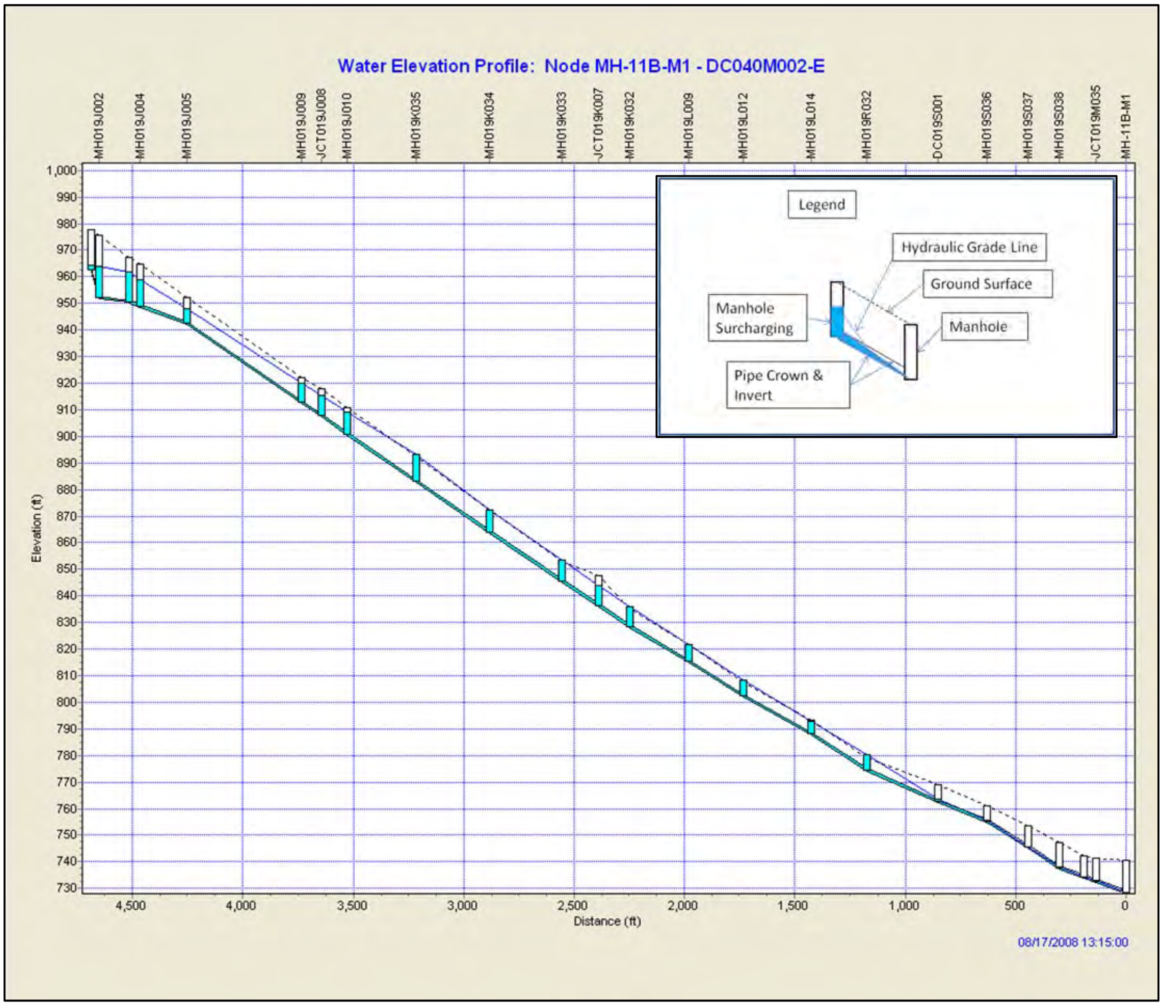


FIGURE MH11-2-3: MH-11 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

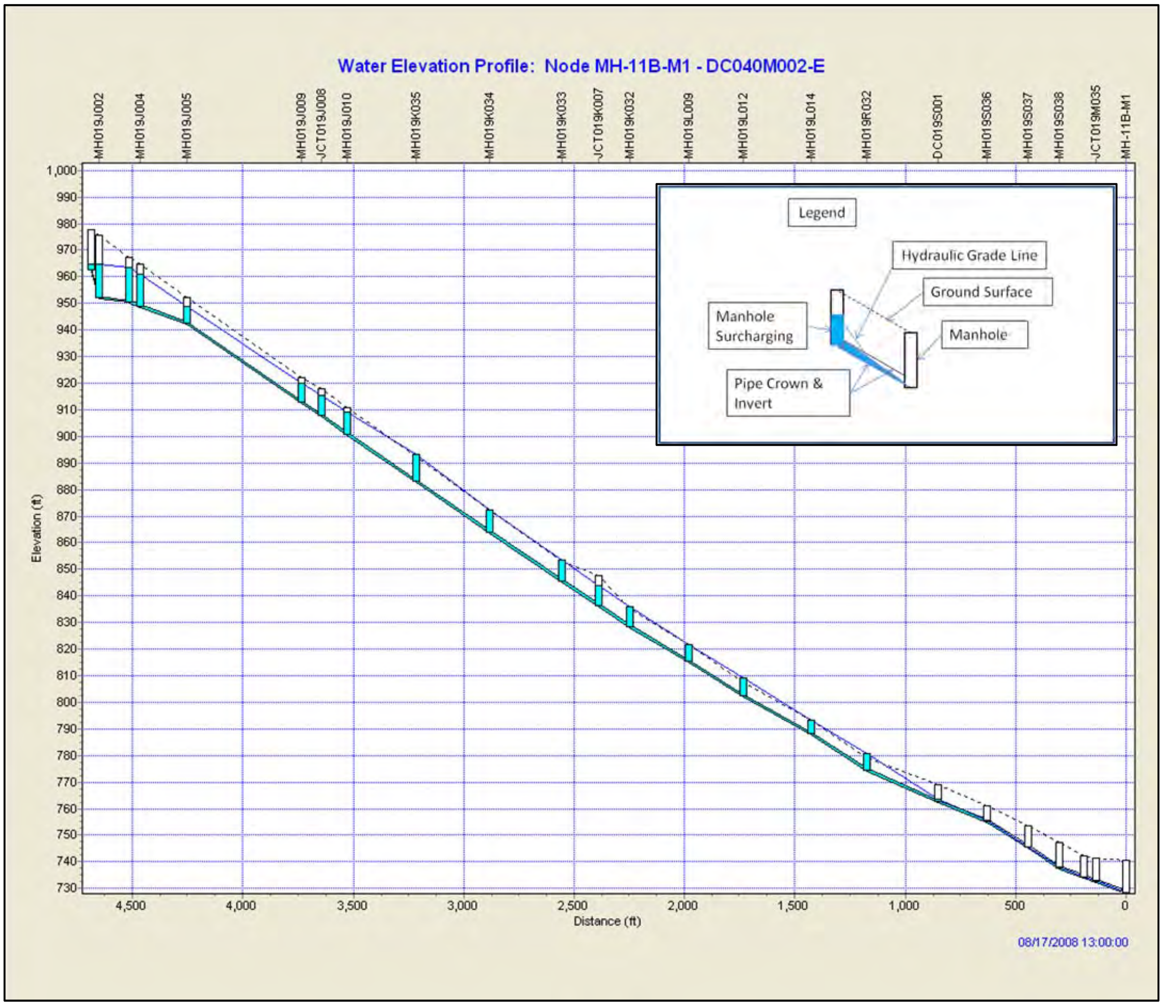
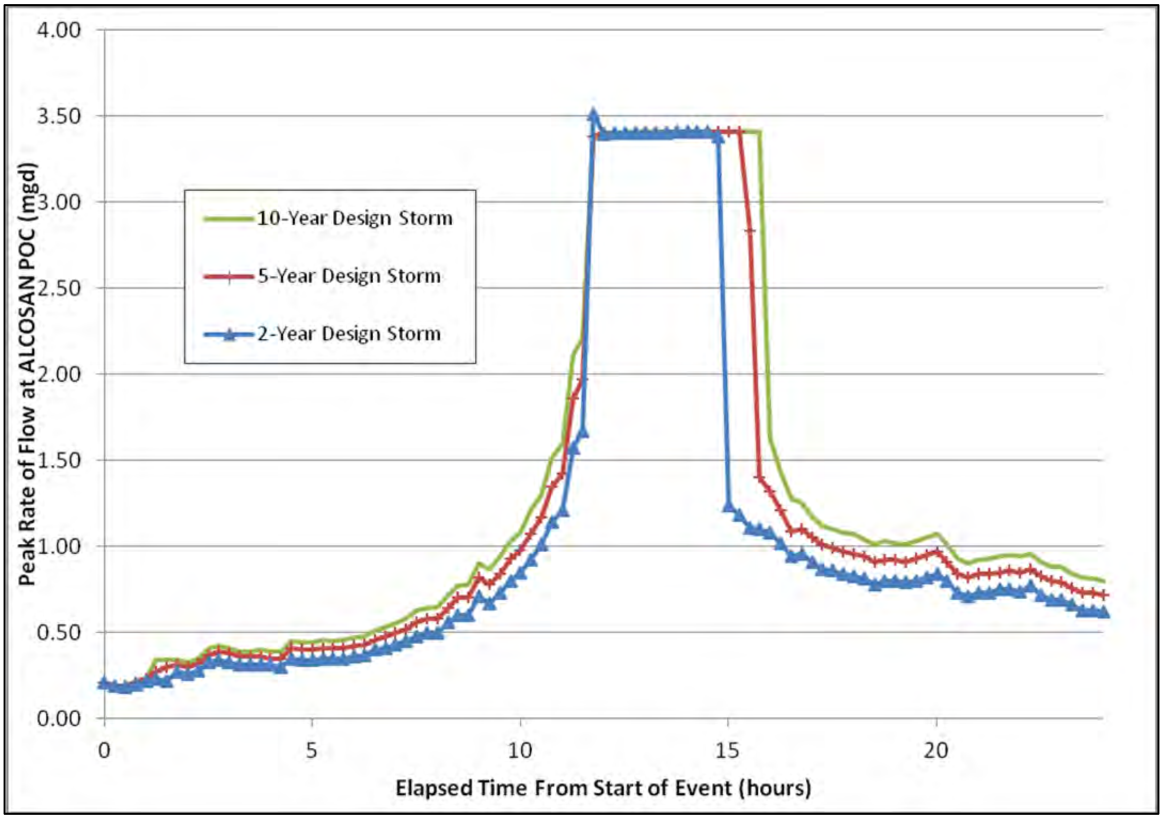


FIGURE MH11-2-4: MH-11 SEWERSHED PEAK FLOW RATES TO THE POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

PWSA investigated but did not locate any chronic basement flooding locations within the PWSA portion of the McCartney Run sewershed. The neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. The results are based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the MH-11 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures MH11-2-5 and MH11-2-6. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figures show that under this range of operating conditions, the existing trunk sewer system does not have sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding. These results validate the findings and recommendations of the Draft Feasibility Study that anticipated the need to construct a consolidation/relief sewer to supplement the capacity of the existing trunk sewer system.

FIGURE MH11-2-5: MH-11 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

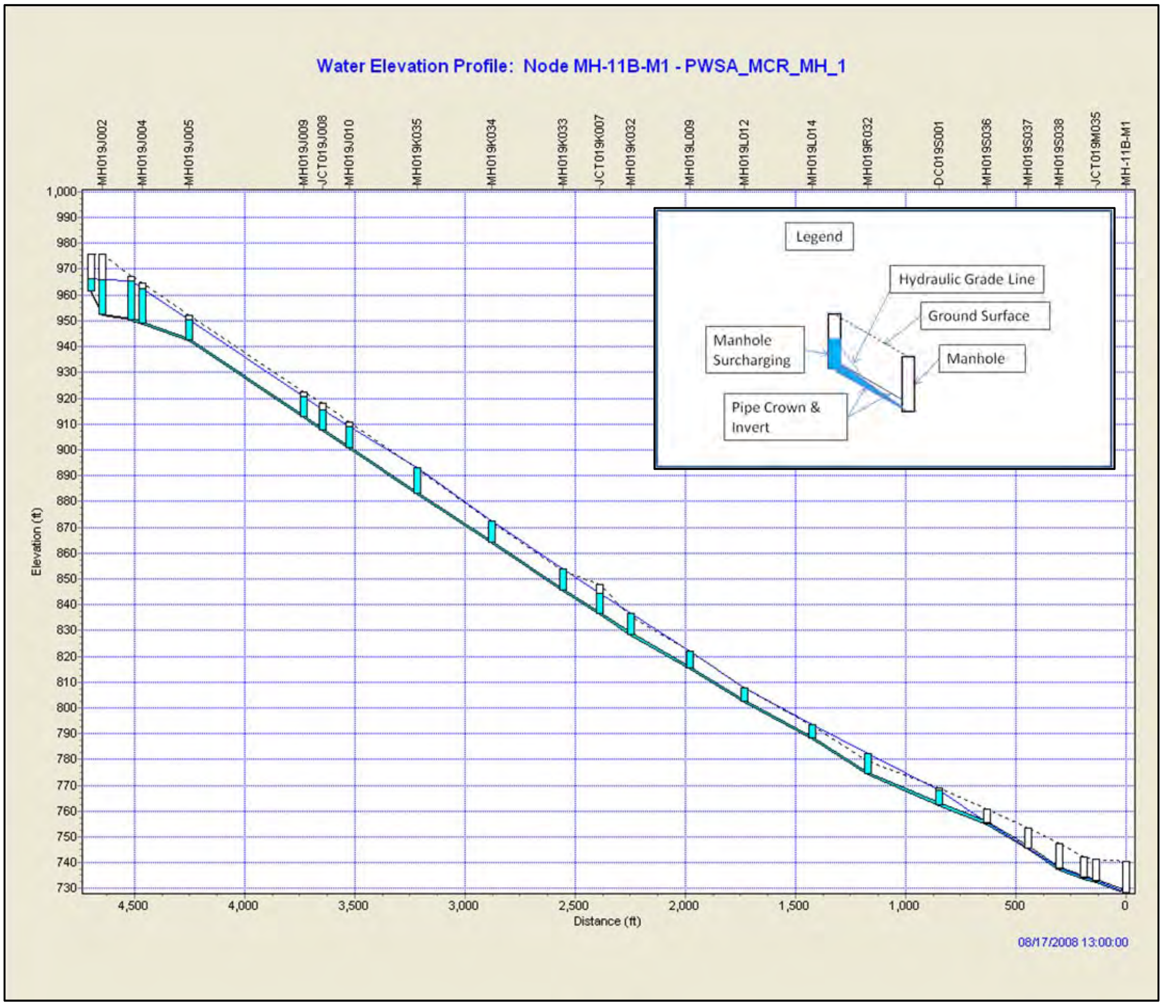
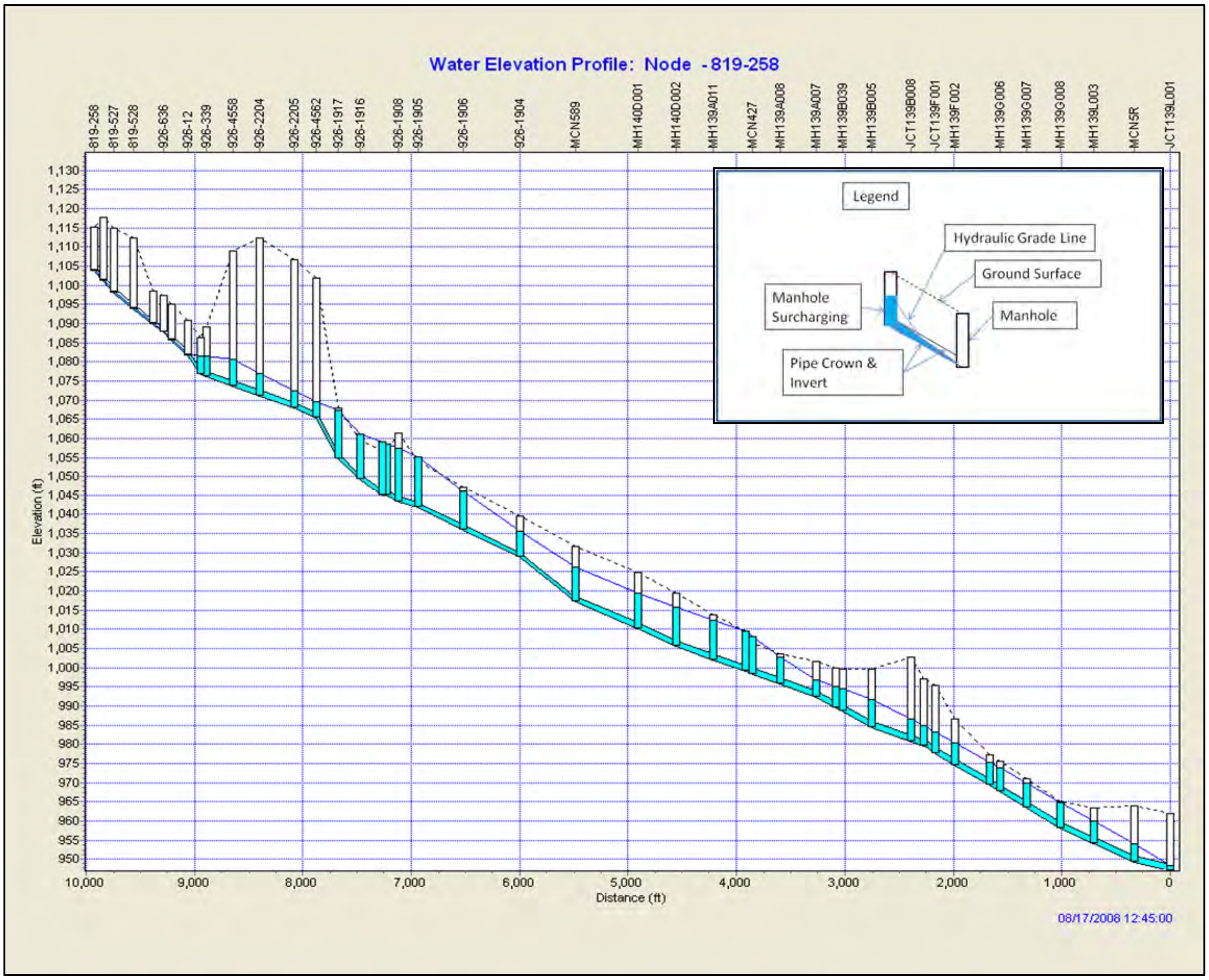


FIGURE MH11-2-6: MH-11 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the MH-11 sewer system performed by PWSA produced the following computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table MH11-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the MH-11: McCartney Run sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.

- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."

- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."

- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. None of these outfalls are found within the MH-11: McCartney Run Sewershed.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.
- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between

February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream, including Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

The receiving water characterization field program resulted in certain findings within Saw Mill Run. In general, the DO concentrations for Saw Mill Run did not meet regulatory limits during wet weather which is likely related to CSO discharges during the storm events and/or wet weather discharges from upstream municipalities. Saw Mill Run also showed DO concentrations not meeting standards during dry weather indicating that CSO discharges are not likely causing the condition.

ALCOSAN Program.[1] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the

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[1] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters, including Saw Mill Run and its tributaries within the PWSA limits, with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL. For Saw Mill Run, the concentration during the recreational season exceeded the 200 cfu/100mL limit in 100% of the samples and exceeded the 400 cfu/100mL limit in 80% of the samples.

Saw Mill Run has an in-stream target concentration of 0.035 mg/L for total phosphorus (TP) which was exceeded by 75% of the samples. TP appears to be a concern throughout Saw Mill Run, with CSO discharges being a potentially significant source in wet weather.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal Coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS. However for Saw Mill Run, it is judged that a higher level of control is needed due to the need to reduce phosphorus levels (see next section).

3.2.2 Saw Mill Run TMDL Report

A TMDL report was completed for Saw Mill Run and its tributaries which showed phosphorus TMDL results are shown below in Table MH11-3-1.

TABLE MH11-3-1: SAW MILL RUN PHOSPHORUS TMDL RESULTS

Total Phosphorus Load	CSO Load	SSO Load
Existing Load (Ib/Growing Season)	7,161.9	1,950.4
Allocated Load (Ib/ Growing Season)	177.5	0.0
Percent Reduction (%)	98%	100%

The implication of this is that substantial reductions of CSOs and complete elimination of SSOs is necessary for compliance. For CSOs, it is judged that a control level of 0 overflows per year will be required.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, such as Saw Mill Run, pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the MH-11 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the MH-11 sewershed, Table MH11-3-3 lists the untreated CSO statistics that were computed for each control level.

TABLE MH11-3-3: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE MH-11 SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC019J001	0	0	0	0	0	0
DC019K001	0	0	3	0.24	4	0.31
DC019L001	0	0	3	0.02	3	0.02
DC019S001	0	0	0	0	0	0
DC040M001	0	0	2	0.59	2	0.59
DC040M002	0	0	2	0.43	8	0.54
Total Volume		**0**		**1.28**		**1.46**

As will be described later in this report, the MH-11 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year and 10-year return frequency events).

Since Saw Mill Run has a TMDL which requires a high level of Phosphorous removal (98%), a higher CSO control level will be required. While 10, 4 and 0 OF/yr are analyzed, it is judged that 0 OF/yr will be necessary for compliance.

A range of design storms (2-yr, 5-yr, and 10-yr) were evaluated for transport of flows. PWSA plans to use the 2-yr storm which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

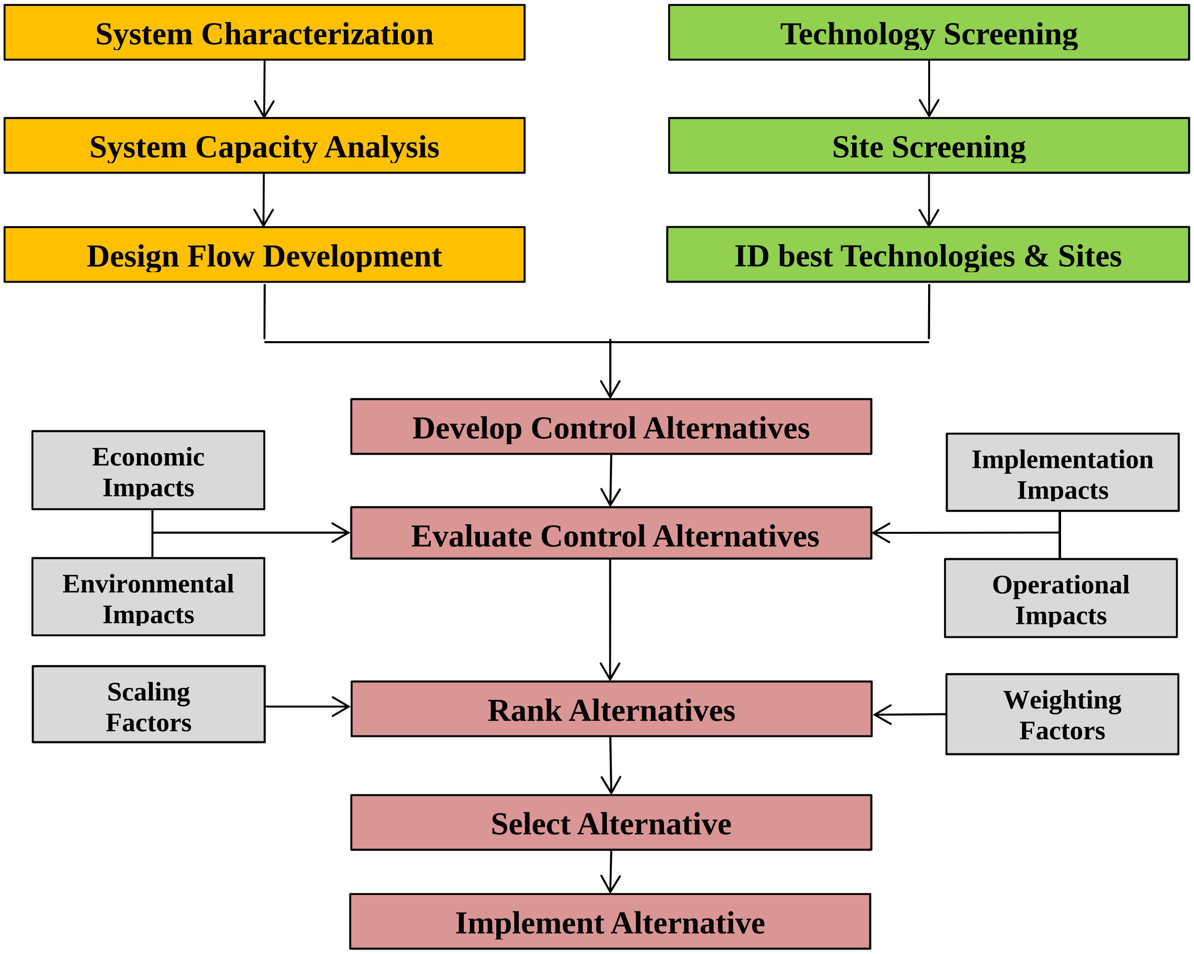
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure MH11-4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE MH11-4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered "feasible" for use in the MH-11 sewershed are shown below in Table MH11-4-1.

TABLE MH11-4-1: MH-11 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies were identified for the MH-11 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table MH11-4-2.

Contributing flows from the municipalities that are tributary to the MH-11 sewershed, which include a small area of Ingram Borough, were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as the waterways.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning “Objective Scores” to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

As described in later paragraphs, these criteria were used to “score” each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN’s Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

PWSA utilized ACT Version 2.1; a summary of the PWSA’s use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA’s cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

TABLE MH11-4-2: MH-11 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 019M001	CS4 019M001: Sewer separation	Complete sewer separation of tributary area.
	S2-019M001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-019M001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-019M001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-019M001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-019M001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-019M001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Regional Controls – MH-11 McCartney Run Controls		
None	NA	NA
Sub-system Controls - Saw Mill Run Controls		
Outfall 019M001	SMR-1a: Tunnel Storage[2]	A 2.8 mile long tunnel O-14 to the S-30 POC. 019M001 is conveyed to tunnel via Drop Shaft.
	SMR-1b: Tunnel Storage[2]	
	SMR-2a: Tunnel Storage[2]	A 5.7 mile long tunnel from O-14 to the S-15 POC. 019M001 is conveyed to tunnel via Drop Shaft.
	SMR-2b: Tunnel Storage[2]	

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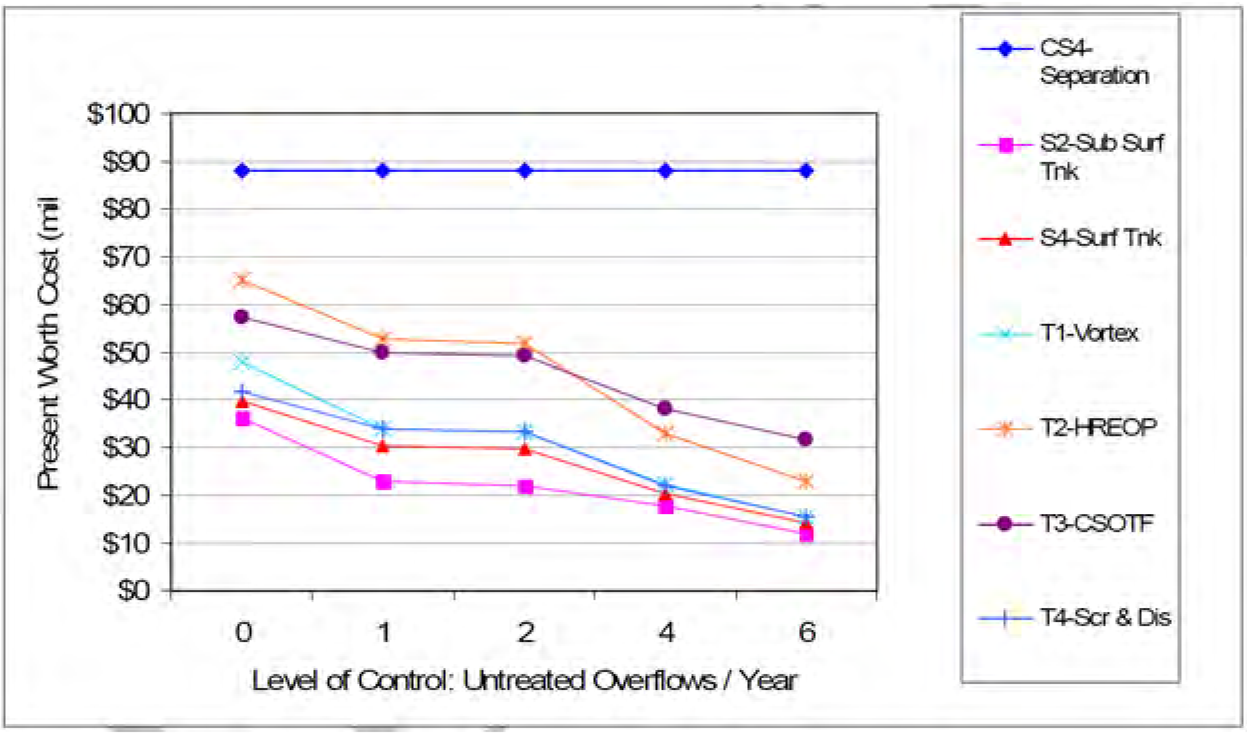
[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

4.2.1 Outfall-Specific Control Alternatives

Outfall 019M001: Cost estimates were produced for outfall-specific control alternatives CS4 097L001: Sewer separation, S2-019M001: Sub-Surface Storage, S4-019M001: Surface Storage, T1-019M001: Suspended Solids Control, T2-019M001: High Rate End of Pipe Treatment, T3-019M001: CSO Treatment Facility, and T4-019M001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure MH11-4-2 illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE MH11-4-2: OUTFALL 019M001 ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

No regional control alternative includes MH-11 McCartney Run.

4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Saw Mill Run sub-system. Table MH11-4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Saw Mill Run subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE MH11-4-3: SAW MILL RUN SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
SMR-1a	249.3	2.1	272.1
SMR-1b	253.3	1.9	274.0
SMR-2a	246.2	1.6	265.1
SMR-2b	251.8	1.5	269.0

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining "Objective Scores" relative to each evaluation criteria.
- Applying "scaling" and "weighting" factors.
- Determining "Weighted Objective Scores" relative to each evaluation criteria.

- Ranking each alternative based on the sum of its "Weighted Objective Scores".

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table MH11-4-4.

TABLE MH11-4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

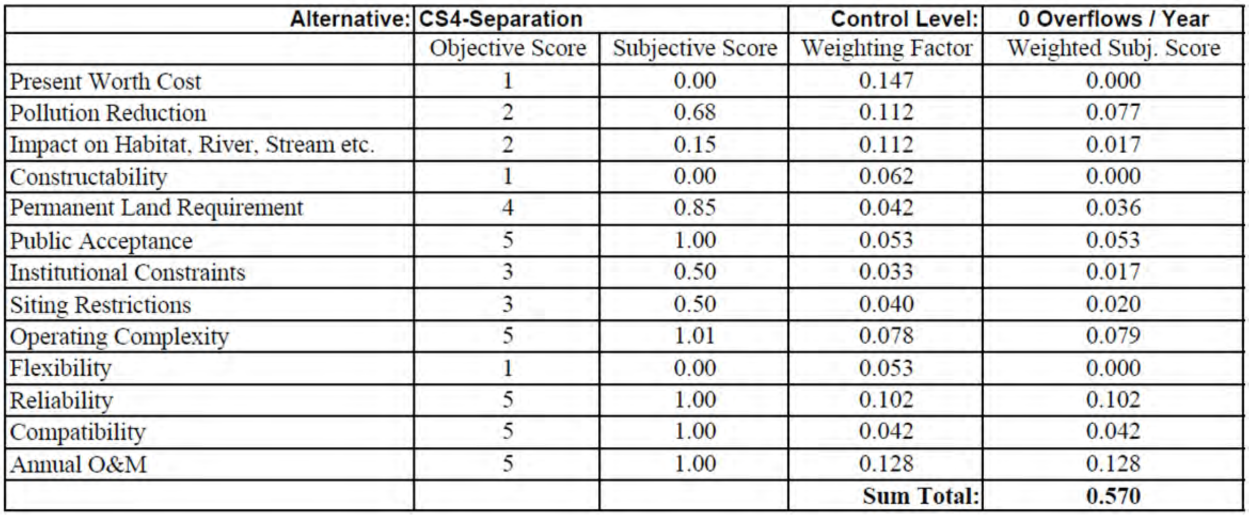
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus “weighted”. Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in Table MH11-4-5.

TABLE MH11-4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4* 019M001*: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in Table MH11-4-6.

TABLE MH11-4-6: WEIGHTED SUBJECTIVE SCORING - CS4 019M001: SEWER SEPARATION



Alternative:	CS4-Separation		Control Level:	0 Overflows / Year
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	1	0.00	0.147	0.000
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.112	0.017
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	3	0.50	0.033	0.017
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.570**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that

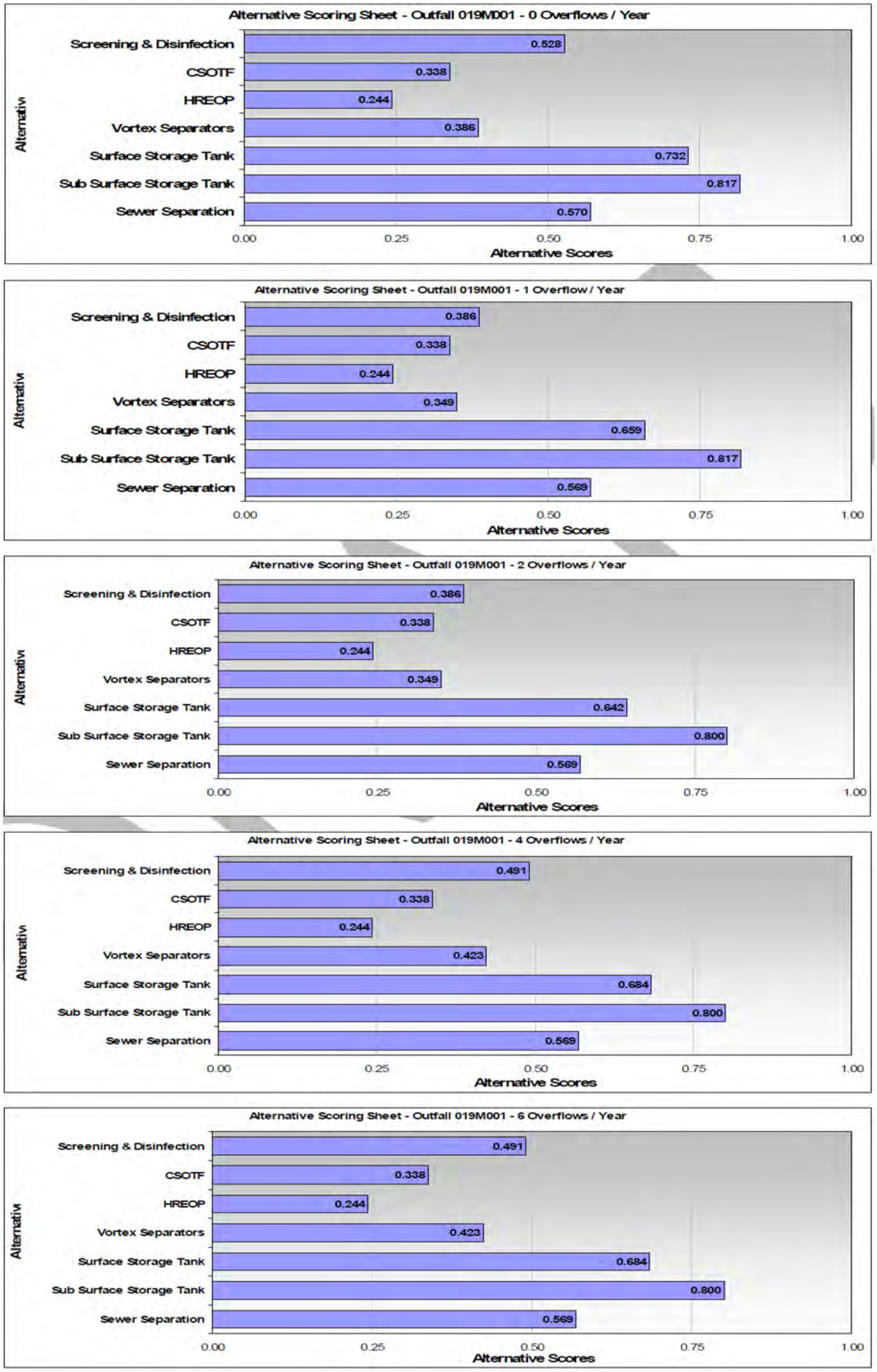
their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 019M001: The results of the control alternative evaluation process are shown in Figure MH11-4-3. It is recommended that for all levels of control, *Alternative S2-019M001: Sub-Surface Storage* be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses.

FIGURE MH11-4-3: ALTERNATIVE SCORING - OUTFALL 019M001



4.4.2 Regional Control Alternatives

No regional control alternative includes MH-11 McCartney Run.

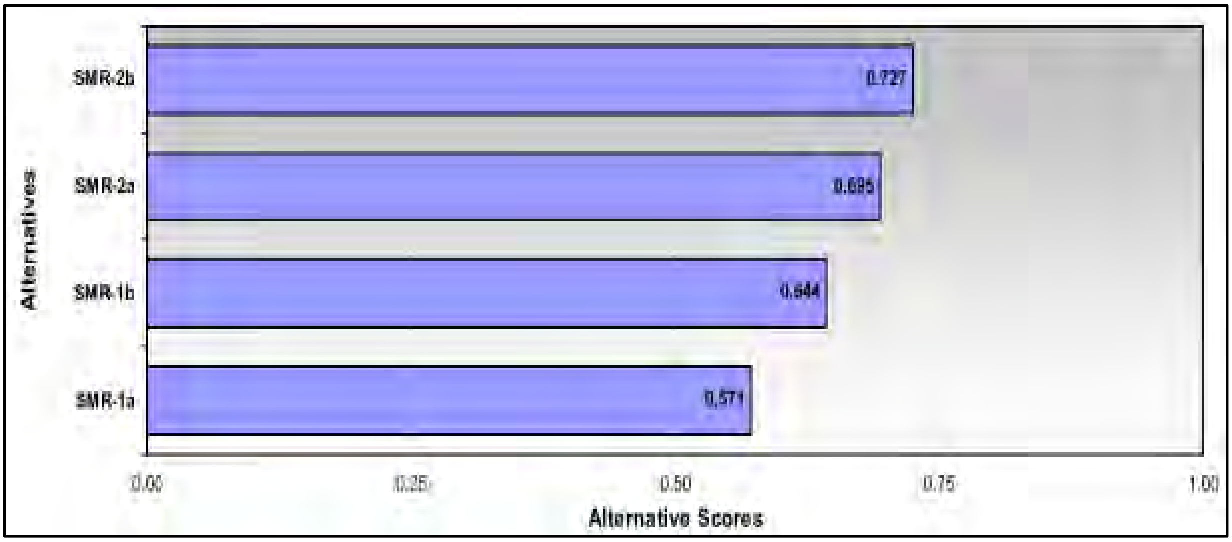
4.4.3 Sub-System Control Alternatives

Saw Mill Run: The results of the sub-system control alternative evaluation process are shown below in Figure MH11-4-4. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative SMR-2b: Tunnel Storage* is carried forward as the Saw Mill Run component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative SMR-2b: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative SMR-2b* included only those components required to deliver flows to the MH-11 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the MH-11 POC would become the responsibility of ALCOSAN.

FIGURE MH11-4-4: ALTERNATIVE SCORING – SAW MILL RUN SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the McCartney Run sewershed would best be accomplished by implementing *Alternative SMR-2b: Tunnel Storage*. Within the MH-11 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the PWSA permitted CSO to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the MH-11 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative SMR-2b* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-MH11-C-0*, *POC-MH11-C-4* and *POC-MH11-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **MH11 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.
- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the MH-11 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the MH-11 sewershed is zero untreated overflows per year. The recommended control alternative for the MH-11 McCartney Run sewershed has been designated as POC-MH11-C-0. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **MH11** The MH-11 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **0** The selected level of control is zero untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of zero (0) untreated overflows per year, the required consolidation / conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-MH11-C-0 are summarized in Table MH11-5-1.

TABLE MH11-5-1: ALTERNATIVE POC-MH11-C-0 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID*	Outfall	Required Improvements	Level of Control (OF/yr)
MH-11	DC019J001 DC019K001 DC019L001 DC019S001 DC040M001 DC040M002	N/A	C*	0

*To be achieved via additional conveyance piping and regulator modifications.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, stream removal projects that may be included, its integration with ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-MH11-C-4 and/or POC-MH11-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. Both analyses determined that the optimal method of increasing the level of control of CSO overflows in the MH-11 sewershed would be to reduce the number of overflows by conveying the additional wastewater to the ALCOSAN point of connection. To accomplish this, the PWSA and/or their tributary municipalities must:

- Modify existing diversion structures to achieve desired level(s) of control.
- Construct additional consolidation piping to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

For each of the diversion structures in the MH-11 sewershed, the H&H model was employed to identify the type and extent of modifications required to achieve zero overflows during the typical year.

The required modifications to the flow diversion settings were determined by the current typical year overflow statistics. Table MH11-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control. The upstream municipality of Ingram Borough is tributary to some of the PWSA CSO diversion structures, but any future changes to their tributary flows are not anticipated to have an impact on the planned diversion structure modifications.

TABLE MH11-5-2: ALTERNATIVE POC-MH11-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC019J001	No Change*	No Change	No Change	No Change
DC019K001	Diversion structure replacement*	10.0	1.0	0.3
DC019L001	Diversion structure replacement*	2.0	No Change	No Change
DC019S001	Closed	Closed	Closed	Closed
DC040M001	Diversion structure replacement*	27.0	No Change	No Change
DC040M002	Diversion structure replacement*	18.0	2.4	No Change

*The installation of screening is planned for all PWSA diversion structures.

As can be seen from the table, new consolidation piping to convey flows at the zero OF/yr level of control must be designed to carry flows ranging from 2.0 to 27 mgd.

5.1.2 Consolidation Piping

The H&H model was employed to identify the capacity improvements necessary to consolidate and convey increased flows from the existing diversion structures to the MH-11 POC. The modeling was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the MH-11 POC without significant manhole surcharging and flooding. These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008)* that anticipated the construction of consolidation / relief sewers to supplement the capacity of the existing trunk sewer system.

It was anticipated that the required increase in conveyance capacity would be achieved by constructing parallel relief sewers designed to convey flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Note that the upstream municipality of Ingram Borough has not reported any plans to modify their system to reduce their tributary flows.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table MH11-5-3 and in Figure MH11-5-1.

TABLE MH11-5-3: POC-MH11-C-0 CONSOLIDATION PIPING

Diameter (in)	Length (ft)
12	232
24	138
30	3,043
36	733
42	285

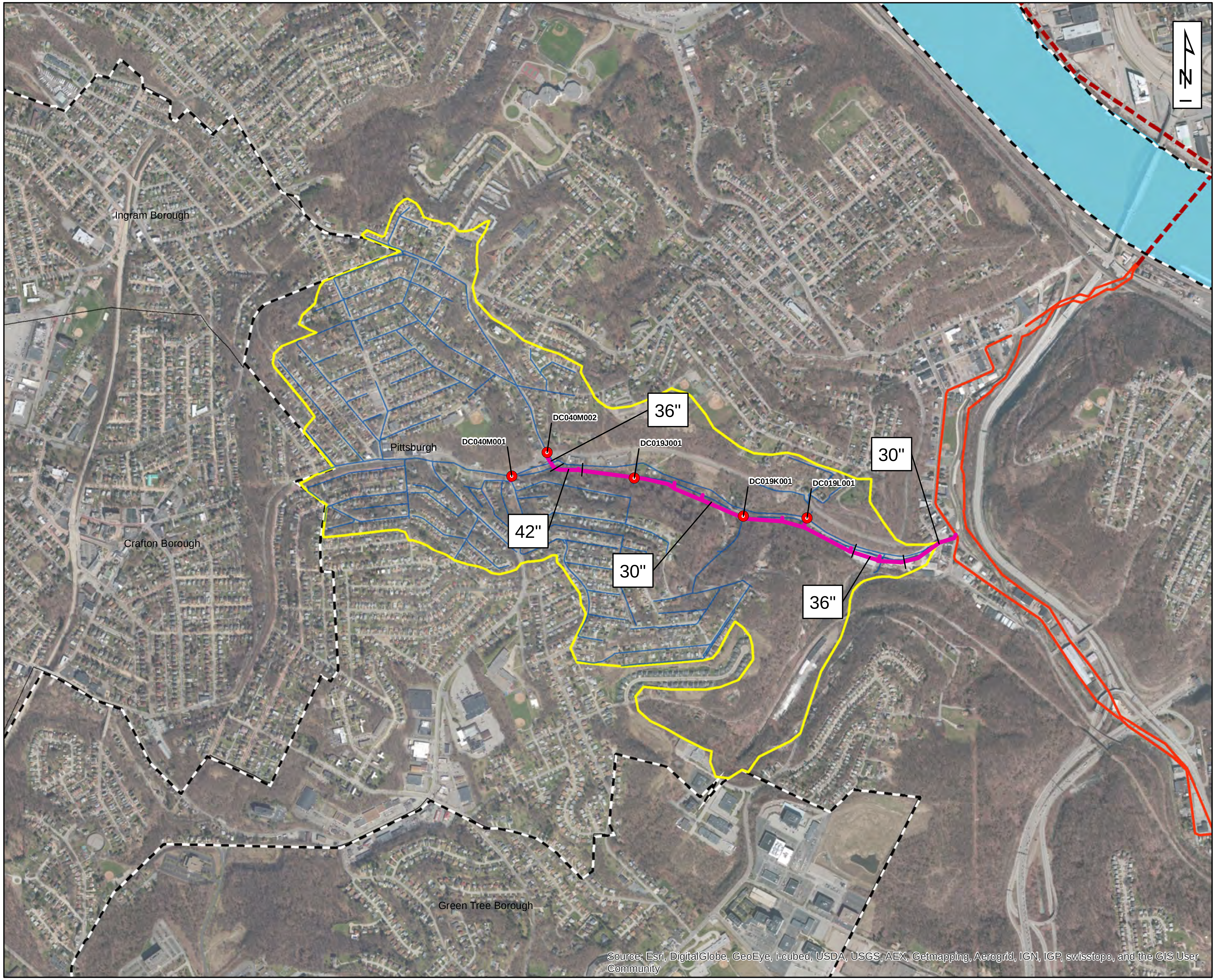
*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table MH11-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 2.1 MG in the typical year.

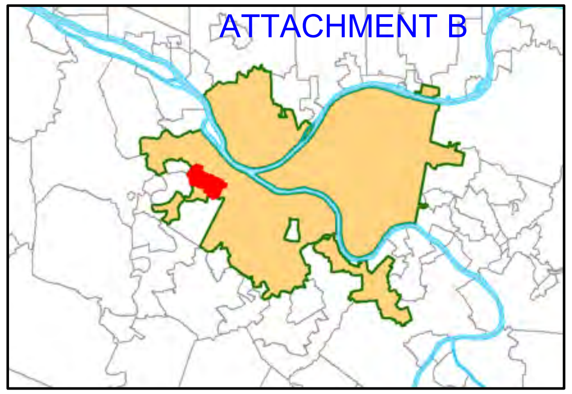
TABLE MH11-5-4: MH-11 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	**Control Alternative Name**					
	POC-MH11-C-0		**POC-MH11-C-4**		**POC-MH11-C-10**	
	No. of OFs	**Annual Volume (Mgal)**	**No. of OFs**	**Annual Volume (Mgal)**	**No. of OFs**	**Annual Volume (Mgal)**
DC019J001	0	0	0	0	0	0
DC019K001	0	0	3	0.2	4	0.3
DC019L001	0	0	3	0.02	3	0.02
DC019S001	0	0	0	0	0	0
DC040M001	0	0	2	0.6	2	0.6
DC040M002	0	0	2	0.4	8	0.5
Total Volume		**0**		**1.2**		**1.4**



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

- ● PWSA Diversion Structure Modification
- ━ Relief/Consolidation Sewer
- ━ Collector Sewer
- ☐ MH-11 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ┅ Deep Tunnel
- ━ Shallow Cut

Figure MH11-5-1: POC MH11-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\McCARTNEY RUN (MH-11)\FIGURE 5-1_MH_11.mxd

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The combination of regulator modifications and additional consolidation piping will result in increased flow rates and volumes to the MH-11 POC. Peak flow rates to the MH-11 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-MH11-C-0, POC-MH11-C-4 and POC-MH11-C-10 are presented in Figure MH11-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the MH-11 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table MH11-5-5.

FIGURE MH11-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE MH-11 POC

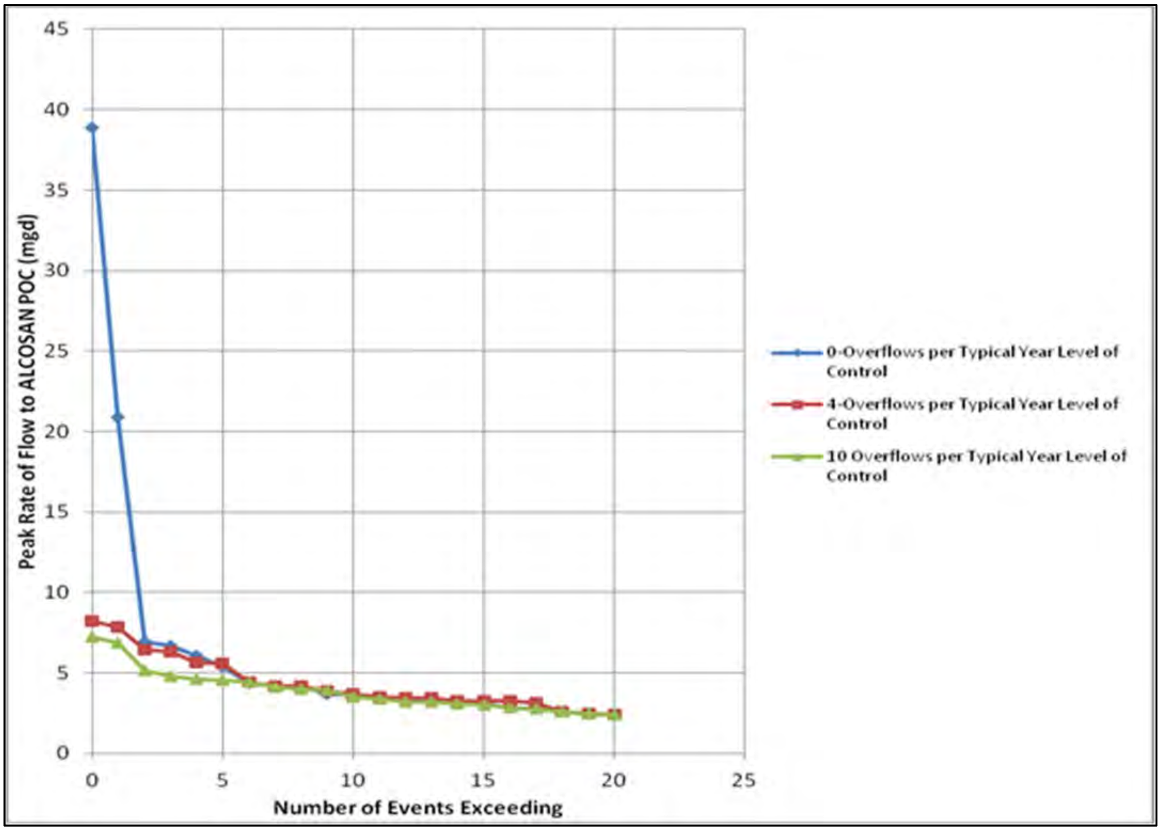


TABLE MH11-5-5: MH-11 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-MH11-C-0	57.4	57.7	57.7	3.3	3.8	4.2
POC-MH11-C-4	10.5	10.9	11.1	1.4	1.6	1.8
POC-MH11-C-10	10.5	10.6	10.9	1.3	1.5	1.7

5.1.5 Recommended Control Alternative Integration

For the purpose of submitting this Feasibility Study, the PWSA recognizes that the flows generated by the tributary municipality of Ingram Borough are minor. Due to their minor flow contributions, the PWSA has not approached Ingram Borough in regards to cost sharing of capital and O&M costs.

However, it is possible that, in the future, the affected municipalities will agree to enter into an Inter-Municipal Agreement to provide for the allocation and payment of capital costs related to each applicable component or components of the recommended alternative.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-MH11-C-0 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through the construction of parallel relief sewers designed to convey flows associated with zero overflows per typical year, under 2-year design storm conditions (0 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the MH-11 sewershed, both before and after implementation of the recommended alternative:

- Peak flow hydraulic grade line (HGL) of the trunk sewer

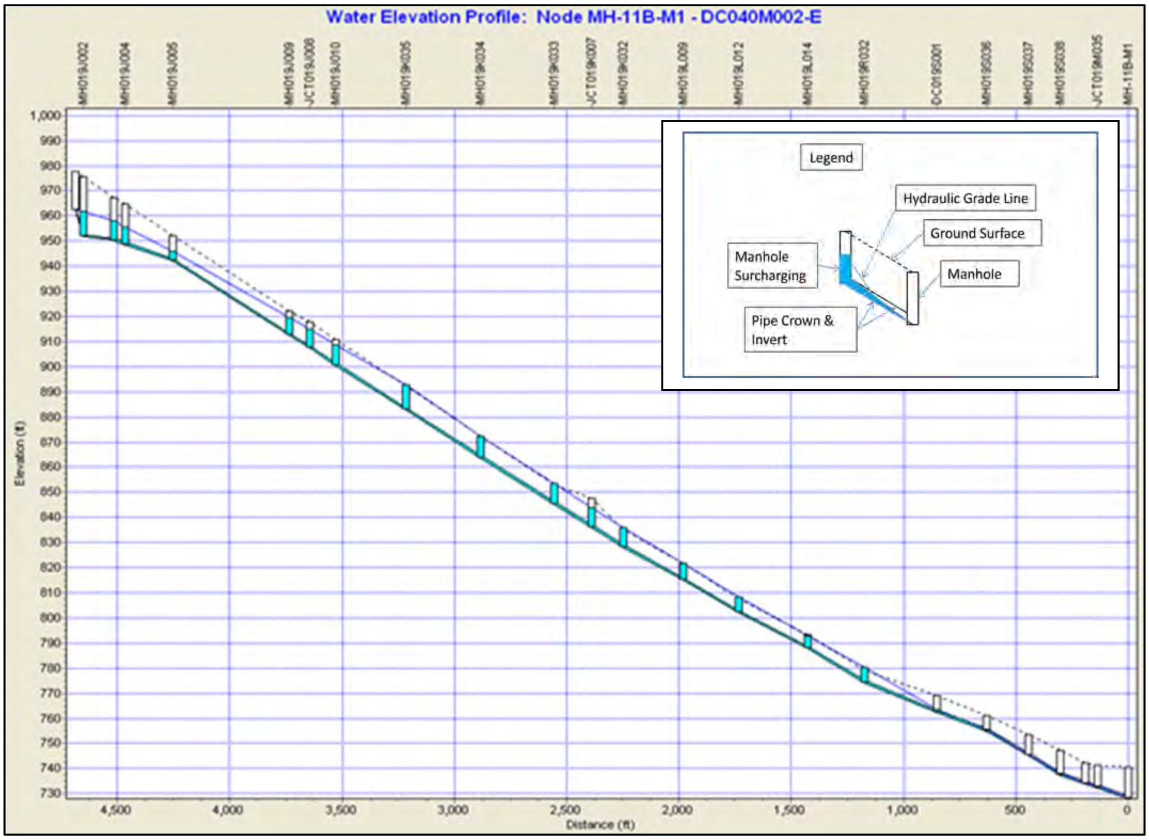
- 2046 peak flows and volumes to the MH-11 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figure 3 from that report presented a profile of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. This figure is reproduced below as Figure MH11-5-3. Under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging and manhole flooding occurs along the length of the trunk sewer.

The HGL along the main trunk sewer following implementation of alternative POC-MH11-C-0 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, modification of the diversion structures combined with additional conveyance capacity (0 OF/yr; 2-yr storm) will satisfactorily reduce manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE MH11-5-3: MH-11 MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



5.2.2 2046 Peak Flows and Volumes to MH-11 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the PWSA system. ALCOSAN made similar assumptions[1], and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, as well as additional consolidation piping to convey increased flows to the MH-11 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the MH-11 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances from ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This contrasts with the PWSA's water quality based decision to recommend a zero OF/yr level of control within the Saw Mill Run planning basin.

However, the control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the MH-11 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from Ingram Borough indicates that they plan to convey all their flows to the MH-11 trunk sewer for the duration of the planning period. They have no plans to implement controls that would alter the modeled flows upon which the recommended alternative was based. This information is summarized in Table MH11-5-6.

TABLE MH11-5-6: MH-11 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

Tributary Municipality	Volume*		
	Captured	Treated	Conveyed
Ingram Borough	N/A	N/A	All modeled flows

*Following implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, as well as increased conveyance piping to convey increased flows to the MH-11 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

As the primary flow contributor within this sewershed, the PWSA intends to extend the incorporation of IWP to the entire sewershed. The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of regulator modifications and additional consolidation piping designed to control CSOs from the PWSA diversion structures to zero overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the MH-11 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts in Saw Mill Run and McCartney Run due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-MH11-C-0 are consolidation piping, CSO screening facilities, and diversion structure modifications. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment MH11-5-1.

5.4.1 Consolidation Piping

In the MH-11 sewershed, additional conveyance capacity was provided through the use of parallel relief sewers to convey flows to the MH-11 POC. As detailed earlier, relief sewers were added to areas of the system that exhibited manhole flooding or surcharging at any time during the 24-hour design storm events. All improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewer.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street

5.4.2 CSO Screening Facilities

It was assumed that each outfall location will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

It was assumed that adjustments to existing regulator settings, including more effective and improved methods of flow control and monitoring, improved access, etc., would be sufficiently extensive as to make it more cost effective to simply replace each structure. The unit cost associated with the installation of each new diversion structure was assumed to be $200,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $360,000.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure MH11-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible "knee of the curve" is evident from this data.

These costs are also presented in a tabular format in Table MH11-5-7.

The selected level of CSO control - 0 OF/yr - was determined based upon water quality considerations. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-MH11-C-0 are summarized in Table MH11-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE MH11-5-4: MH-11 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

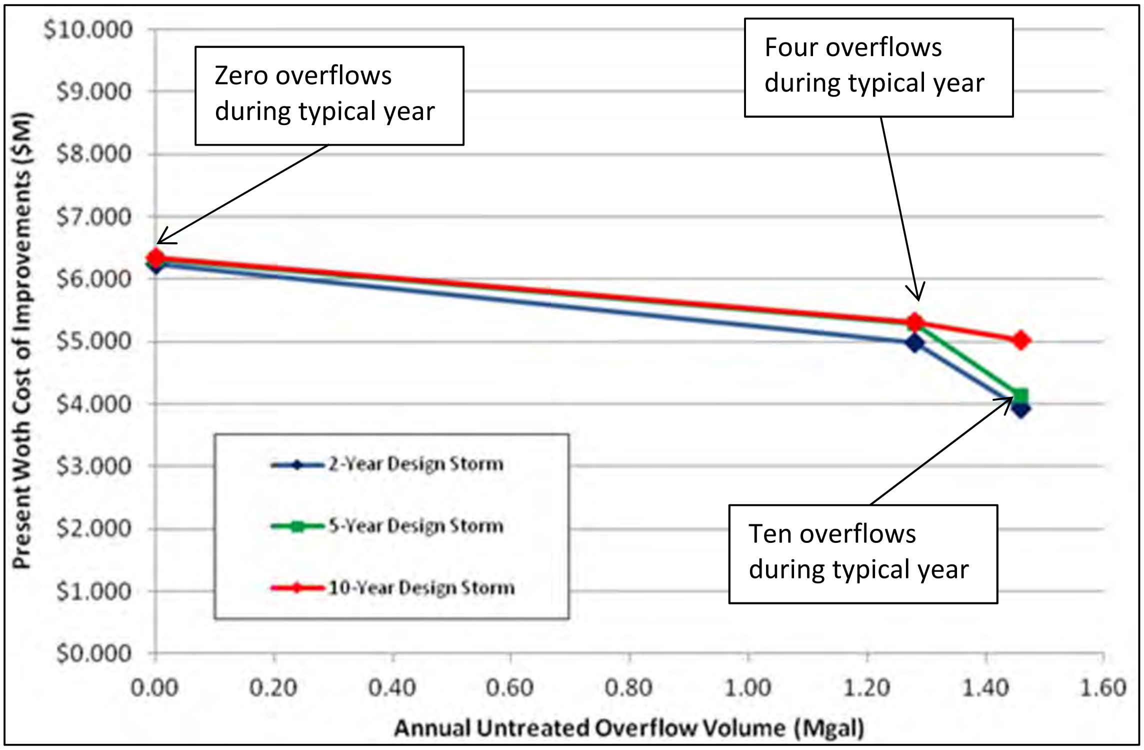


TABLE MH11-5-7: MH-11 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	**CSO Control**				
	Untreated CSO Vol. (MG)	**CSO Control Level (OF/yr)**	**PW Capital Cost ($MM)**	**PW O&M Cost* ($MM)**	**TPW CSO Control ($MM)**
POC-MH11-C-0	0	0	$6.1	$0.1	$6.2
POC-MH11-C-4	1.3	4	$4.9	$0.1	$5.0
POC-MH11-C-10	1.5	10	$3.8	$0.1	$3.9
Alternative Name	**SSO Control**				
	Untreated SSO Vol. (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-MH11-C-0	0	2-year	$0	$0	$0
POC-MH11-C-4	0	2-year	$0	$0	$0
POC-MH11-C-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE MH11-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-MH11-C-0

Capital Improvements	Size/ Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Close diversion structure: DC019S001	N/A	$0	$0	$0
Replace diversion structures: DC019K001 DC019L001 DC040M001 DC040M002	0 OF/yr Each	$1.44	$1.44	$1.46
Add screening to diversion structures: DC019J001 DC019K001 DC019L001 DC040M001 DC040M002	2.0 to 27 mgd overflow rates	$2.25	$2.25	$2.27
Conveyance Piping	12-in dia.	$0.09	$0.09	$0.09
Conveyance Piping	24-in dia.	$0.07	$0.07	$0.07
Conveyance Piping	30-in dia.	$1.58	$1.58	$1.65
Conveyance Piping	36-in dia.	$0.47	$0.47	$0.48
Conveyance Piping	42-in dia.	$0.21	$0.21	$0.22

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA recognizes that the flows generated by the tributary municipality of Ingram Borough are minor. Due to their minor flow contributions, the PWSA has not approached Ingram Borough in regards to cost sharing of capital and O&M costs.

However, it is possible that, in the future, the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the MH-11 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC MH-11 overflow is not intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the "Selected Plan" to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the "Recommended Plan". This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the "Selected Plan" is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

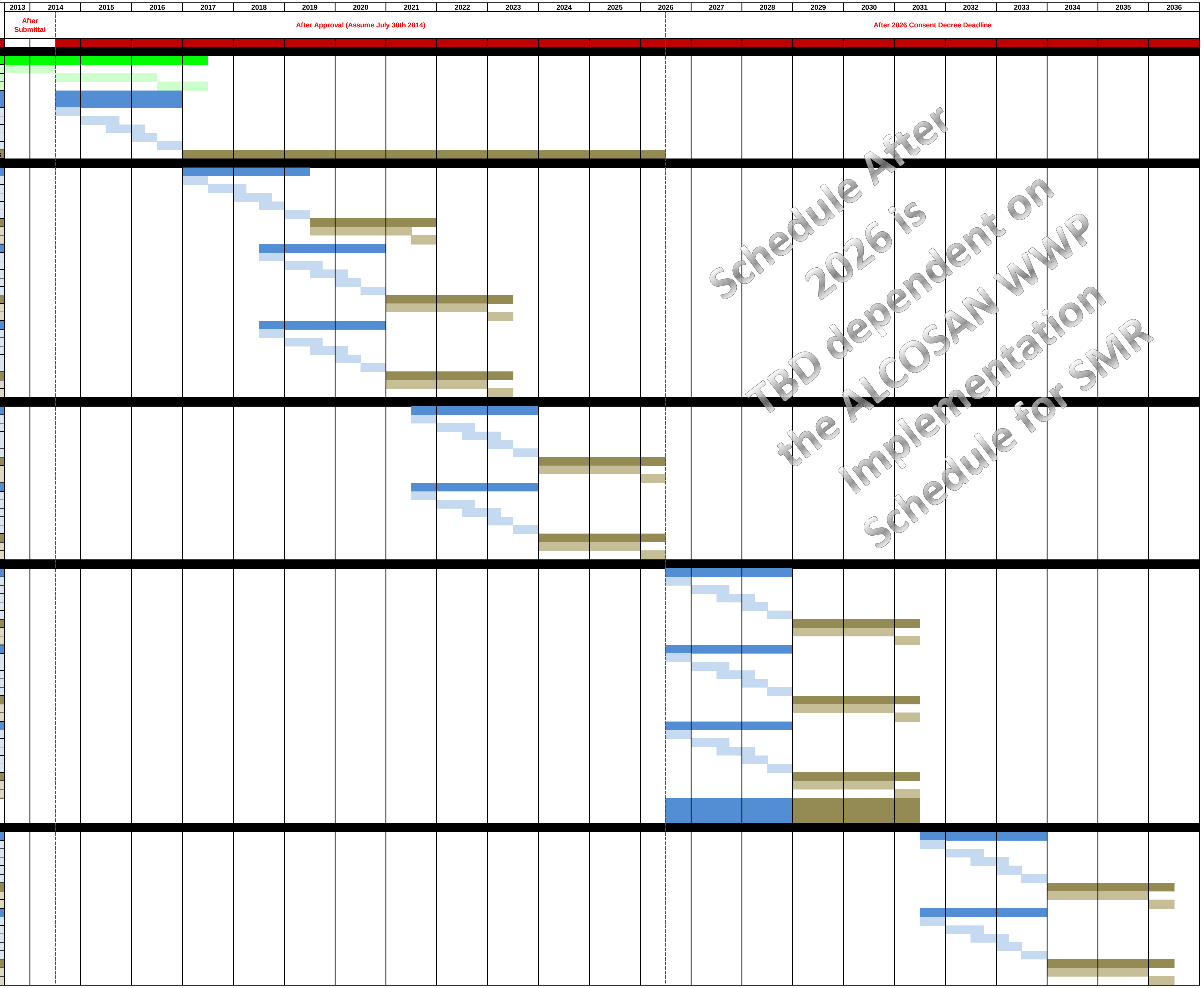
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it's important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the SMR portion of the regional plan is not being implemented by 2026, and an implementation date is not specified in the plan. Therefore, an implementation schedule for MH-11 improvements cannot be specified at this time as it depends on the ALCOSAN WWP' SMR implementation schedule. The deadline shown in the schedule for MH-11, which is shown in Figure MH18-5-5, is for reference purposes only.

ATTACHMENT B

FIGURE MH11-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the MH-11 sewershed. At this point, there are no multi-municipal improvements being proposed for this sewershed. Therefore, Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Ingram Borough, and the Pittsburgh Water and Sewer Authority are not being considered. Other considerations regarding the MH-11 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the “2-year design storm” for the municipal separate sanitary system portions and “4 OF/ typical year” for the PWSA’s combined system outside of Saw Mill Run where “0 OF/ typical year” is proposed.

At this point, since the recommended improvements involve little to no contribution from Ingram Borough, cost allocations and inter-municipal cost sharing agreements have not been pursued at this point.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

If cost sharing agreements becomes a necessary option, a DRAFT Memorandum of Understanding (MOU) would be used in developing cost allocation procedures and move towards arriving at inter-municipal agreements. The MOU development would be guided by and be based on the following set of principles:

- The major goal is to develop a fair and equitable cost allocation process.
- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.
- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.
- Cost allocations should be simple and easy to calculate in the future.
- The final cost allocation methodology should encourage efficiencies between municipalities.
- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.
- Unless agreed to by all parties, existing contracts should not form the only basis for cost allocations.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended MH-11 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after M-11 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination

- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

Phase I	2013 through 2017
Phase II	2017 through 2023
Phase III	2021 through 2026
Phase IV	TBD
Phase V	TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure MH11-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the MH-11 shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

---

[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

6.3.2 Joint Municipal Planning and Implementation

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. As previously stated in Section 6.2, a draft MOU has not been pursued at this time. If a draft MOU was deemed a necessary option, then it would contain provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

At this time, there are no known flow management strategy conflicts / concerns or institutional / administrative obstacles that could delay or impede the signing of the MOU.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$6,100,000.
- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance
- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of

annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table MH11-6-1. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE MH11-6-1: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638
Ingram Borough	Not Available	Not Available	Not Available

---

[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.

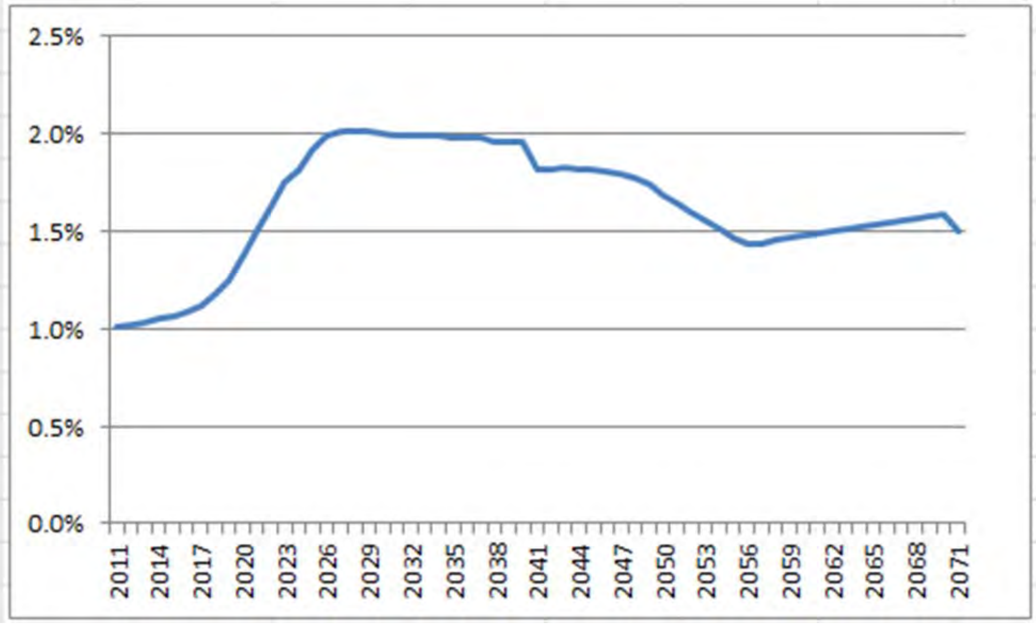
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure MH11-6-1.

FIGURE MH11-6-1 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.

7.0 STAKEHOLDER INVOLVEMENT

For the purpose of developing the PWSA Feasibility Study and this POC-based feasibility study, the PWSA recognized that the flow tributary to the McCartney Run sewershed generated by the municipality of Ingram Borough is minor. Due to their minor flow contribution, the PWSA did not lead a Wet Weather Feasibility Study Coordination Meeting to facilitate stakeholder participation between the PWSA and Ingram Borough, with the purpose of coordinating the development of planning information specific to the multi-municipal sewershed, reaching a consensus agreement on the recommended improvements or receiving authorization to submit the results. Additionally, stakeholder meetings facilitated by 3RWW, titled POC Sewershed Coordination Meetings, were not held for POC MH-11. However, other PWSA stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
MH-18: LITTLE SAW MILL RUN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

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1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report On The Current Status Of The Development Of The Wet Weather Feasibility Study For The City Of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report On The Current Status Of The Development Of The Wet Weather Feasibility Study For The City Of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh, Dormont Borough, Green Tree Borough, Mt. Lebanon, and Scott Township. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.
- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.
- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.
- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development, alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.
- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.

- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.
- Section 7.0 describes how stakeholders were included in the development of the plan.

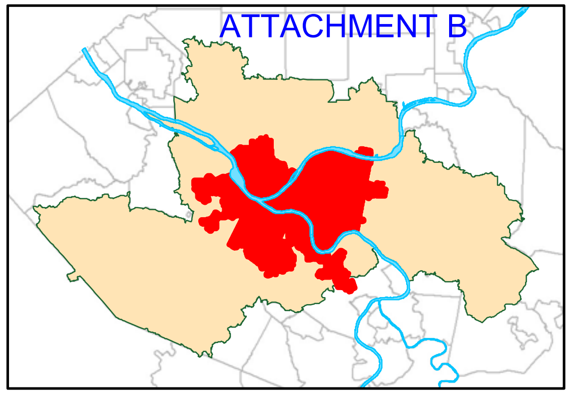
1.2 EXISTING SYSTEM DESCRIPTION

This POC FS Report addresses POC MH-18, also known as Little Saw Mill Run. The MH-18 sewershed is located in the Saw Mill Run Planning Basin. The Saw Mill Run basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

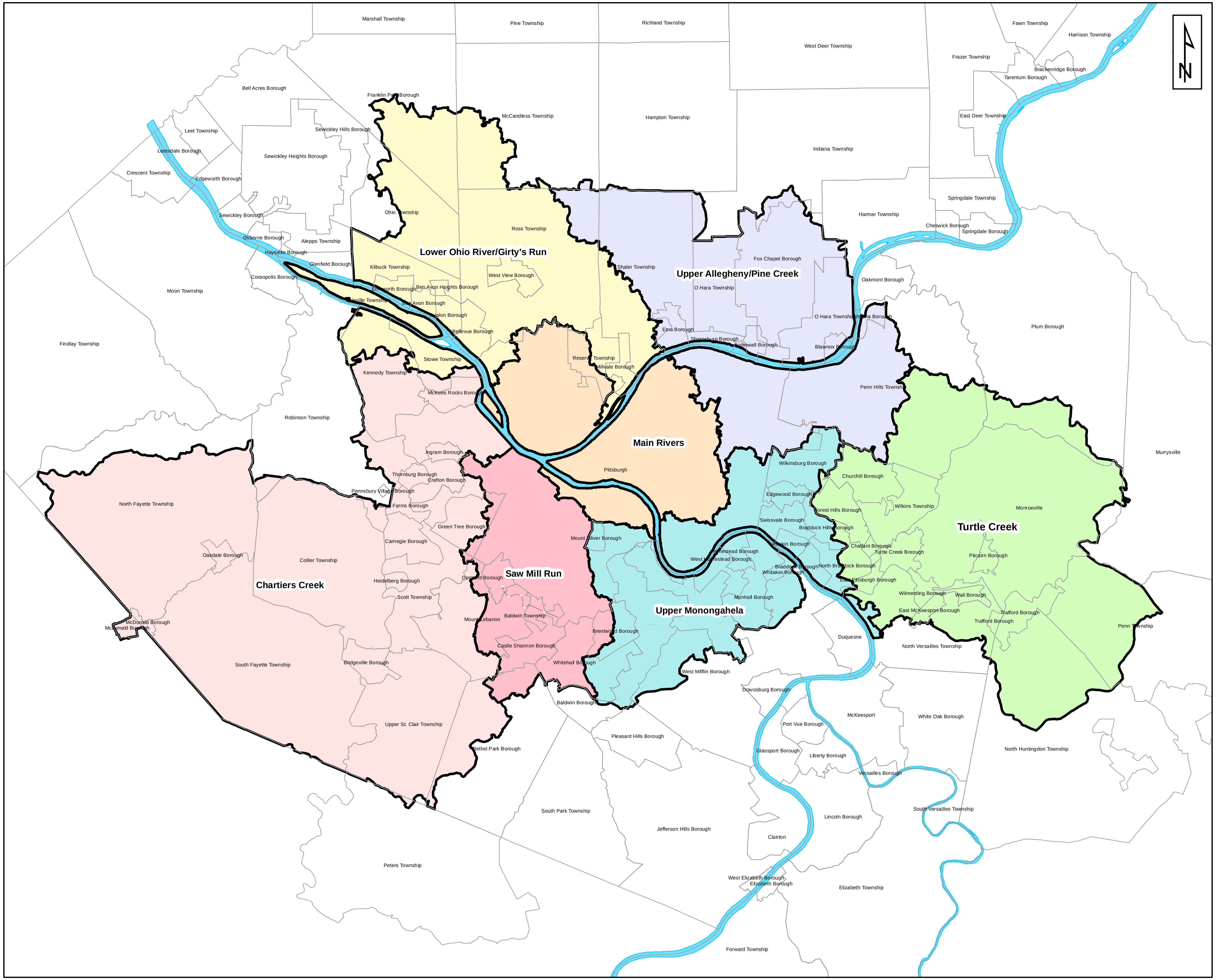
The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: MH-18 Little Saw Mill Run Existing Facilities Map*. The MH-18 sewershed is served by one main trunk sewer that connects to ALCOSAN's Saw Mill Run Interceptor at manhole MH-18. The main trunk sewer extends from the direct connection at MH-18 in a southerly direction along and adjacent to Banksville Road and varies in size from 20 inches to 30 inches in diameter. The sewer is constructed primarily of vitrified clay and ductile iron.

There are ten PWSA CSO diversion chambers in the sewershed that overflow to Little Saw Mill Run at six permitted CSOs. The MH-18 sewershed encompasses approximately 1,819 acres. The sewershed is made up of 1,146 acres of the City of Pittsburgh, 228 acres of Dormont Borough, 233 acres of Green Tree Borough, 175 acres Mt. Lebanon, and 37 acres of Scott Township. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to MH-18* for specific information on this POC.

ATTACHMENT B



ALCOSAN Service Area Overview



Legend

- ☐ Municipal Boundary
- ▨ Chartiers Creek
- ▨ Lower Ohio River / Girty's Run
- ▨ Main Rivers
- ▨ Saw Mill Run
- ▨ Turtle Creek
- ▨ Upper Allegheny / Pine Creek
- ▨ Upper Monongahela
- ▨ River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins Feasibility Study Report

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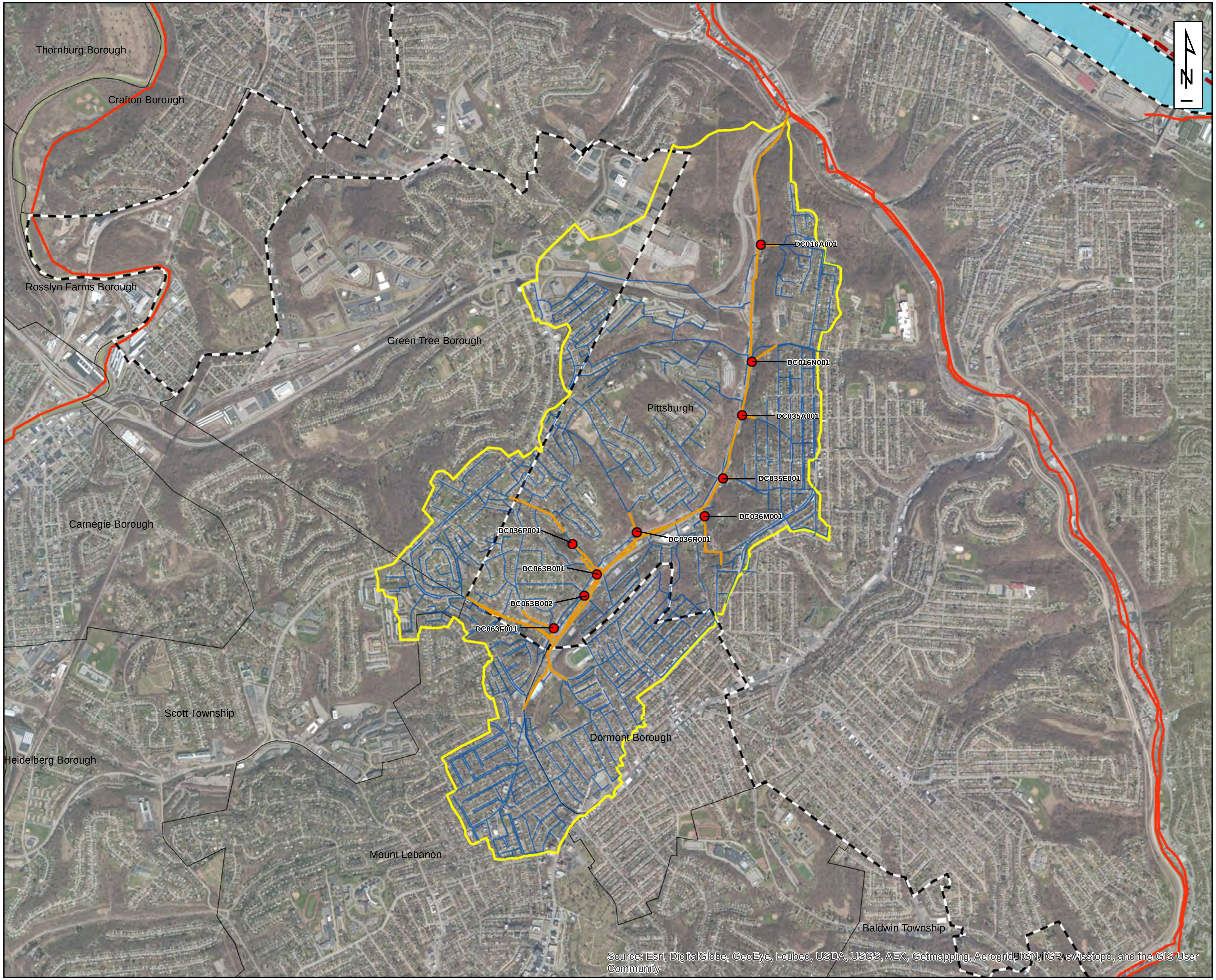
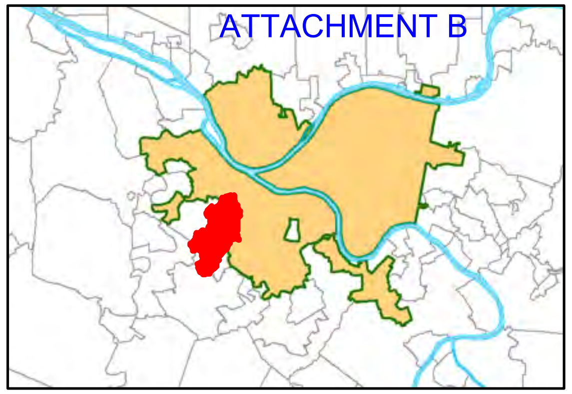
Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd

ATTACHMENT B





PWSA Service Area Overview

Legend

- ● PWSA CSO Diversion Structure
- — Trunk Sewer
- — Collector Sewer
- ☐ MH-18 Sewershed Boundary
- ⬚ PWSA Service Area Boundary
- ☐ Municipal Boundary
- ■ River

Existing ALCOSAN Interceptor

- - - - Deep Tunnel
- — Shallow Cut

2,000 1,000 0 2,000 Feet

Figure 1 - 2: MH-18 Little Saw Mill Run Existing Facilities

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Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\LITTLE SAW MILL RUN (MH-18)\FIGURE 1-2_MH_18Existing Overflows_.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR MUNICIPALITIES TRIBUTARY TO MH-18

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY				
	City of Pittsburgh	Dormont Borough	Green Tree Borough	Mt. Lebanon[1]	Scott Township
Tributary Area (Acres)	1,146	228	233	184.87	37
Population	6,932	3,537	753	2,234	467
Combined					
Inch-Miles	206	0	6	0	0
Linear Feet	74,800	0	4,100	0	0
Inch-Miles/Acre	0.18	0	0.03	0	0
Separate					
Inch-Miles	176	82	49	80.80	11
Linear Feet	83,600	47,500	32,400	51,154	7,400
Inch-Miles/Acre	0.15	0.36	0.21	0.44	0.30

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows from the upstream PWSA diversion structures tie directly into the Saw Mill Run interceptor with no overflow structure. The Saw Mill Run interceptor conveys those flows to ALCOSAN diversion structure O-14.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to MH-18*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008).*

---

[1] Data provided by Municipality of Mt. Lebanon per municipal RFI.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO MH-18

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
016A002	DC016A001	CSO016A002	Banksville Road	Little Saw Mill Run
016A001	DC016N001	CSO016A001	Crane Avenue and Banksville Road	Little Saw Mill Run
035A001	DC035A001	CSO035A001	Goldstrom Avenue and Banksville Road	Little Saw Mill Run
035E001	DC035E001	CSO035E001	Coast Avenue and Banksville Road	Little Saw Mill Run
035J001	DC036M001	CSO035J001	Banksville Avenue	Little Saw Mill Run
036R001	DC036P001 DC036R001 DC063B001 DC063B002 DC063F001	CSO036R001	Banksville Road	Little Saw Mill Run

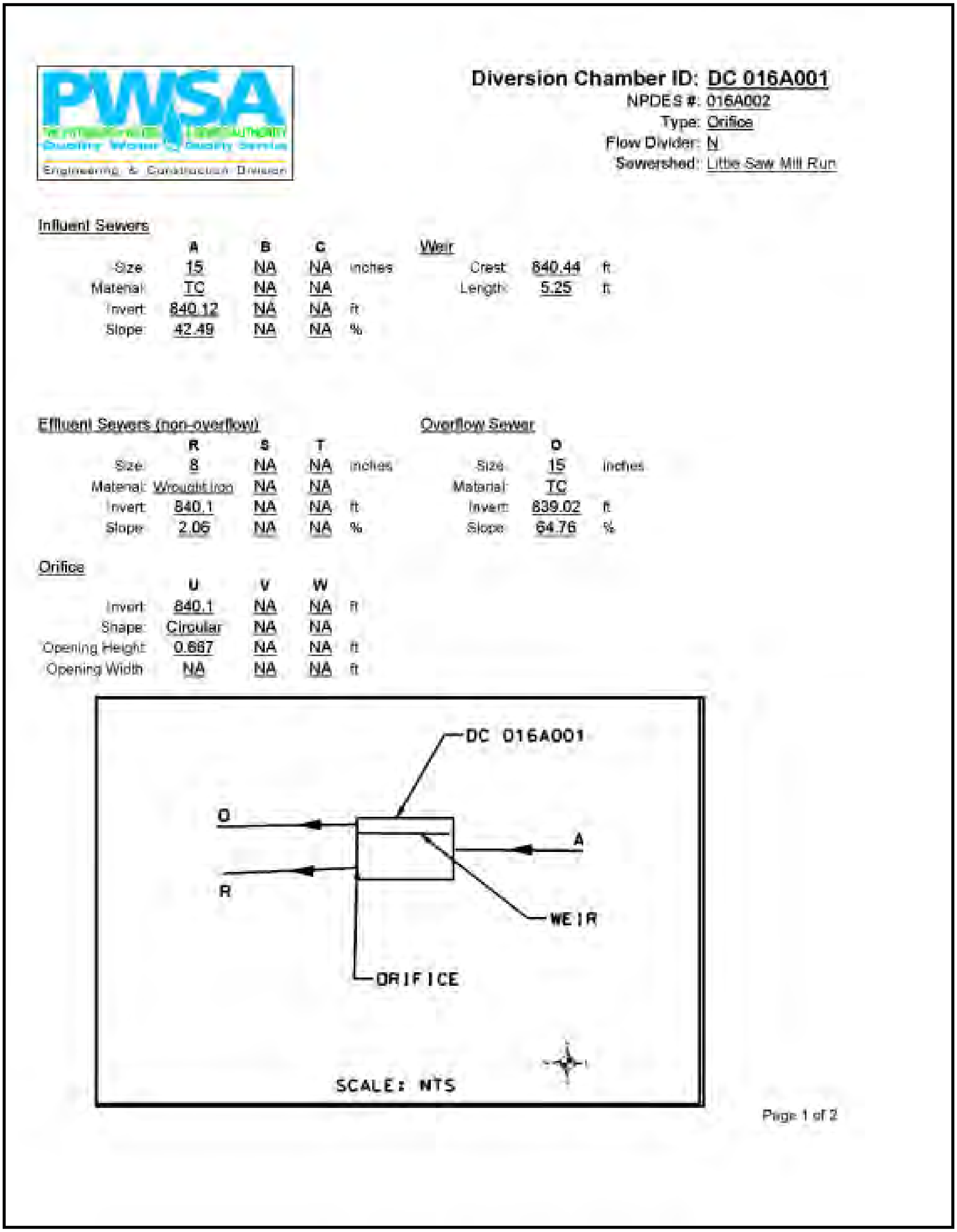
As shown in *Table 1-3: MH-18 Sewershed Typical Year Overflow Statistics*, during the typical year these ten structures overflow between three and 55 times. Overflow volumes range from 20,000 gallons to 810,000 gallons per event, and from 70,000 gallons to 4.8 million gallons annually, on a structure by structure basis. Annual overflow volume for this sewershed is 12.24 million gallons.

TABLE 1-3: MH-18 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC016A001	4	12.28	N/A	N/A	0.21	N/A	N/A	0.37
DC016N001	42	18.96	4.50	2.04	0.61	0.15	0.06	2.53
DC035A001	10	19.90	1.36	N/A	0.41	0.02	N/A	0.58
DC035E001	12	18.83	2.61	0.53	0.40	0.03	0.01	0.69
DC036M001	3	4.94	N/A	N/A	0.08	N/A	N/A	0.13
DC036P001	46	33.14	7.44	3.97	0.81	0.25	0.14	4.78
DC036R001	10	0.76	0.23	N/A	0.02	0.01	N/A	0.07
DC063B001	3	6.47	N/A	N/A	0.14	N/A	N/A	0.20
DC063B002	5	4.52	0.01	N/A	0.10	0.01	N/A	0.12
DC063F001	55	16.41	4.04	2.18	0.46	0.14	0.08	2.77
Total Annual Volume								**12.24**

1.2.1 Diversion Structure Sketches

The following sketches of the MH-18 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.



Diversion Chamber ID: DC 016A001
NPDES #: 016A002
Type: Orifice
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	TC	NA	NA	
Invert:	840.12	NA	NA	ft
Slope:	42.49	NA	NA	%

Weir

Crest:	840.44	ft
Length:	5.25	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	Wrought Iron	NA	NA	
Invert:	840.1	NA	NA	ft
Slope:	2.06	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	839.02	ft
Slope:	64.76	%

Orifice

	U	V	W	
Invert:	840.1	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	0.667	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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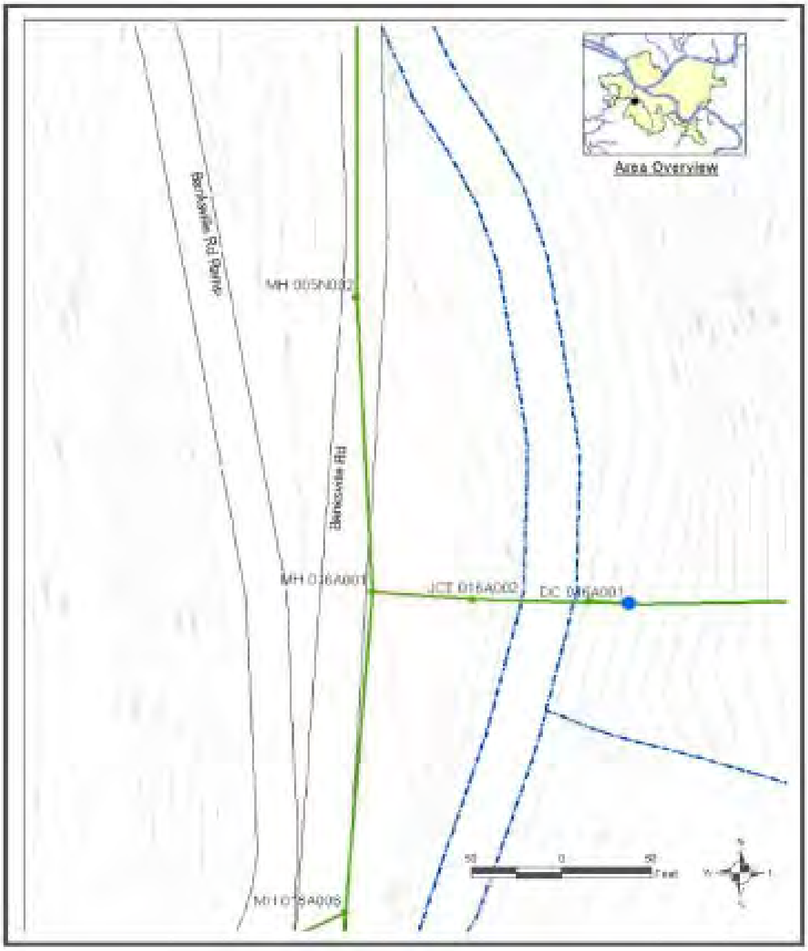
Diversion Chamber ID: DC 016A001



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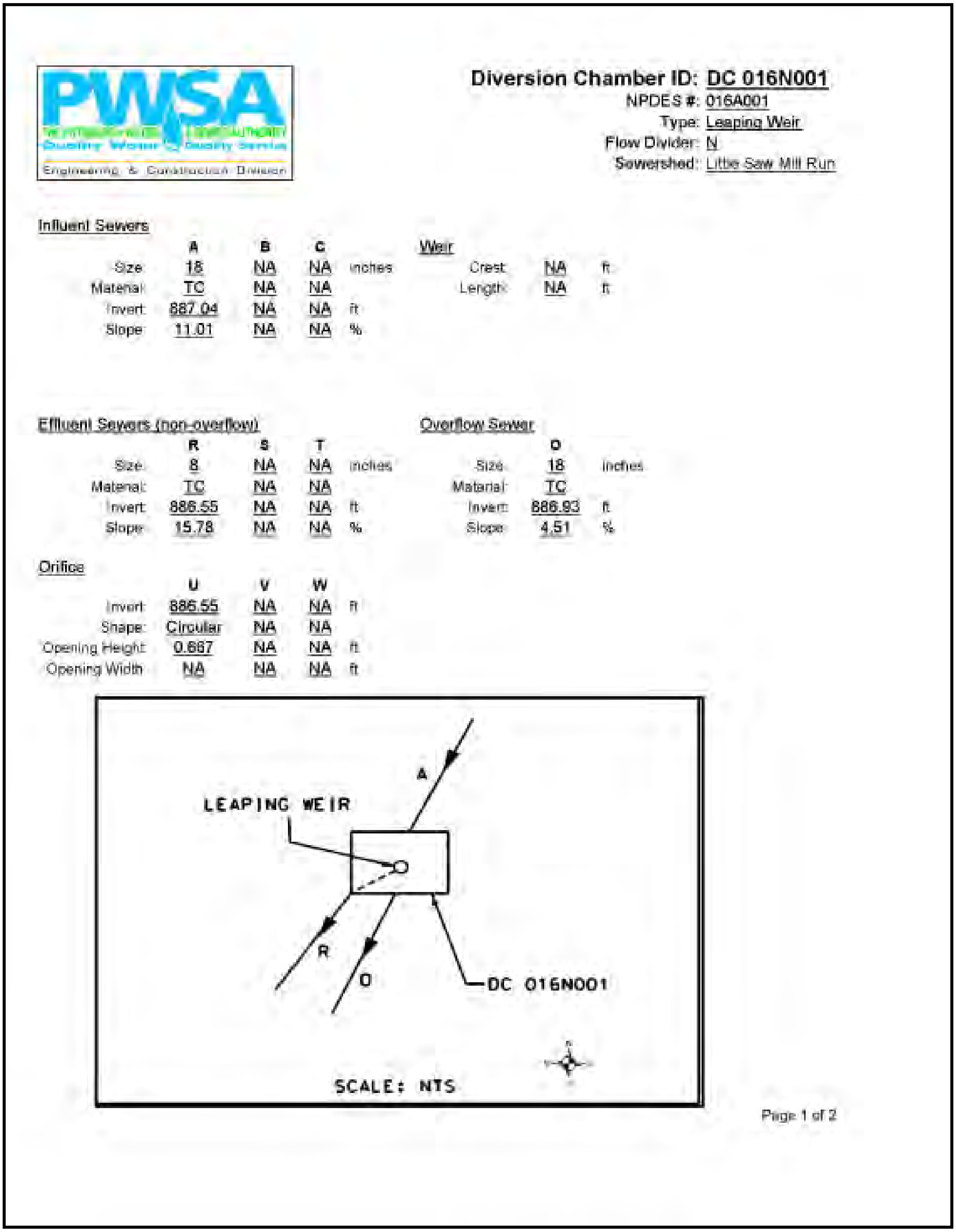

PWSA
Quality Water © Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 016N001
NPDES #: 016A001
Type: Leaping Weir
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size:	18	NA	NA	inches
Material:	TC	NA	NA	
Invert:	887.04	NA	NA	ft
Slope:	11.01	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	886.55	NA	NA	ft
Slope:	15.78	NA	NA	%

Overflow Sewer

	O	
Size:	18	inches
Material:	TC	
Invert:	886.93	ft
Slope:	4.51	%

Orifice

	U	V	W	
Invert:	886.55	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	0.667	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 016N001

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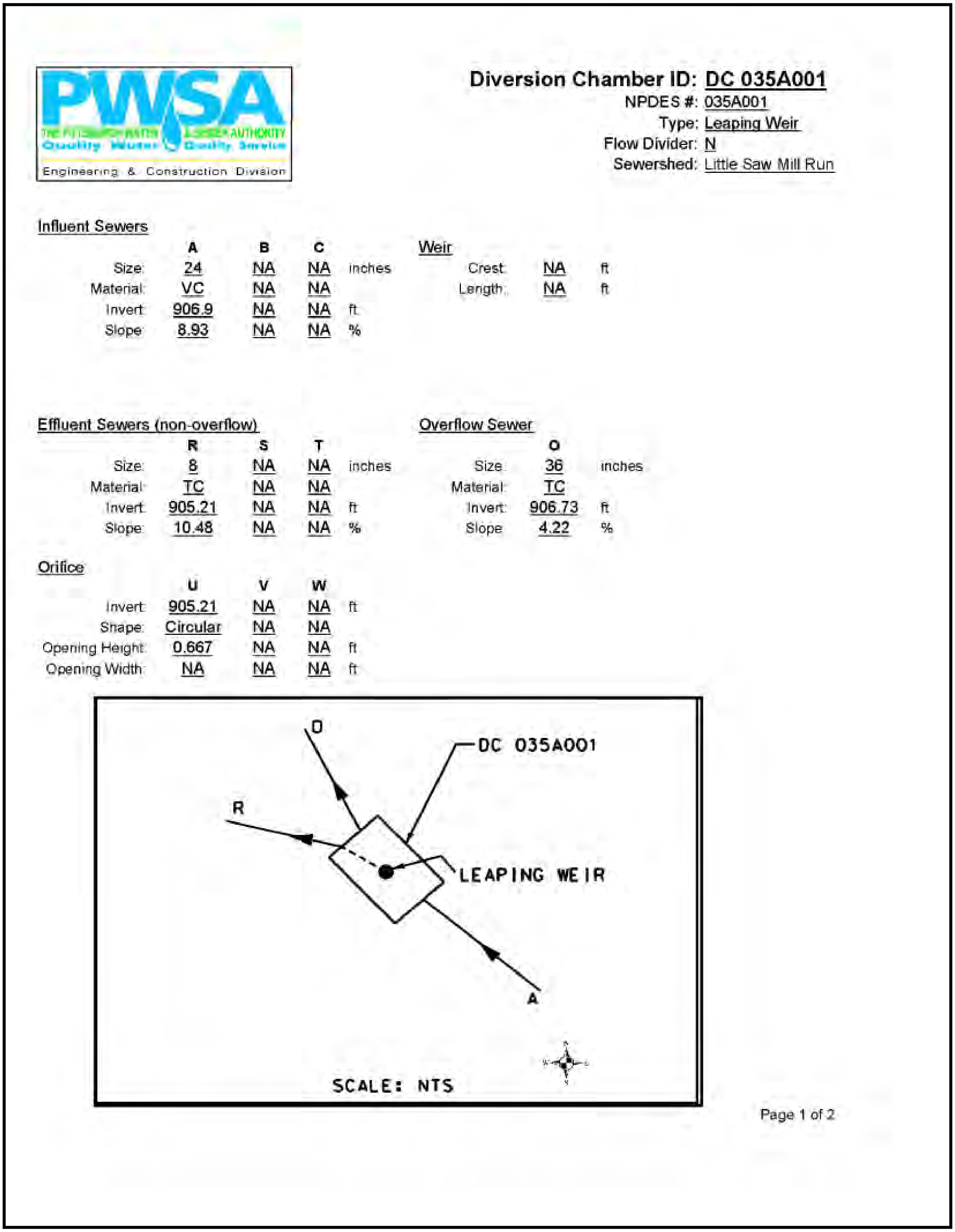

Engineering & Construction Division

Diversion Chamber ID: DC 035A001
NPDES #: 035A001
Type: Leaping Weir
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size:	24	NA	NA	inches
Material:	VC	NA	NA	
Invert:	906.9	NA	NA	ft
Slope:	8.93	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	905.21	NA	NA	ft
Slope:	10.48	NA	NA	%

Overflow Sewer

	O	
Size:	36	inches
Material:	TC	
Invert:	906.73	ft
Slope:	4.22	%

Orifice

	U	V	W	
Invert:	905.21	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	0.667	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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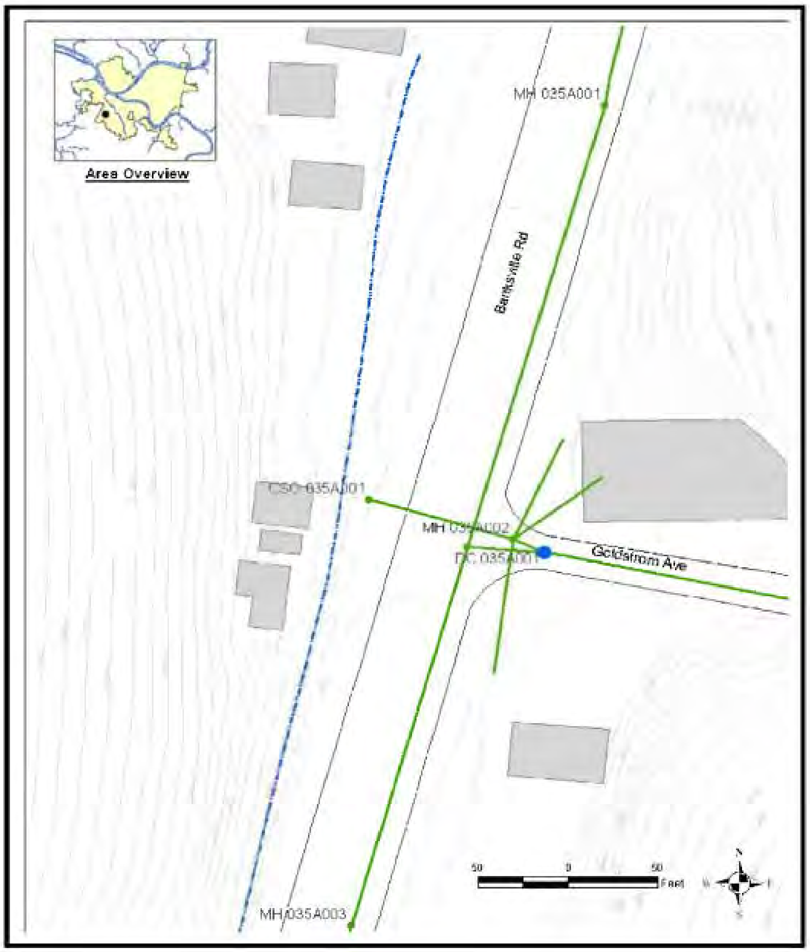
Diversion Chamber ID: DC 035A001



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PWSA
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Diversion Chamber ID: DC 035E001
NPDES #: 035E001
Type: Leaping Weir
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size:	30	NA	NA	inches
Material:	RC	NA	NA	
Invert:	931.3	NA	NA	ft
Slope:	10.09	NA	NA	%

Weir

Crest:	NA	ft
Length:	NA	ft

Effluent Sewers (non-overflow)

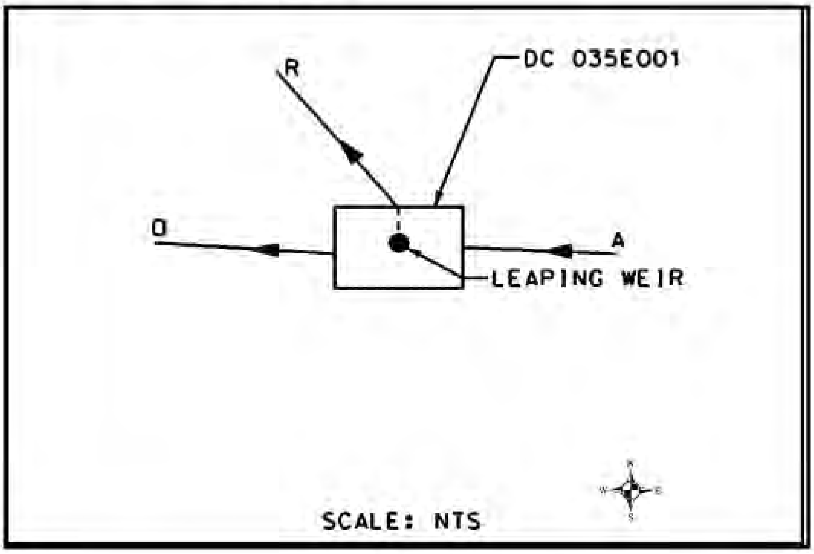
	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	929.24	NA	NA	ft
Slope:	9.88	NA	NA	%

Overflow Sewer

	O	
Size:	30	inches
Material:	RC	
Invert:	931.16	ft
Slope:	6.56	%

Orifice

	U	V	W	
Invert:	930.22	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	0.667	NA	NA	ft
Opening Width:	NA	NA	NA	ft



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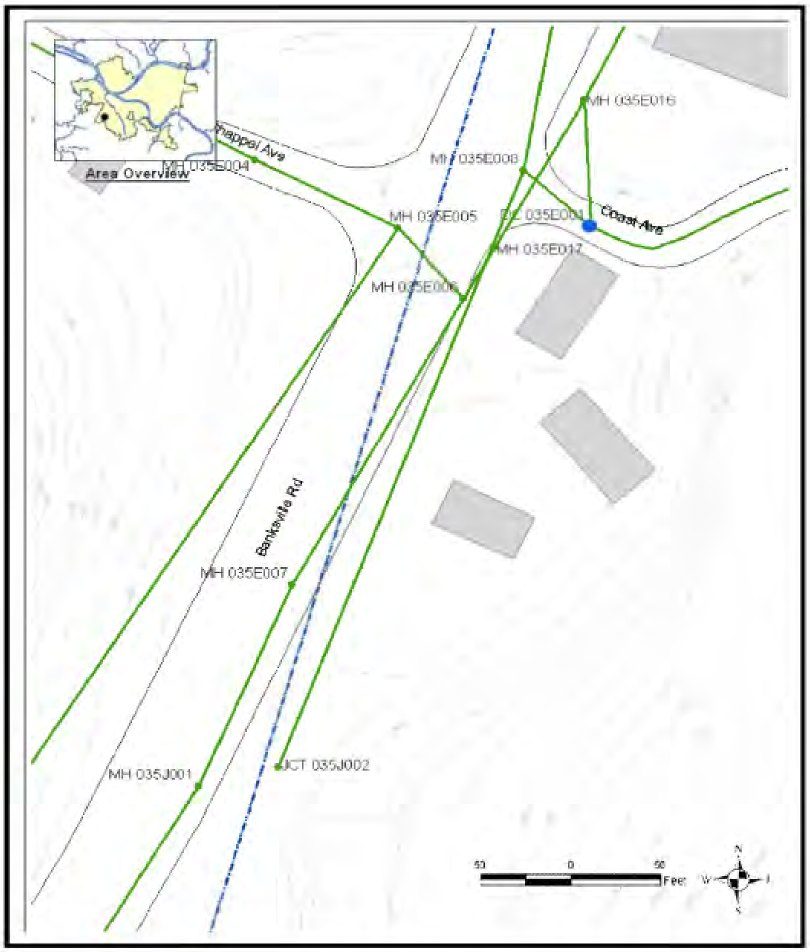
Diversion Chamber ID: DC 035E001



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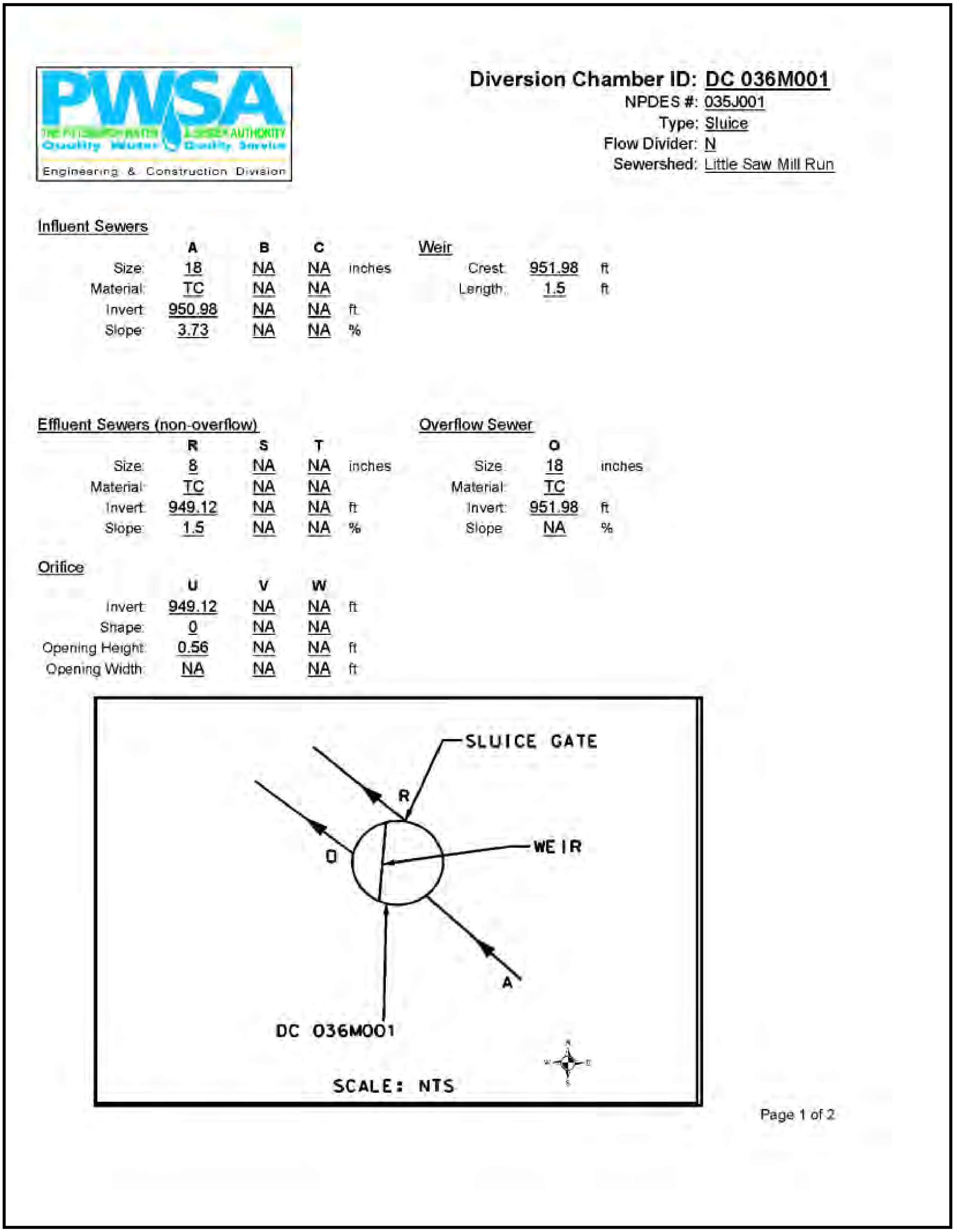

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 036M001
NPDES #: 035J001
Type: Sluice
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size:	18	NA	NA	inches
Material:	TC	NA	NA	
Invert:	950.98	NA	NA	ft
Slope:	3.73	NA	NA	%

Weir

Crest:	951.98	ft
Length:	1.5	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	949.12	NA	NA	ft
Slope:	1.5	NA	NA	%

Overflow Sewer

	O	
Size:	18	inches
Material:	TC	
Invert:	951.98	ft
Slope:	NA	%

Orifice

	U	V	W	
Invert:	949.12	NA	NA	ft
Shape:	0	NA	NA	
Opening Height:	0.56	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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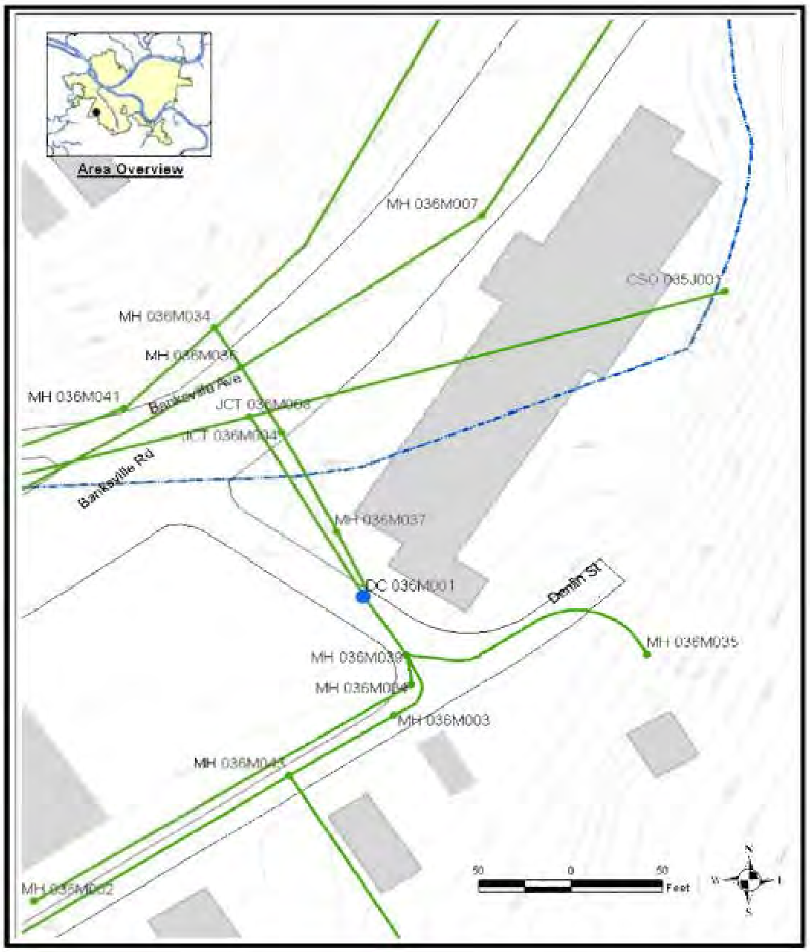
Engineering & Construction Division

Diversion Chamber ID: DC 036M001



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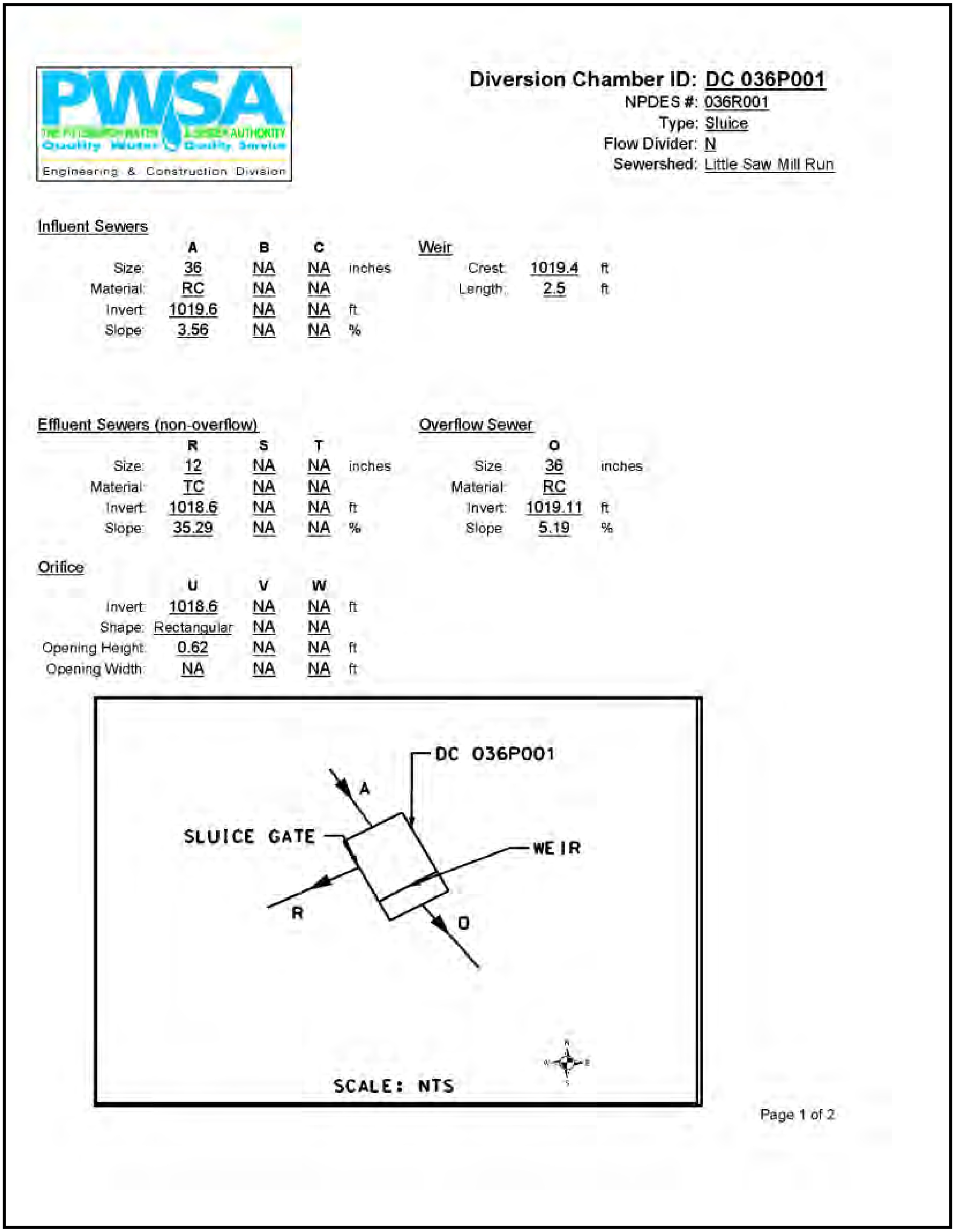

PWSA
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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 036P001
NPDES #: 036R001
Type: Sluice
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size:	36	NA	NA	inches
Material:	RC	NA	NA	
Invert:	1019.6	NA	NA	ft
Slope:	3.56	NA	NA	%

Weir

Crest:	1019.4	ft
Length:	2.5	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1018.6	NA	NA	ft
Slope:	35.29	NA	NA	%

Overflow Sewer

	O	
Size:	36	inches
Material:	RC	
Invert:	1019.11	ft
Slope:	5.19	%

Orifice

	U	V	W	
Invert:	1018.6	NA	NA	ft
Shape:	Rectangular	NA	NA	
Opening Height:	0.62	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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Engineering & Construction Division

Diversion Chamber ID: DC 036P001

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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 036R001
NPDES #: 036R001
Type: Sluice
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	TC	NA	NA	
Invert:	976.07	NA	NA	ft
Slope:	2.62	NA	NA	%

Weir

Crest:	976.85	ft
Length:	4.25	ft

Effluent Sewers (non-overflow)

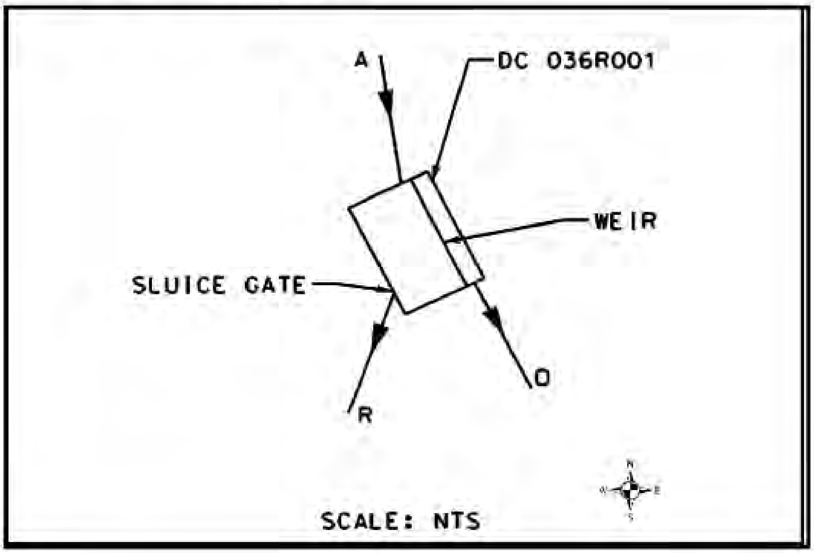
	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	975.98	NA	NA	ft
Slope:	13.34	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	976.17	ft
Slope:	1.03	%

Orifice

	U	V	W	
Invert:	975.98	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.5	NA	NA	ft
Opening Width:	NA	NA	NA	ft



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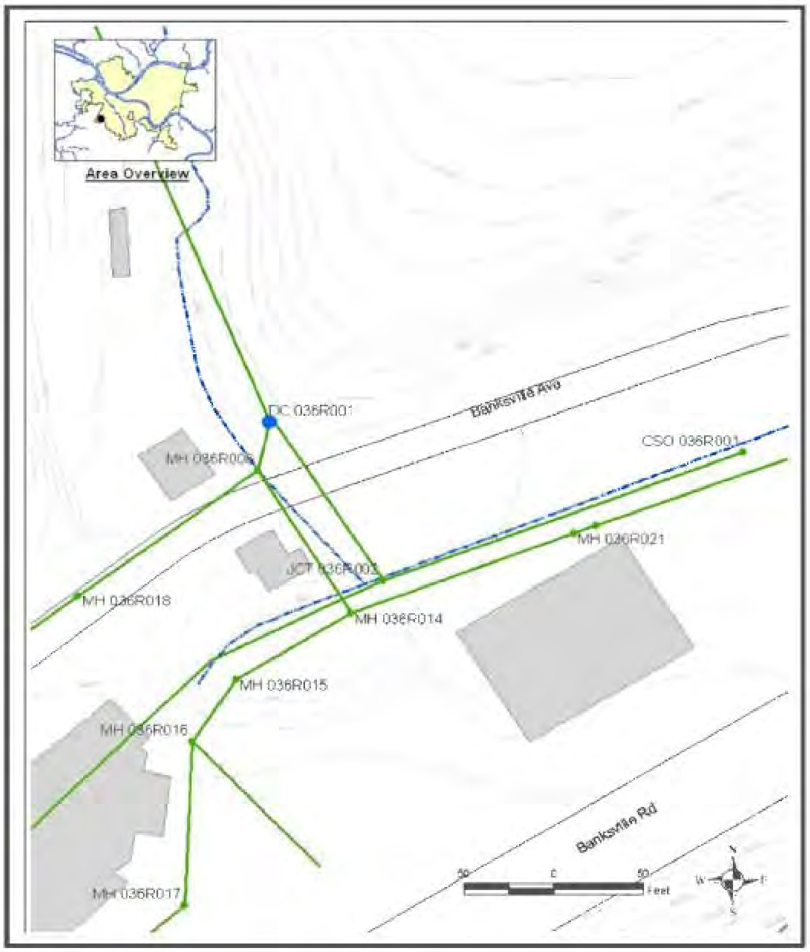
Diversion Chamber ID: DC 036R001



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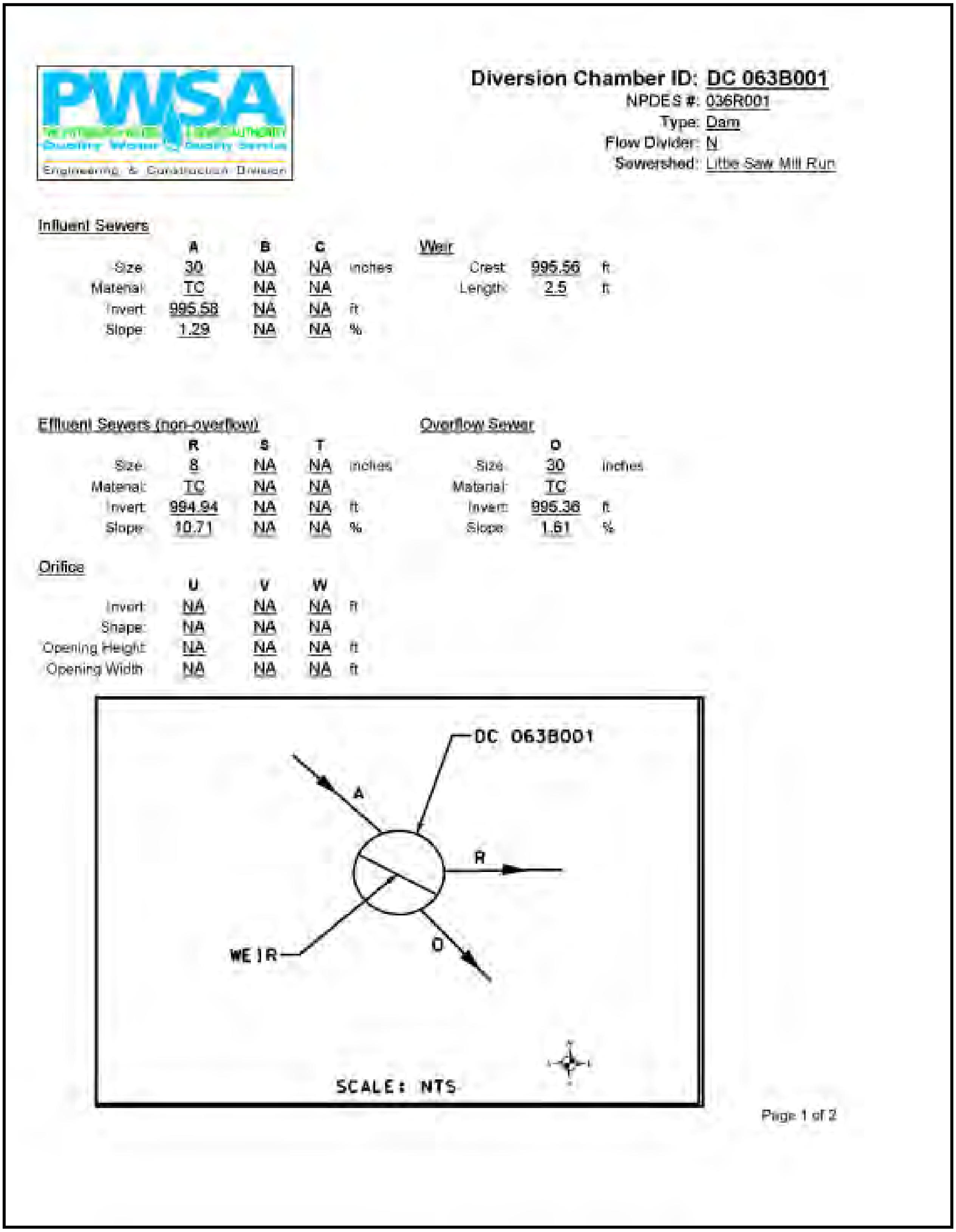

PWSA
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Quality Water & Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 063B001
NPDES #: 036R001
Type: Dam
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size:	30	NA	NA	inches
Material:	TC	NA	NA	
Invert:	995.58	NA	NA	ft
Slope:	1.29	NA	NA	%

Weir

Crest:	995.56	ft
Length:	2.5	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	994.94	NA	NA	ft
Slope:	10.71	NA	NA	%

Overflow Sewer

	O	
Size:	30	inches
Material:	TC	
Invert:	995.36	ft
Slope:	1.61	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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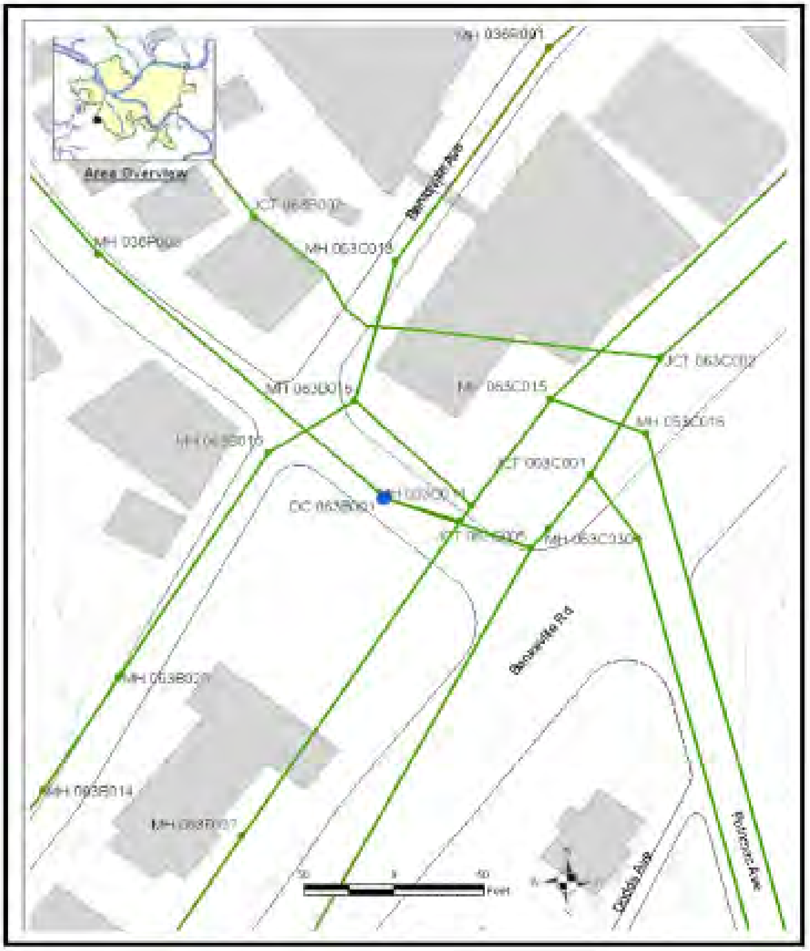
Engineering & Construction Division

Diversion Chamber ID: DC 063B001



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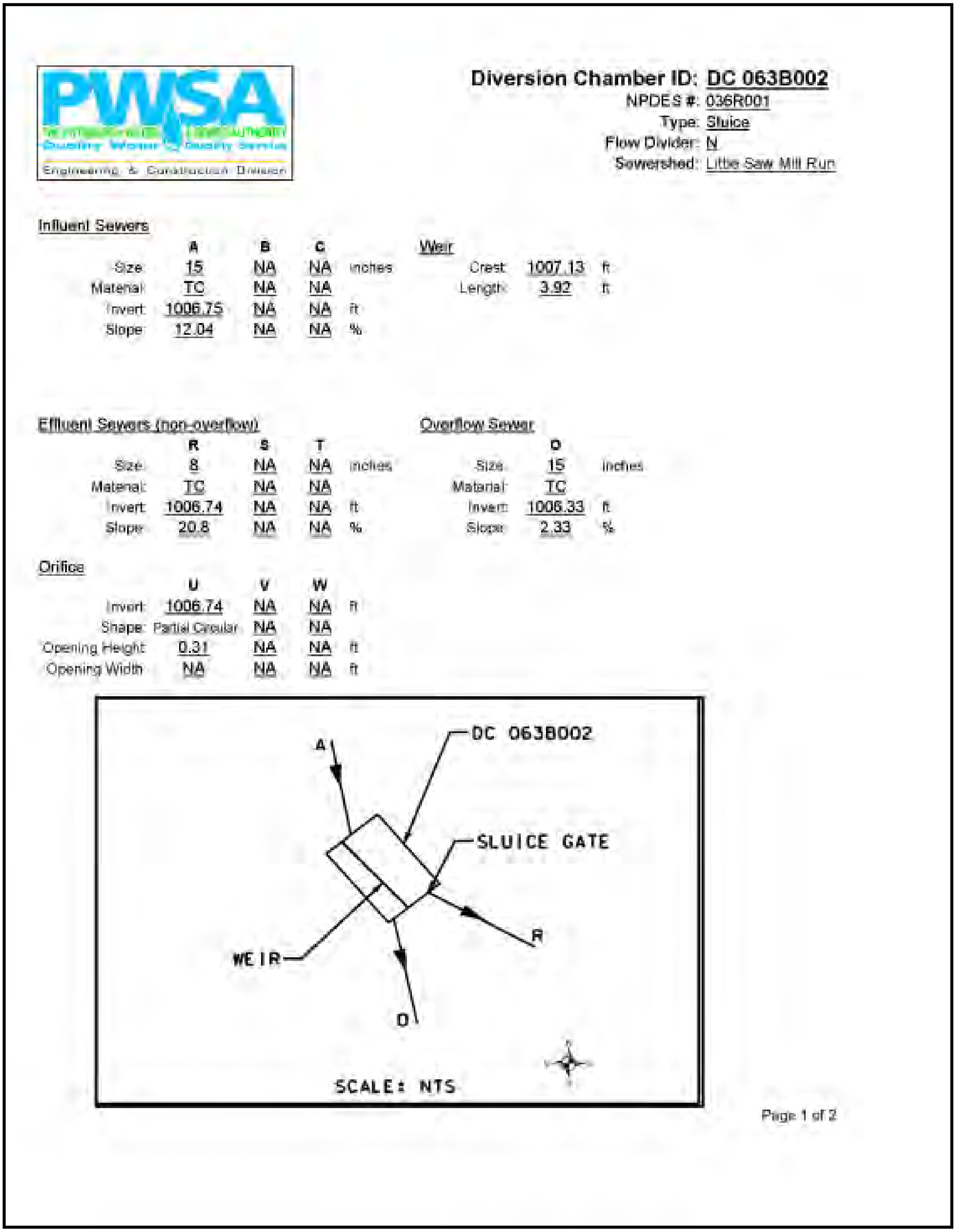

Engineering & Construction Division

Diversion Chamber ID: DC 063B002
NPDES #: 036R001
Type: Sluice
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size	15	NA	NA	inches
Material	TC	NA	NA	
Invert	1006.75	NA	NA	ft
Slope	12.04	NA	NA	%

Weir

Crest	1007.13	ft
Length	3.92	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	TC	NA	NA	
Invert	1006.74	NA	NA	ft
Slope	20.8	NA	NA	%

Overflow Sewer

	O	
Size	15	inches
Material	TC	
Invert	1006.33	ft
Slope	2.33	%

Orifice

	U	V	W	
Invert	1006.74	NA	NA	ft
Shape	Partial Circular	NA	NA	
Opening Height	0.31	NA	NA	ft
Opening Width	NA	NA	NA	ft

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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 063B002

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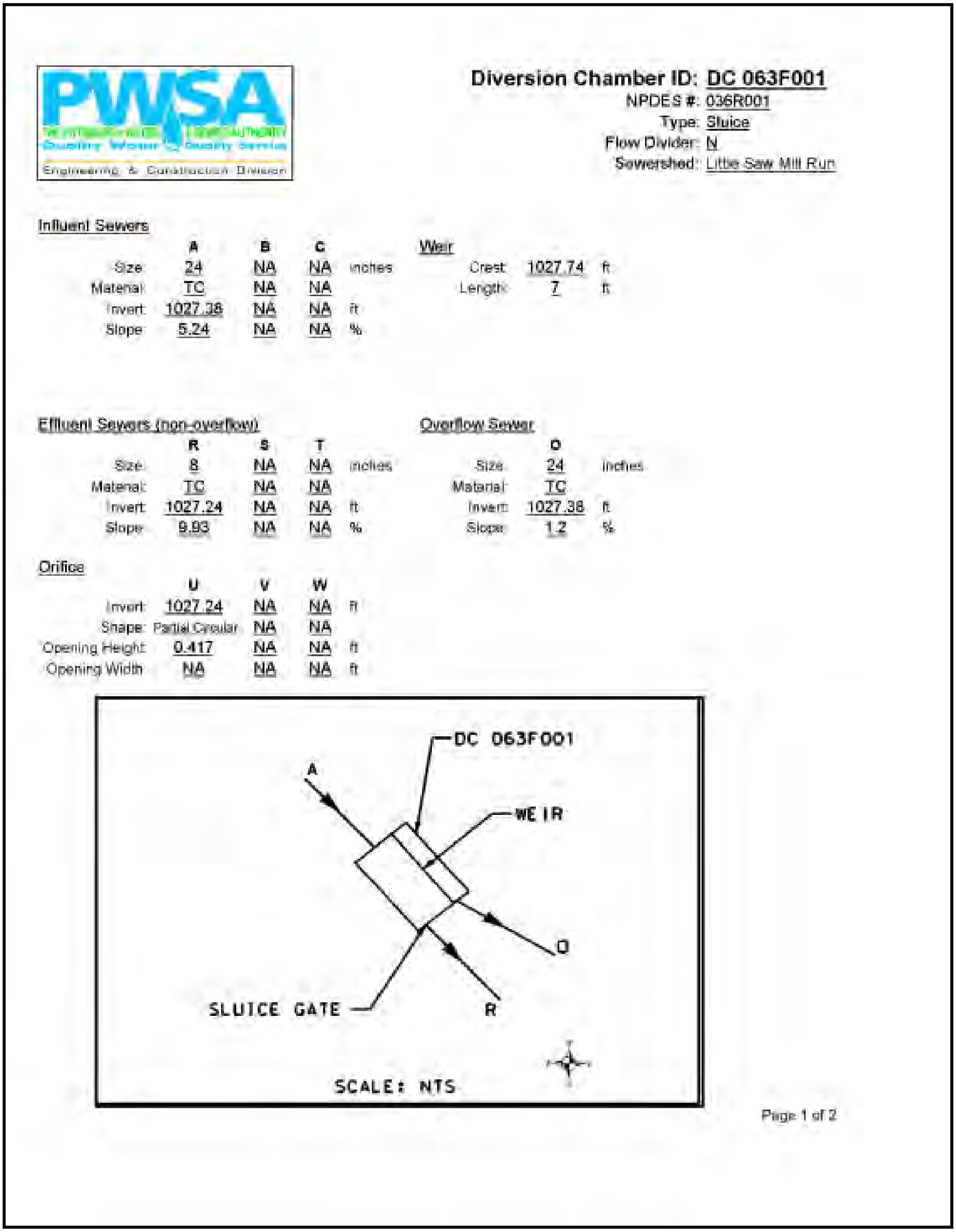

Engineering & Construction Division

Diversion Chamber ID: DC 063F001
NPDES #: 036R001
Type: Sluice
Flow Divider: N
Sewershed: Little Saw Mill Run

Influent Sewers

	A	B	C	
Size	24	NA	NA	inches
Material	TC	NA	NA	
Invert	1027.38	NA	NA	ft
Slope	5.24	NA	NA	%

Weir

Crest	1027.74	ft
Length	7	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	TC	NA	NA	
Invert	1027.24	NA	NA	ft
Slope	9.93	NA	NA	%

Overflow Sewer

	O	
Size	24	inches
Material	TC	
Invert	1027.38	ft
Slope	1.2	%

Orifice

	U	V	W	
Invert	1027.24	NA	NA	ft
Shape	Partial Circular	NA	NA	
Opening Height	0.417	NA	NA	ft
Opening Width	NA	NA	NA	ft

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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 063F001

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2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC MH-18: Little Saw Mill Run (LSMR) through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Saw Mill Run Basin Planners (SMR_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for MH-18.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The

flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. Twenty-one (21) flow meters located within the MH-18 sewershed were used in the RCS-FMP. Details on the twenty-one (21) RCS-FMP flow monitors installed within the LSMR sewershed are found in Table MH18-2-1.

TABLE MH18-2-1: MH-18 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Term[1]
MH1800_-MB_-L-03_	City of Pittsburgh	L
MH1800_-MB_-L-04_	Dormont Borough	L
MH1800_-MB_-L-05_	Municipality of Mt. Lebanon	L
MH1800_-MM_-L-02_	City of Pittsburgh	L
MH1800_-OSC-M-06_	City of Pittsburgh	M
MH1800_-OSC-M-06O	City of Pittsburgh	M
MH1800_-OSC-M-07_	City of Pittsburgh	M
MH1800_-OSC-M-07O	City of Pittsburgh	M
MH1800_-OSC-M-08_	City of Pittsburgh	M
MH1800_-OSC-M-08O	City of Pittsburgh	M
MH1800_-OSC-M-09_	City of Pittsburgh	M
MH1800_-OSC-M-09O	City of Pittsburgh	M
MH1800_-OSC-M-10_	City of Pittsburgh	M
MH1800_-OSC-M-10O	City of Pittsburgh	M
MH1800_-OSC-M-11_	City of Pittsburgh	M
MH1800_-OSC-M-11O	City of Pittsburgh	M
MH1800_-OSC-M-11OB	City of Pittsburgh	M
MH1800_-OSC-M-12_	City of Pittsburgh	M
MH1800_-OSC-M-12O	City of Pittsburgh	M
MH1800_-OSC-M-12OB	City of Pittsburgh	M
MH1800_-POC-L-01_	City of Pittsburgh	L

[1]S=Short Term: 3-months to 6 months, M=Medium Term: 6 months to 9 months, Long Term: 1-year minimum to 21-month maximum.

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[1] The flow monitor information in this table is from a file titled “Summary of Program Monitors by Name, Type and Dates.xls”. This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled “Summary and Report of Flow Monitoring June 2009”.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).
- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.
- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.
- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the MH-18 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the MH-18 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.
- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The average daily flows, GWI ratio, and GWI per inch-mile of sewer for each flow monitor within the LSMR sewershed are listed in Table MH18-2-2. The GWI ratio is an estimated amount of the DWF that can be associated with GWI compared to the DWF peaking factor (i.e. Average Daily Maximum Flow vs. Average Daily Minimum Flow). Relatively high GWI ratios, up to 0.9, can be seen at some of the meters.

TABLE MH18-2-2: MH-18 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

Flow Monitor[1]	Average Daily Flow (ADF)		DWF Peaking Factor (ADF Max/ ADF Min)	GWI Ratio (min/avg)
	(mgd)	(gpcpd)		
MH1800_-MB_-L-03_	0.1	246	4.3	0.4
MH1800_-MB_-L-04_	0.3	13.	2.1	0.6
MH1800_-MM_-L-02_	1.7	196	2.0	0.7
MH1800_-OSC-M-06_	0.1	397	1.1	0.9
MH1800_-OSC-M-07_	0.2	491	2.2	0.3
MH1800_-OSC-M-08_	0.2	694	1.3	0.9
MH1800_-OSC-M-09_	0.1	110	1.7	0.7
MH1800_-OSC-M-10_	0.2	322	1.7	0.7
MH1800_-OSC-M-11_	0.1	94	1.8	0.7
MH1800_-OSC-M-12_	0.1	260	1.8	0.8
MH1800_-POC-L-01_	2.1	142	1.7	0.7

[1] Not all flow monitors from Table MH18-2-1 were included in the source document for this table. No explanation was given.

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table MH18-2-3.

TABLE MH18-2-3: MH-18 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-18	3.61	3.64	0.8%

---

[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Saw Mill Run Planning Basin – Table 2.3.

[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.4

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event. RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for LSMR are presented in Table MH18-2-4.

TABLE MH18-2-4: MH-18 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-18	19.8	20.1	1.5%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

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[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.5

2.3 Capacity Deficient Sewers

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure MH18-2-1 presents the computed hydraulic profiles of the existing MH-18 main trunk sewer system under projected 2-year design storm peak flow conditions. As is indicated in the figures, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along a significant portion of the trunk sewer.

Figure MH18-2-2 presents the computed hydraulic profiles of the existing MH-18 main trunk sewer system under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along a significant portion of the trunk sewer.

Figure MH18-2-3 present the computed hydraulic profiles of the existing MH-18 main trunk sewer system under projected 10-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along a significant portion of the trunk sewer.

Computed flow hydrographs for each of the design storms at the MH-18 POC are presented in Figure MH18-2-4. It is noted that the peak flows reaching the POC are truncated due to extensive manhole surcharging and manhole flooding.

FIGURE MH18-2-1: MH-18 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

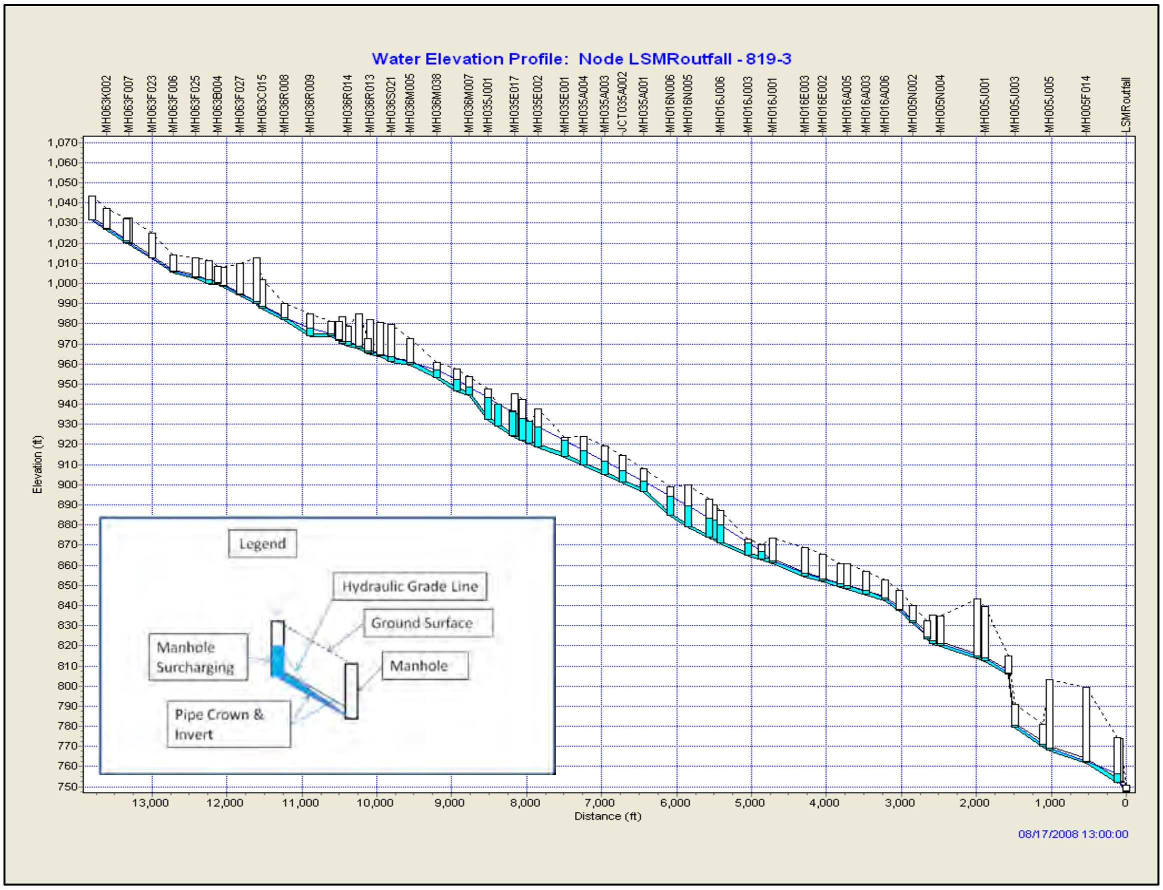


FIGURE MH18-2-2: MH-18 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

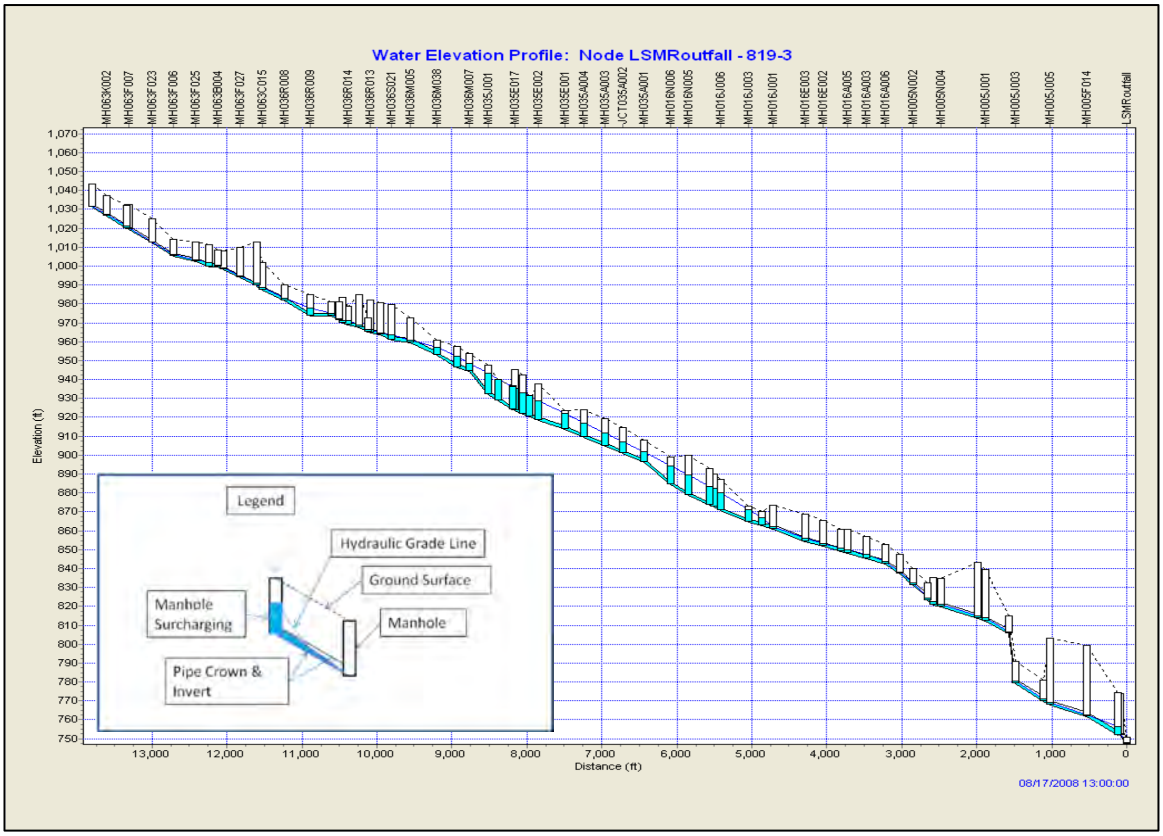


FIGURE MH18-2-3: MH-18 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

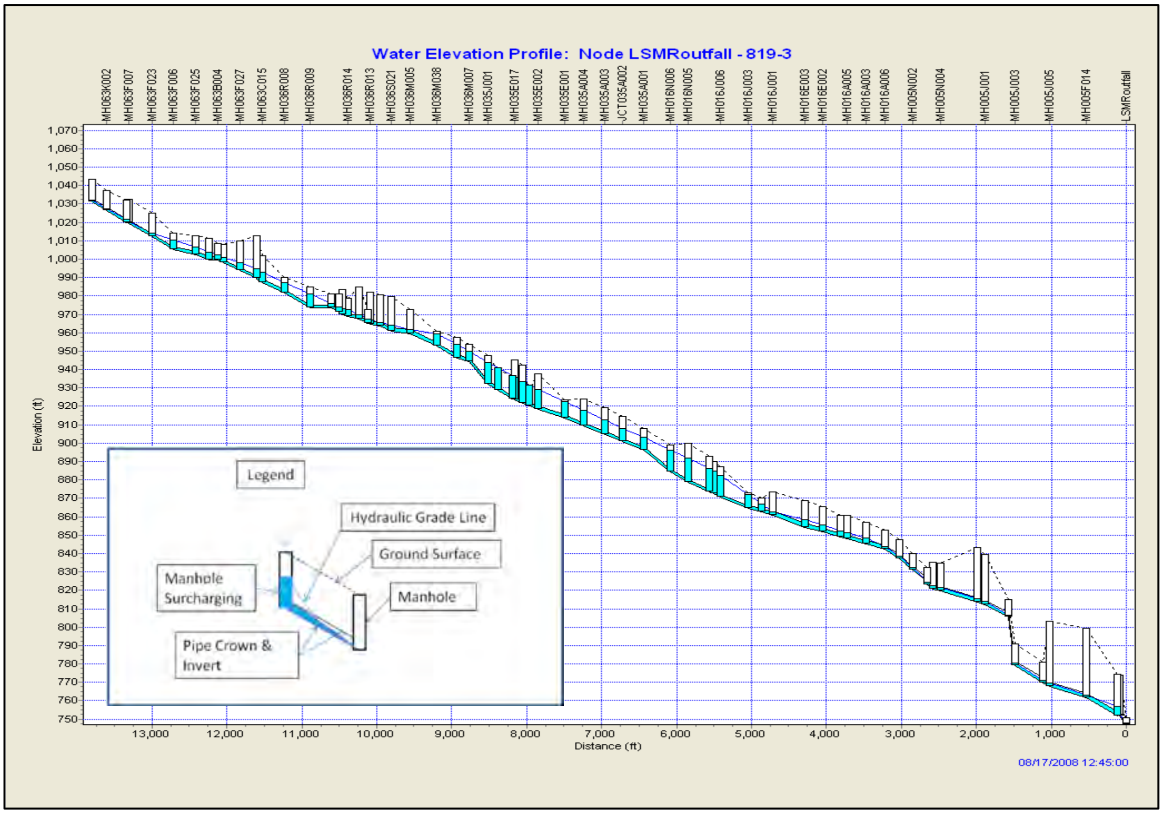
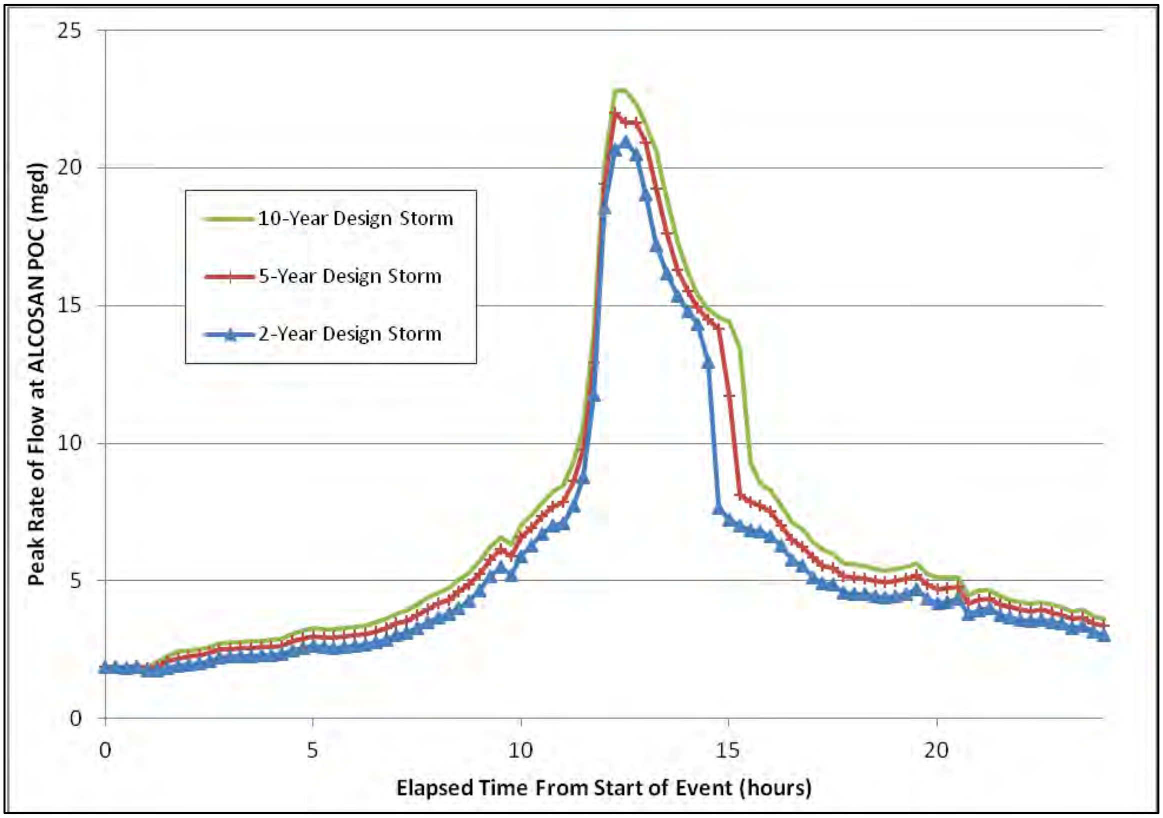


FIGURE MH18-2-4: MH-18 SEWERSHED PEAK FLOW RATES TO ALCOSAN POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

Table MH18-2-5 presents a summary of the identified chronic basement flooding locations within the PWSA portion of the LSMR sewershed. The neighboring municipalities, with the exception of Mt. Lebanon, that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. Mt. Lebanon has indicated via response to a request for information letter that their municipality has no basement backups within MH-18.

The data presented in Table 2-5 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE MH18-2-5: MH-18 CHRONIC BASEMENT BACKUP LOCATIONS (PWSA SYSTEM)[5]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
2343 Allender Ave	2	2006
2218 Boustead St	4	2008
1703 Rutherford St	2	2004
6 Younger St	2	2005
1537 Rutherford Ave	2	2010
1225 Crane Ave	2	2010
Banksville Rd	2	2009

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[5] Information from analysis of PWSA SAP system

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the MH-18 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures MH18-2-5 and MH18-2-6. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figure shows that under this range of operating conditions, the existing trunk sewer system does not have sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding. These results validate the findings and recommendations of the Draft Feasibility Study that anticipated the need to construct a consolidation/relief sewer to supplement the capacity of the existing trunk sewer system.

FIGURE MH18-2-5: MH-18 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

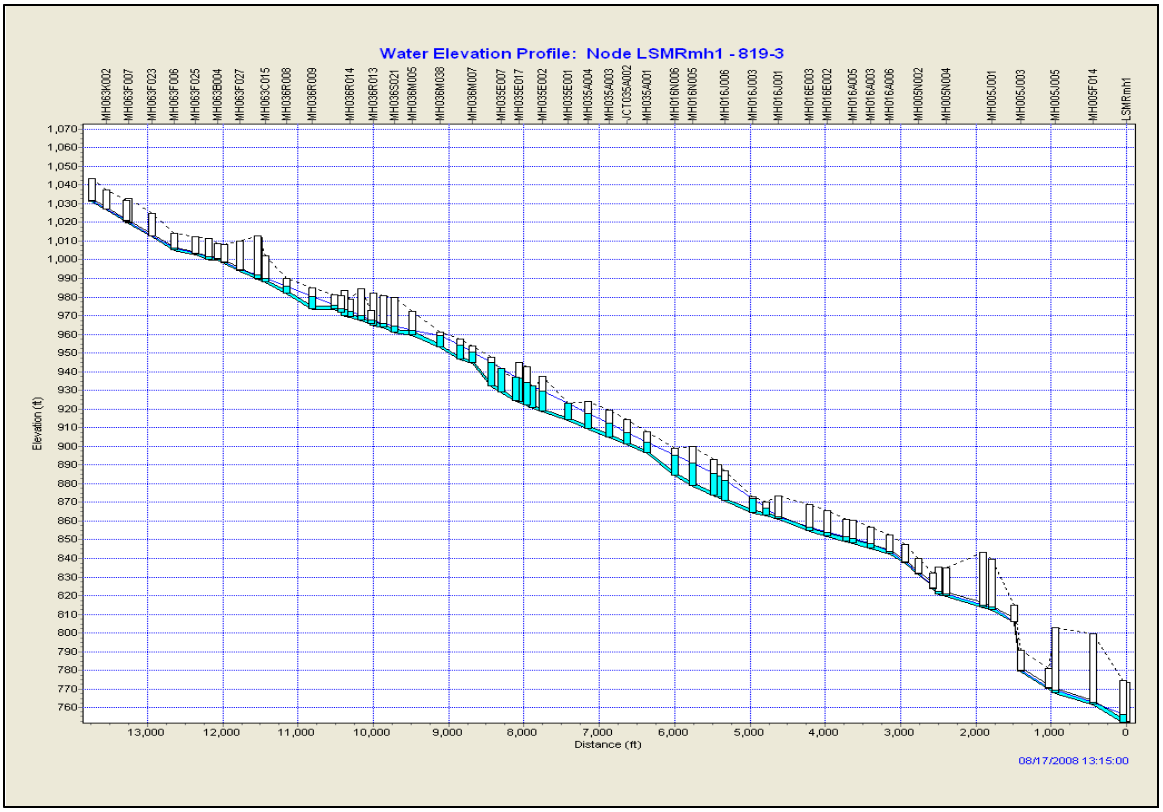
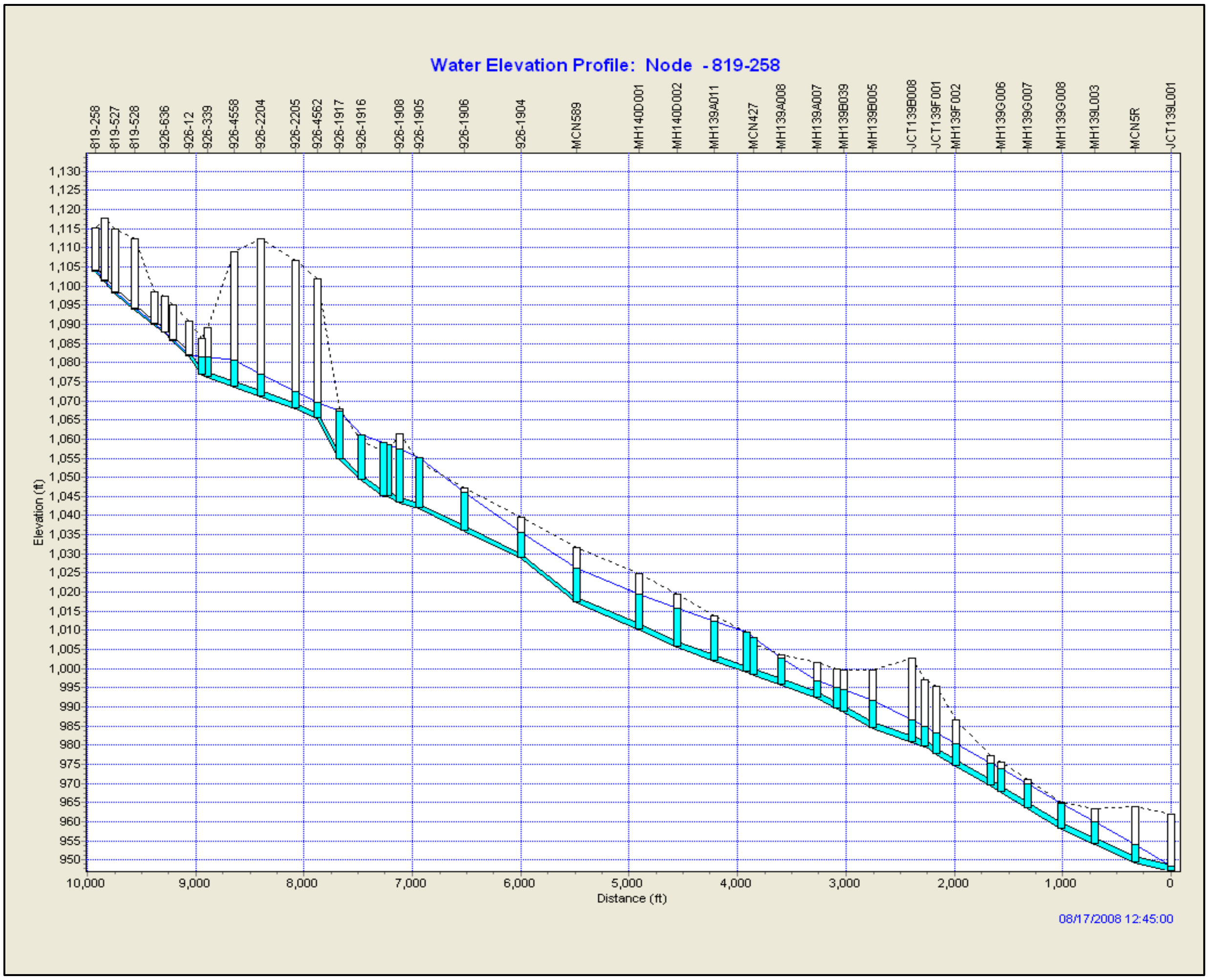


FIGURE MH18-2-6: MH-18 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the MH-18 sewer system performed by PWSA produced computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table MH18-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the MH-18: Little Saw Mill Run sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. Six (6) of these outfalls are found within the MH-18 or Little Saw Mill Run Sewershed, as shown in Table MH18-3-1.

TABLE MH18-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE MH-18: LITTLE SAW MILL RUN SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
CSO036R001	SMR	MH-18	Little Saw Mill	WWF[1]	N	Y
OF035E001	SMR	MH-18	Little Saw Mill	WWF	N	Y
OF035A001	SMR	MH-18	Little Saw Mill	WWF	N	Y
CSO016A001	SMR	MH-18	Little Saw Mill	WWF	N	Y
OF035J001	SMR	MH-18	Little Saw Mill	WWF	N	Y
CSO016A002	SMR	MH-18	Little Saw Mill	WWF	N	Y

As shown in the table, the six (6) PWSA owned outfalls discharge into Little Saw Mill Run. This receiving water is classified as warm water fishery (WWF) and currently does not meet its assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

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[1] Warm Water Fishery

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.

- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream, including Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical

characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

The receiving water characterization field program resulted in certain findings within Saw Mill Run. In general, the DO concentrations for Saw Mill Run did not meet regulatory limits during wet weather which is likely related to CSO discharges during the storm events and/or wet weather discharges from upstream municipalities. Saw Mill Run also showed DO concentrations not meeting standards during dry weather indicating that CSO discharges are not likely causing the condition.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring in ALCOSAN included parameters for which PWSA had not monitored and encompasses a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters, including Saw Mill Run and its tributaries within the PWSA limits, with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL. For Saw Mill Run, the concentration during the recreational season exceeded the 200 cfu/100mL limit in 100% of the samples and exceeded the 400 cfu/100mL limit in 80% of the samples.

Saw Mill Run has an in-stream target concentration of 0.035 mg/L for total phosphorus (TP) which was exceeded by 75% of the samples. TP appears to be a concern throughout Saw Mill Run, with CSO discharges being a potentially significant source in wet weather.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS. However for Saw Mill Run, it is judged that a higher level of control is needed due to the need to reduce phosphorus levels (see next section).

3.2.2 Saw Mill Run TMDL Report

A TMDL report was completed for Saw Mill Run and its tributaries which showed phosphorus TMDL results are shown below in Table MH18-3-2.

TABLE MH18-3-2: SAW MILL RUN PHOSPHORUS TMDL RESULTS

Total Phosphorus Load	**CSO Load**	**SSO Load**
Existing Load (Ib/Growing Season)	7,161.9	1,950.4
Allocated Load (Ib/ Growing Season)	177.5	0.0
Percent Reduction (%)	98%	100%

The implication of this is that substantial reductions of CSOs and complete elimination of SSOs is necessary for compliance. For CSOs, it is judged that a control level of 0 overflows per year will be required.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, such as Saw Mill Run, pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the MH-18 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the MH-18 sewershed, Table MH18-3-3 lists the untreated CSO statistics that were computed for each control level.

TABLE MH18-3-3: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE MH-18: LITTLE SAW MILL RUN SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC16N001	0	0	3	0.69	10	1.11
DC16A002	0	0	4	0.61	4	0.37
DC035A001	0	0	3	0.40	10	0.47
DC035E001	0	0	3	0.40	7	0.62
DC036M001	0	0	3	0.19	3	0.19
DC036P001	0	0	4	0.56	7	1.10
DC036R001	0	0	4	0.56	10	0.10
DC063B001	0	0	3	0.20	10	0.34
DC063B002	0	0	3	0.10	3	0.10
DC063F001	0	0	4	0.30	10	0.77
Total Volume		**0**		**4.01**		**5.17**

As will be described later in this report, the MH-18 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year and 10-year return frequency events).

Since Saw Mill Run has a TMDL which requires a high level of Phosphorous removal (98%), a higher CSO control level will be required. While 10, 4 and 0 OF/yr are analyzed, it is judged that 0 OF/yr will be necessary for compliance.

A range of design storms (2-yr, 5-yr, and 10-yr) were evaluated for transport of flows. PWSA plans to use the 2-yr storm which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

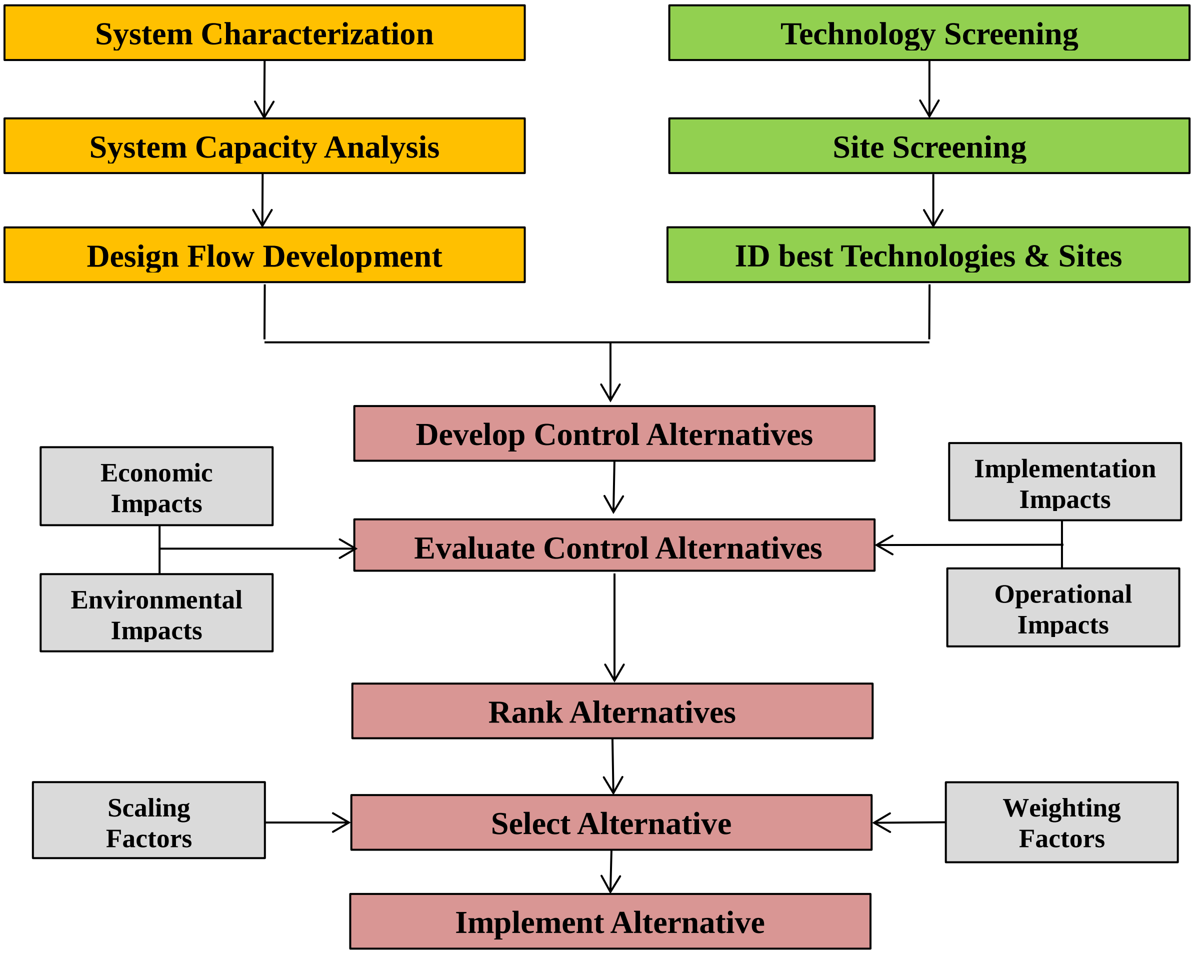
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure 4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE 4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered “feasible” for use in the MH-18 sewershed are shown below in Table 4-1.

TABLE 4-1: MH-18 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies was identified for the MH-18 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table 4-2.

Contributing flows from the municipalities that are tributary to the MH-18 sewershed, which include Dormont Borough, Green Tree Borough, the Municipality of Mt. Lebanon and Scott Township were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as waterways.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning “Objective Scores” to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

TABLE 4-2: MH-18 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 036R001	CS4 036R001: Sewer separation	Complete sewer separation of tributary area.
	S2-036R001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-036R001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-036R001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-036R001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-036R001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-036R001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfalls 016A001	No activations during the typical year.	No control required.
Outfalls 016A002		
Outfalls 035A001		
Outfalls 035E001		
Outfalls 035J001		
Consolidation Outfalls 016A001, 016A002, 035A001, 035E001, and 035J001	CS4-016A001 TO 035J001: Sewer Separation	Complete sewer separation of tributary area.
	S2-016A001 TO 035J001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-016A001 TO 035J001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-016A001 TO 035J001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-016A001 TO 035J001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-016A001 TO 035J001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-016A001 TO 035J001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Regional Controls – MH-18: Little Saw Mill Run Controls		
Outfalls 016A001, 016A002, 035A001, 035E001, 035J001, and 036R001	CS4- 016A001 TO 036R001: Sewer Separation	Complete sewer separation of tributary areas.
	S2-016A001 TO 036R001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-016A001 TO 036R001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-016A001 TO 036R001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.

CSO(s)	Control Alternative(s)	Description
	T2-016A001 TO 036R001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-016A001 TO 036R001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-016A001 TO 036R001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Sub-system Controls - Saw Mill Run Controls		
Outfalls 016A001, 016A002, 035A001, 035E001, 035J001, and 036R001	SMR-1a: Tunnel Storage[2]	A 2.8 mile long tunnel O-14 to the S-30 POC. The MH-18 CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 036R001 - Sub-Surface Storage • 016A001 to 035J001 - Sub-Surface Storage
	SMR-1b: Tunnel Storage[2]	
	SMR-2a: Tunnel Storage[2]	A 5.7 mile long tunnel from O-14 to the MH-18 POC. The MH-18 CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 036R001 - Sub-Surface Storage • 016A001 to 035J001 - Sub-Surface Storage
	SMR-2b: Tunnel Storage[2]	A 5.7 mile long tunnel from O-14 to the MH-18 POC. The MH-18 CSOs is conveyed to the tunnel via a drop shaft.

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

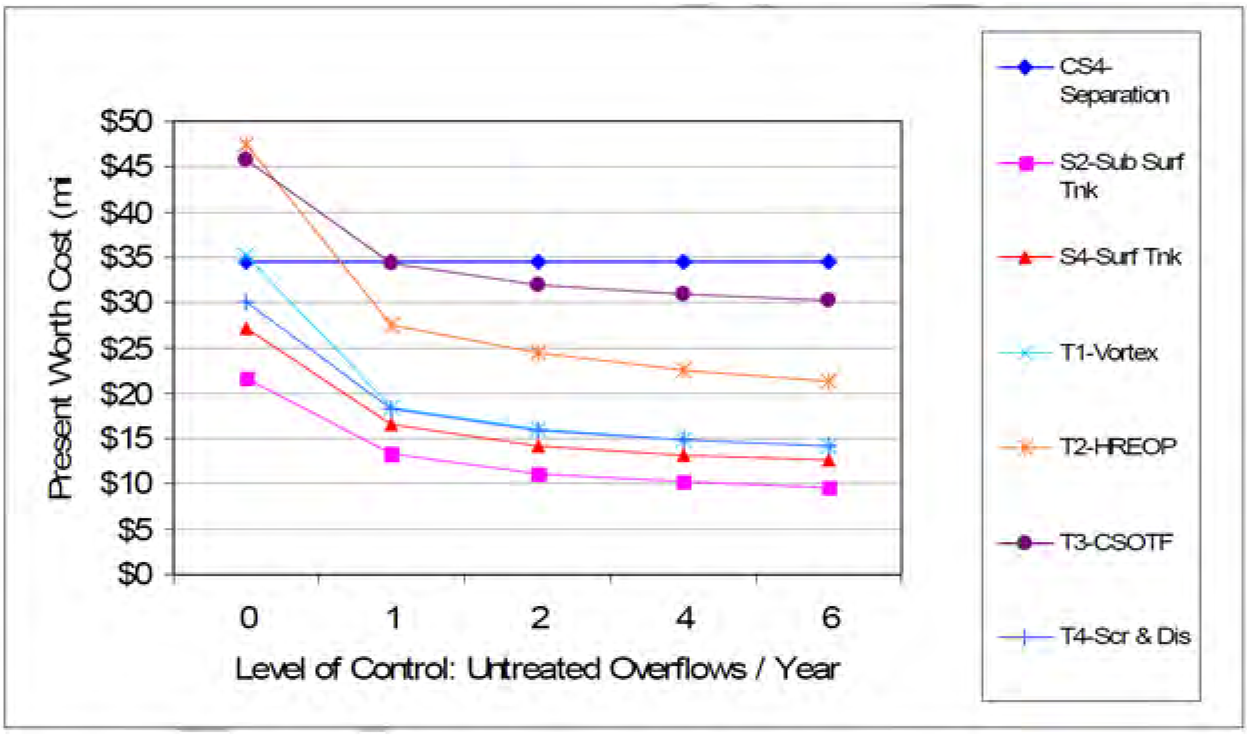
PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

Outfall 036R001: Cost estimates were produced for outfall-specific control alternatives CS4 036R001: Sewer separation, S2-036R001: Sub-Surface Storage, S4-036R001: Surface Storage, T1-036R001: Suspended Solids Control, T2-036R001: High Rate End of Pipe Treatment, T3-036R001: CSO Treatment Facility, and T4-036R001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2a illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2A: OUTFALL 036R001 ALTERNATIVE COSTS



Outfall 016A001: Outfall 016A001 did not activate the typical year, and no control alternatives were required.

Outfall 016A002: Outfall 016A002 did not activate the typical year, and no control alternatives were required.

Outfall 035A001: Outfall 035A001 did not activate the typical year, and no control alternatives were required.

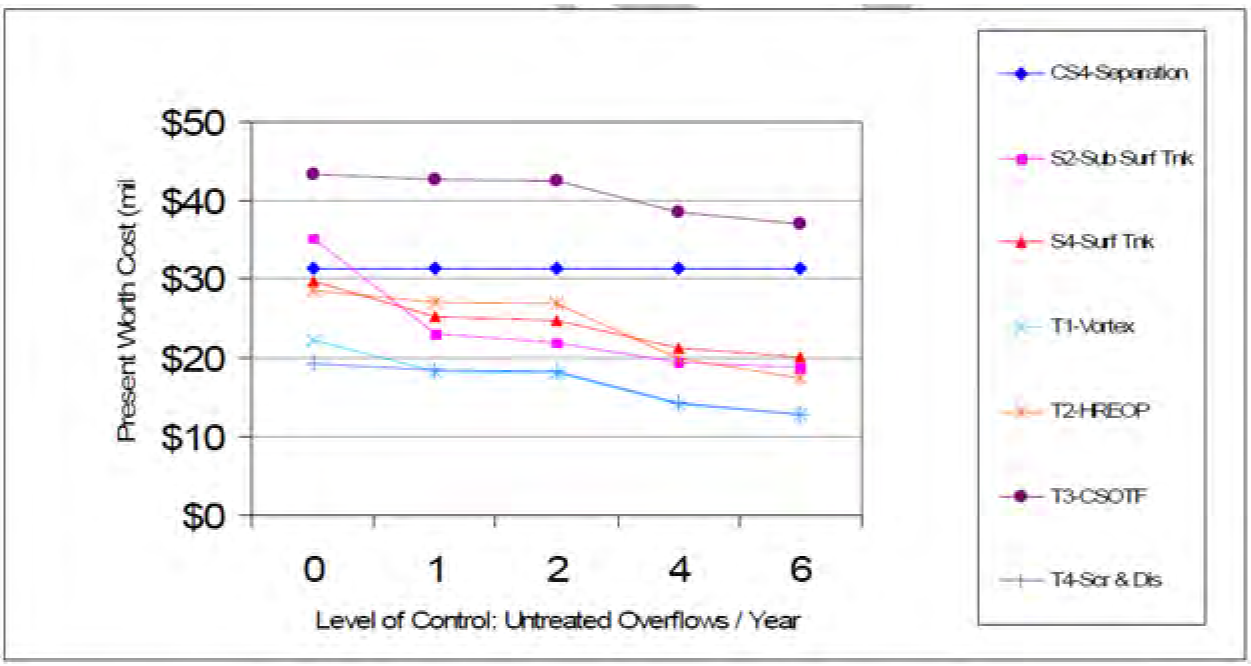
Outfall 035E001: Outfall 035E001 did not activate the typical year, and no control alternatives were required.

Outfall 035J001: Outfall 035J001 did not activate the typical year, and no control alternatives were required.

Consolidation Outfalls 016A001 TO 035J001: Cost estimates were produced for outfall-specific control alternatives CS4-016A001 TO 035J001Sewer separation, S2-016A001 TO 035J001: Sub-Surface Storage, S4-016A001 TO 035J001: Surface Storage, T1-016A001 TO 035J001: Suspended Solids Control, T2-016A001 TO 035J001: High Rate End of Pipe Treatment, T3-016A001 TO 035J001: CSO Treatment Facility, and

T4-016A001 TO 035J001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2b illustrates the ranges of estimated present worth costs for these alternatives.

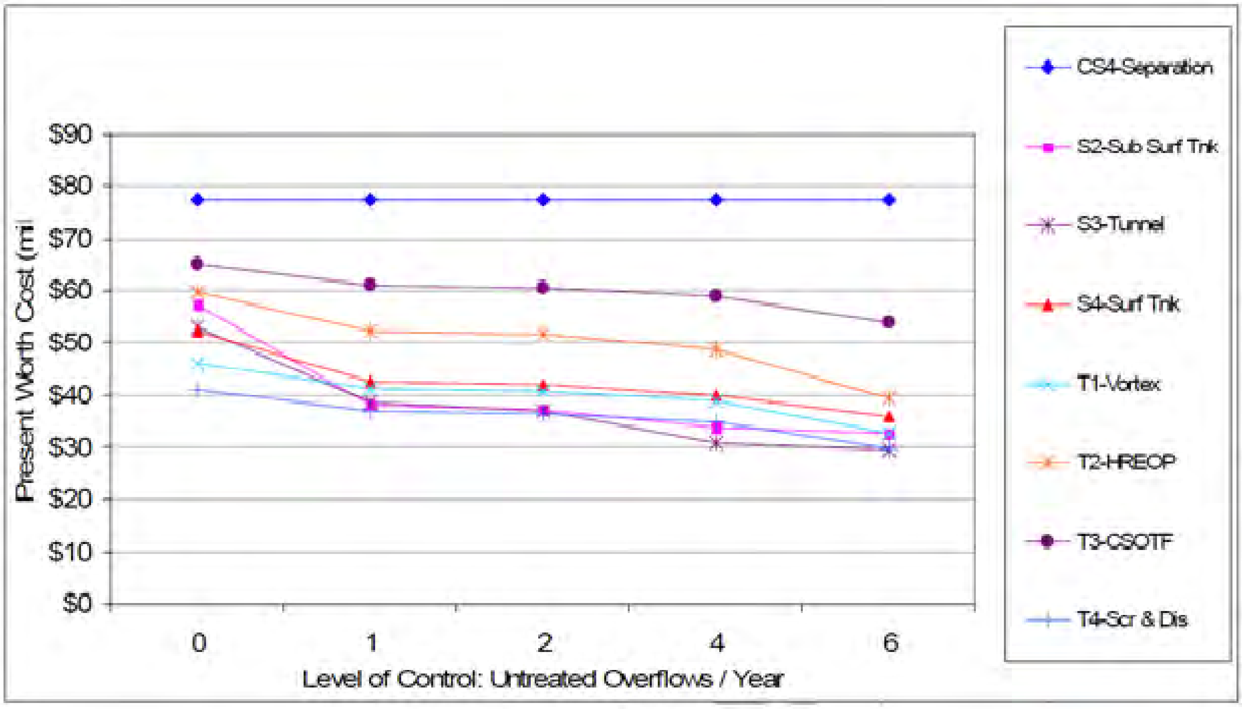
FIGURE 4-2B: OUTFALLS 016A001 TO 035J001ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

Cost estimates were produced for regional control alternatives developed for the Little Saw Mill Run region. Figure 4-3 illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-3: LITTLE SAW MILL RUN ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Saw Mill Run sub-system. Table 4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Saw Mill Run subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE 4-3: SAW MILL RUN SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
SMR-1a	249.3	2.1	272.1
SMR-1b	253.3	1.9	274.0
SMR-2a	246.2	1.6	265.1
SMR-2b	251.8	1.5	269.0

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining "Objective Scores" relative to each evaluation criteria.
- Applying "scaling" and "weighting" factors.
- Determining "Weighted Objective Scores" relative to each evaluation criteria.
- Ranking each alternative based on the sum of its "Weighted Objective Scores".

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table 4-4.

TABLE 4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in Table 4-5.

TABLE 4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 036R001: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in Table 4-6.

TABLE 4-6: WEIGHTED SUBJECTIVE SCORING - CS4 036R001: SEWER SEPARATION

Alternative:	**CS4-Separation**		**Control Level:**	**0 Overflows / Year**
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	1	0.00	0.147	0.000
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.112	0.017
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	3	0.50	0.033	0.017
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.570**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008)*. Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 036R001: The results of the control alternative evaluation process are shown in Figure 4-4a. For all control levels, it is recommended that Alternative S2-016A001 to 036R001: Sub-Surface Storage be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

Outfall 016A001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This "no activation" outfall was not considered further in the alternatives analysis process.

Outfall 016A002: According to the results of the H&H model, this outfall had no activations throughout the typical year. This "no activation" outfall was not considered further in the alternatives analysis process.

Outfall 035A001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This "no activation" outfall was not considered further in the alternatives analysis process.

Outfall 035E001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This "no activation" outfall was not considered further in the alternatives analysis process.

Outfall 035J001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This "no activation" outfall was not considered further in the alternatives analysis process.

Outfalls 016A001 TO 035J001: The results of the control alternative evaluation process are shown in Figure 4-4b. It was recommended that, for all levels of control, *Alternative S2-016A001 TO 035J001: Sub-Surface Storage* be carried forward and re-evaluated during the regional and sub-system alternatives analyses.

FIGURE 4-4A: ALTERNATIVE SCORING - OUTFALL 036R001

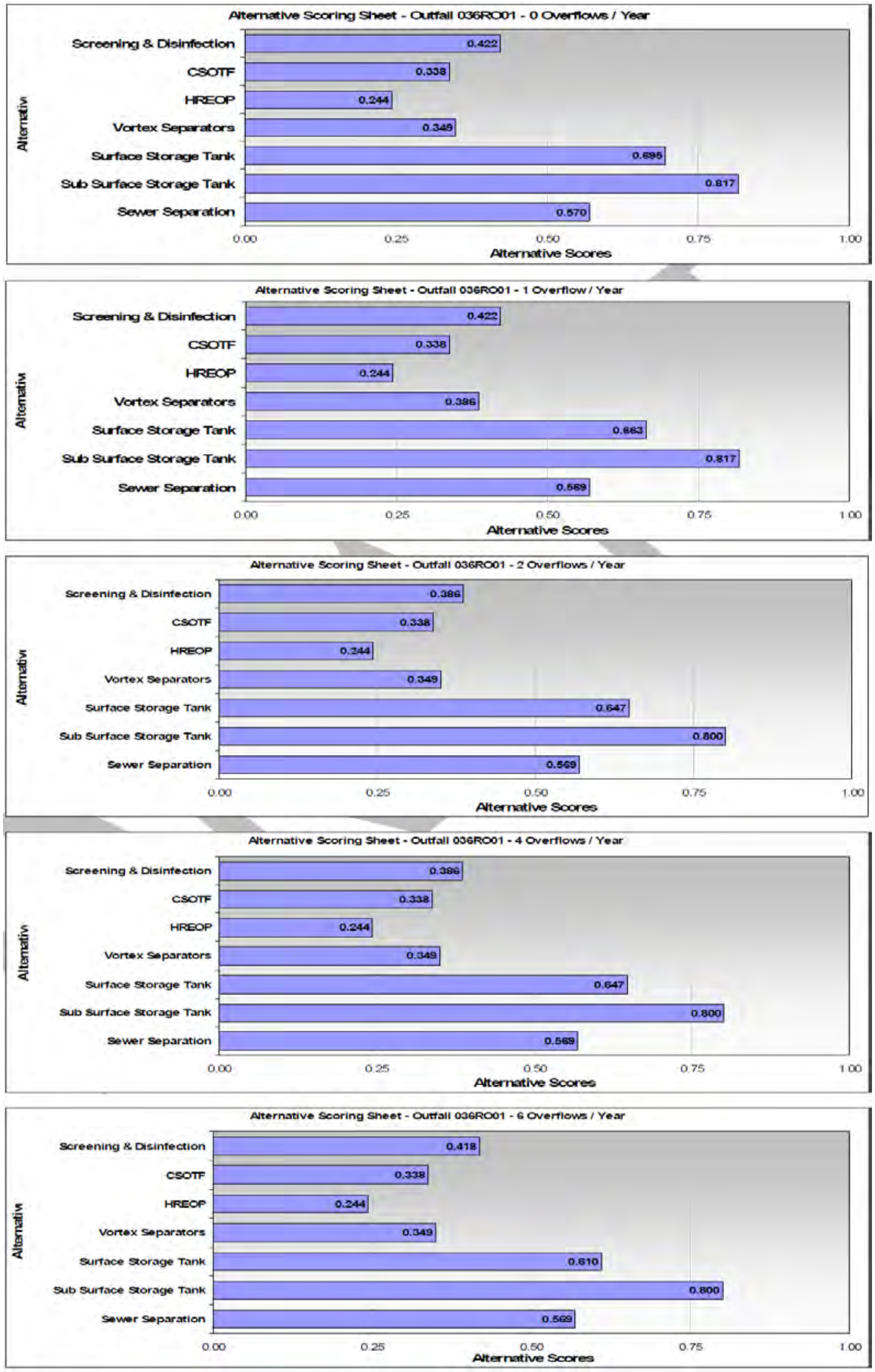
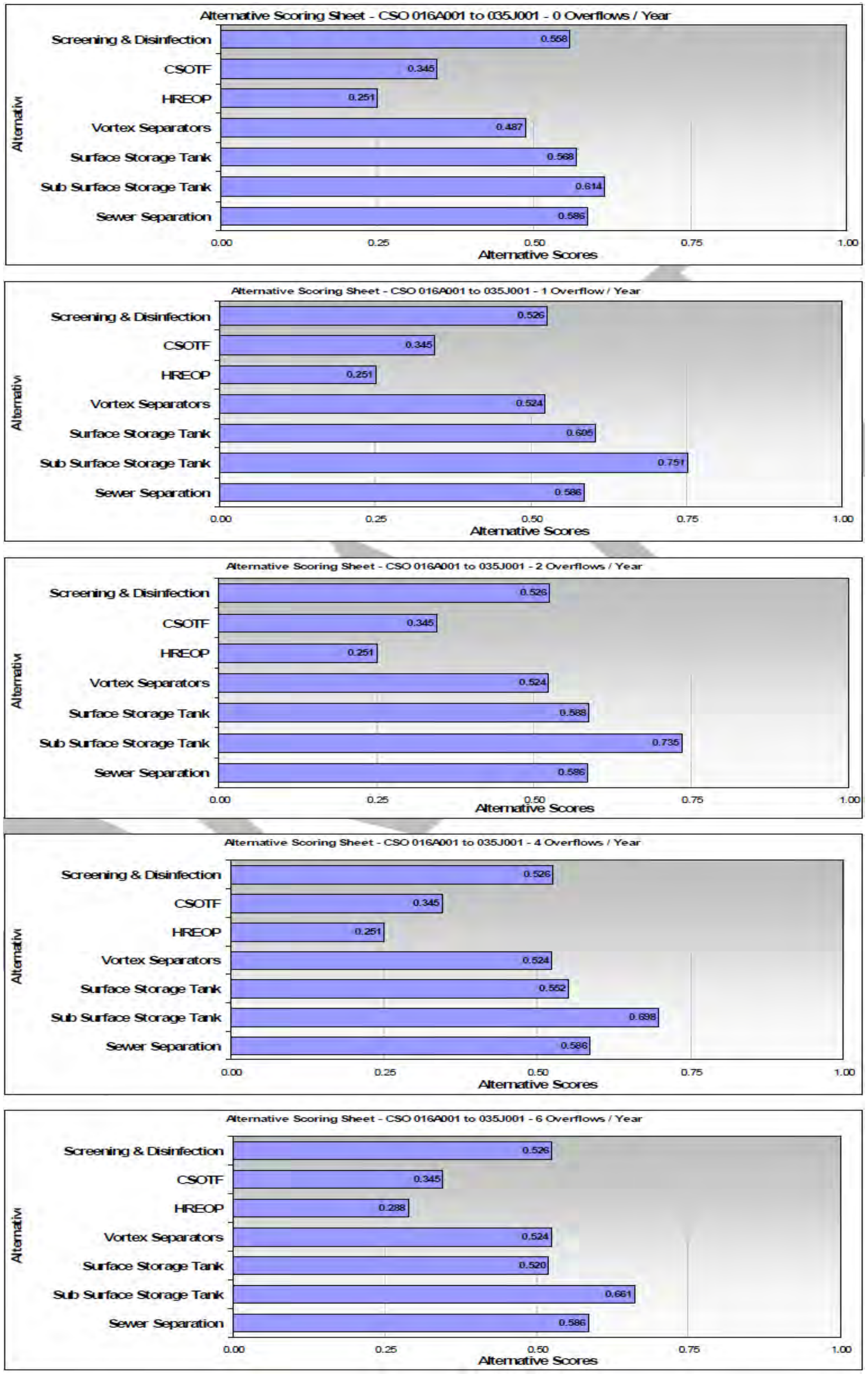


FIGURE 4-4B: ALTERNATIVE SCORING - OUTFALLS 016A001 TO 035J001



4.4.2 Regional Control Alternatives

016A001 TO 036R001 Region: The results of the regional control alternative evaluation process are shown below in Figure 4-5. For all control levels, it is recommended that Alternative S2-016A001 to 036R001: Sub-Surface Storage be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

4.4.3 Sub-System Control Alternatives

Saw Mill Run. The results of the sub-system control alternative evaluation process are shown below in Figure 4-6. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative SMR-2b: Tunnel Storage* be carried forward as the Saw Mill Run component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative SMR-2b: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative SMR-2b* included only those components required to deliver flows to the MH-18 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the MH-18 POC would become the responsibility of ALCOSAN.

FIGURE 4-5: ALTERNATIVE SCORING - 016A001 TO 036R001 REGION

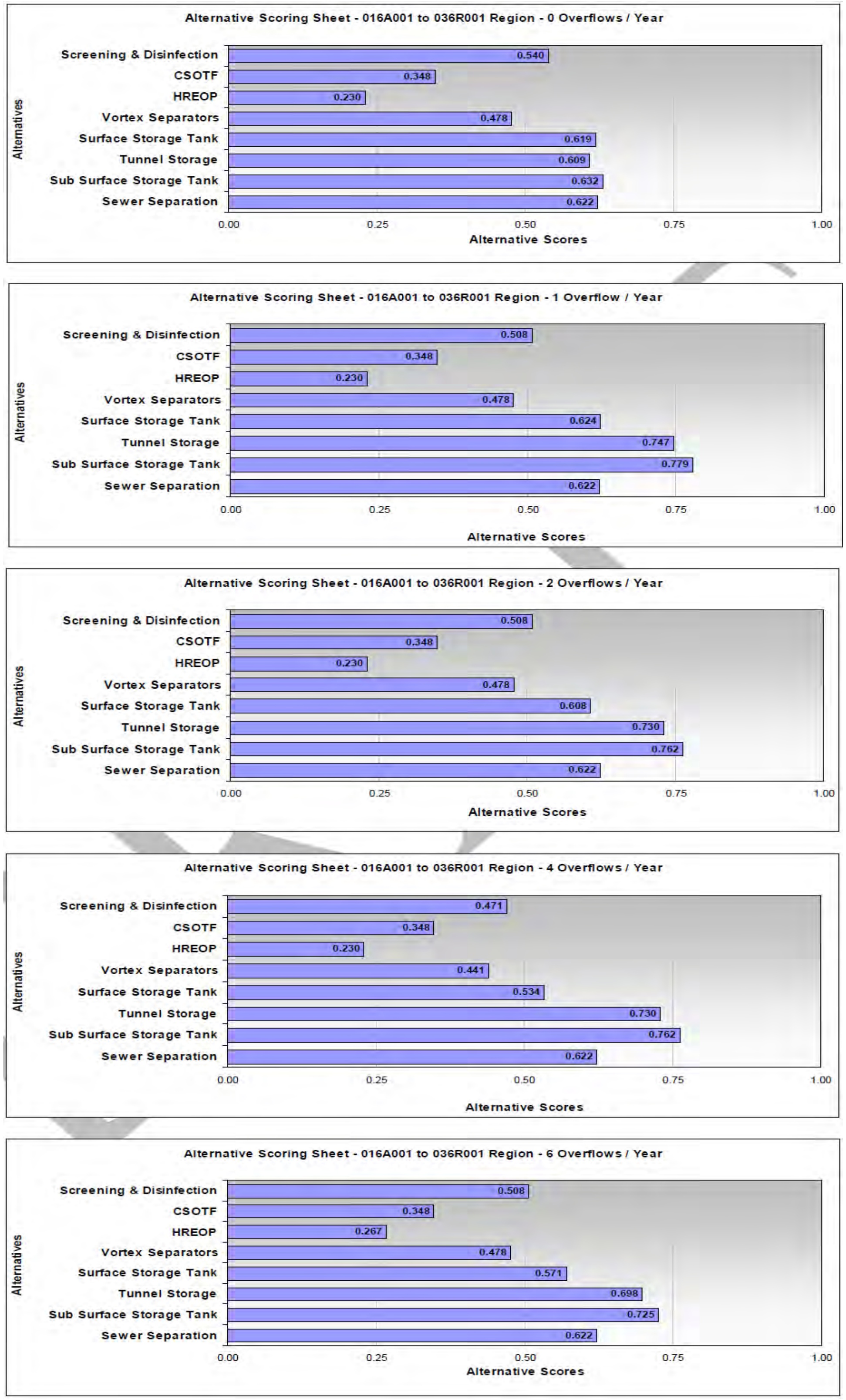
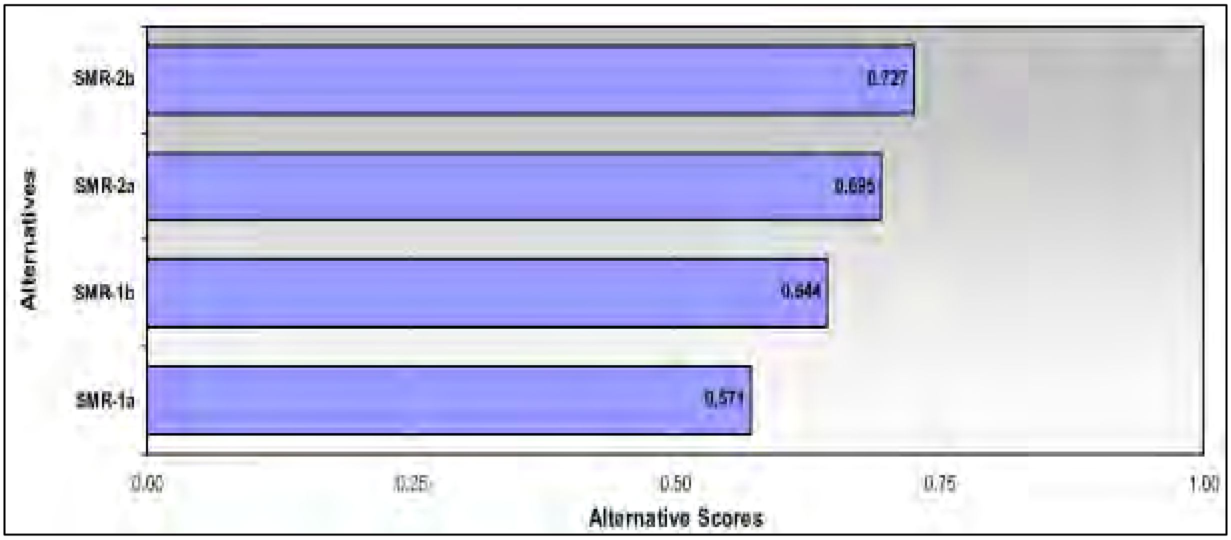


FIGURE 4-6: ALTERNATIVE SCORING – SAW MILL RUN SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Little Saw Mill Run sewershed would best be accomplished by implementing *Alternative SMR-2b: Tunnel Storage*. Within the MH-18 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the six PWSA permitted CSOs to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the MH-18 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative SMR-2b* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-MH18-C-0*, *POC-MH18-C-4* and *POC-MH18-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **MH18 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.

- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the MH-18 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities, with the exception of Mt. Lebanon, did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows. The Municipality of Mt. Lebanon indicated that no wet weather projects would result in reductions of projected flows. All flows will be conveyed through the MH-18 trunk line.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the MH-18 sewershed is zero untreated overflows per year. The recommended control alternative for the MH-18 Little Saw Mill Run sewershed has been designated as POC-MH18-C-0. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **MH18** The MH-18 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **0** The selected level of control is zero untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of zero (0) untreated overflows per year, the required consolidation / conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-MH18-C-0 are summarized in Table MH18-5-1.

TABLE MH18-5-1: ALTERNATIVE POC-MH18-C-0 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
MH-18	DC016A001	016A002	C*	0
	DC016N001	016A001		
	DC035A001	035A001		
	DC035E001	035E001		
	DC036M001	035J001		
	DC036P001	036R001		
	DC036R001			
	DC063B001			
	DC063B002			
	DC063F001			

*To be achieved via additional conveyance piping and regulator modifications.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, any anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, any stream removal projects that may be included, its integration with ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-MH18-C-4 and/or POC-MH18-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. Both analyses determined that the optimal method of increasing the level of control of CSO overflows in the MH-18 sewershed would be to reduce the number of overflows by conveying the additional wastewater to the ALCOSAN point of connection. To accomplish this, the PWSA and/or their tributary municipalities must:

- Modify existing diversion structures to achieve desired level(s) of control.
- Construct additional consolidation piping to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

For each of the diversion structures in the MH-18 sewershed, the H&H model was employed to identify the type and extent of modifications required to achieve zero overflows during the typical year.

The required modifications to the flow diversion settings were determined by the current typical year overflow statistics. Table MH18-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control. The upstream municipalities of Borough of Dormont, Green Tree Borough, Mt. Lebanon and Scott Township are tributary to many of the PWSA CSO diversion structures, but any future changes to their tributary flows are not anticipated to have an impact on the planned diversion structure modifications.

TABLE MH18-5-2: ALTERNATIVE POC-MH18-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC016A001	Diversion structure replacement*	25.0	No change	No change
DC016N001	Diversion structure replacement*	23.0	6.0	2.5
DC035A001	Diversion structure replacement*	23.0	3.0	No change
DC035E001	Diversion structure replacement*	23.0	3.5	2.0
DC036M001	Diversion structure replacement*	7.5	No change	No change
DC036P001	Diversion structure replacement*	37.0	11.0	6.0
DC036R001	Diversion structure replacement*	1.6	1.0	No change
DC063B001	Diversion structure replacement*	9.5	No change	No change
DC063B002	Diversion structure replacement*	5.2	0.6	No change
DC063F001	Diversion structure replacement*	20.0	5.5	2.4

*The installation of screening is planned for all PWSA diversion structures.

As can be seen from the table, new consolidation piping to convey flows at the zero OF/yr level of control must be designed to carry flows ranging from 1.6 to 37 mgd.

5.1.2 Consolidation Piping

The H&H model was employed to identify the capacity improvements necessary to consolidate and convey increased flows from the existing diversion structures to the

MH-18 POC. The modeling was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the MH-18 POC without significant manhole surcharging and flooding. These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008)* that anticipated the construction of consolidation / relief sewers to supplement the capacity of the existing trunk sewer system.

It was anticipated that the required increase in conveyance capacity would be achieved by constructing parallel relief sewers designed to convey flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Note that the upstream municipalities of the Borough of Dormont, Mt. Lebanon, Green Tree Borough and Scott Township and have not reported any plans to modify their systems to reduce their tributary flows.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table MH18-5-3 and in Figure MH18-5-1.

TABLE MH18-5-3: POC-MH18-C-0 CONSOLIDATION PIPING

Diameter (in)	Length (ft)
12	166
24	2,573
30	62
36	4,869
42	2,429
48	5,495

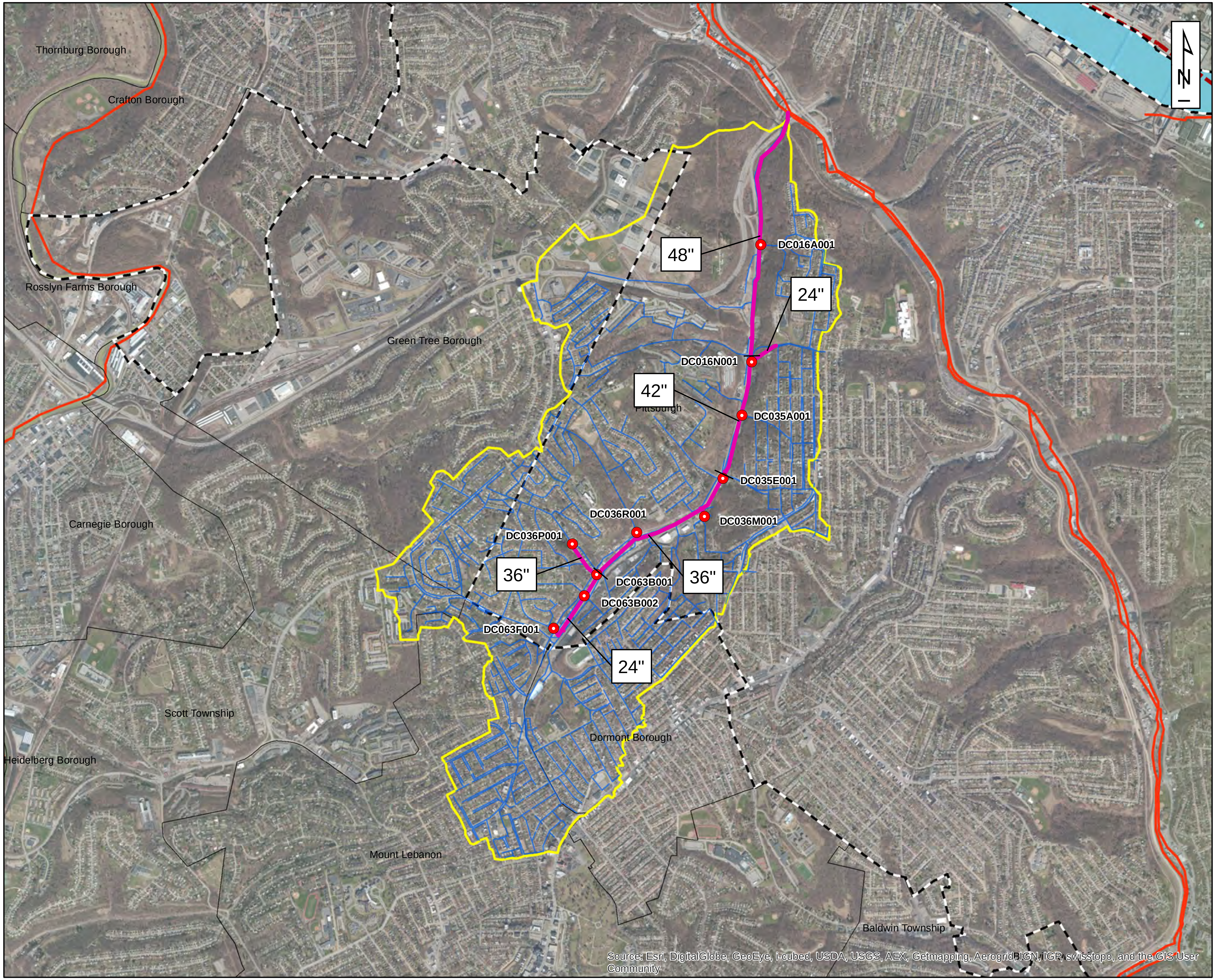
*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

5.1.3 Future Untreated CSO Volumes

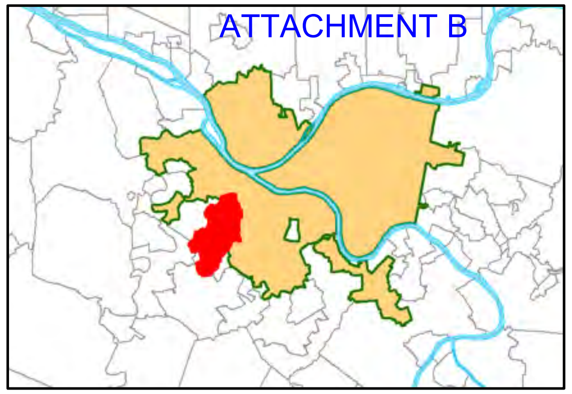
Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table MH18-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 12 MG in the typical year.

TABLE MH18-5-4: MH-18 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name					
	POC-MH18-C-0		POC-MH18-C-4		POC-MH18-C-10	
	No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)
DC016A001	0	0	4	0.6	4	0.4
DC016N001	0	0	3	0.7	10	1.1
DC035A001	0	0	3	0.4	10	0.5
DC035E001	0	0	3	0.4	7	0.6
DC036M001	0	0	3	0.2	3	0.2
DC036P001	0	0	4	0.6	7	1.1
DC036R001	0	0	4	0.6	10	0.1
DC063B001	0	0	3	0.2	10	0.3
DC063B002	0	0	3	0.1	3	0.1
DC063F001	0	0	4	0.3	10	0.8
Total Volume		**0**		**4.1**		**5.2**



ATTACHMENT B



PWSA Service Area Overview

Figure MH18-5-1: POC MH18-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\LITTLE SAW MILL RUN (MH-18)\FIGURE 5-1_MH_18.mxd

5.1.4 Anticipated Flow Rates To The ALCOSAN POC

The combination of regulator modifications and additional consolidation piping will result in increased flow rates and volumes to the MH-18 POC. Peak flow rates to the MH-18 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-MH18-C-0, POC-MH18-C-4 and POC-MH18-C-10 are presented in Figure MH18-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the MH-18 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table MH18-5-5.

FIGURE MH18-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE MH-18 POC

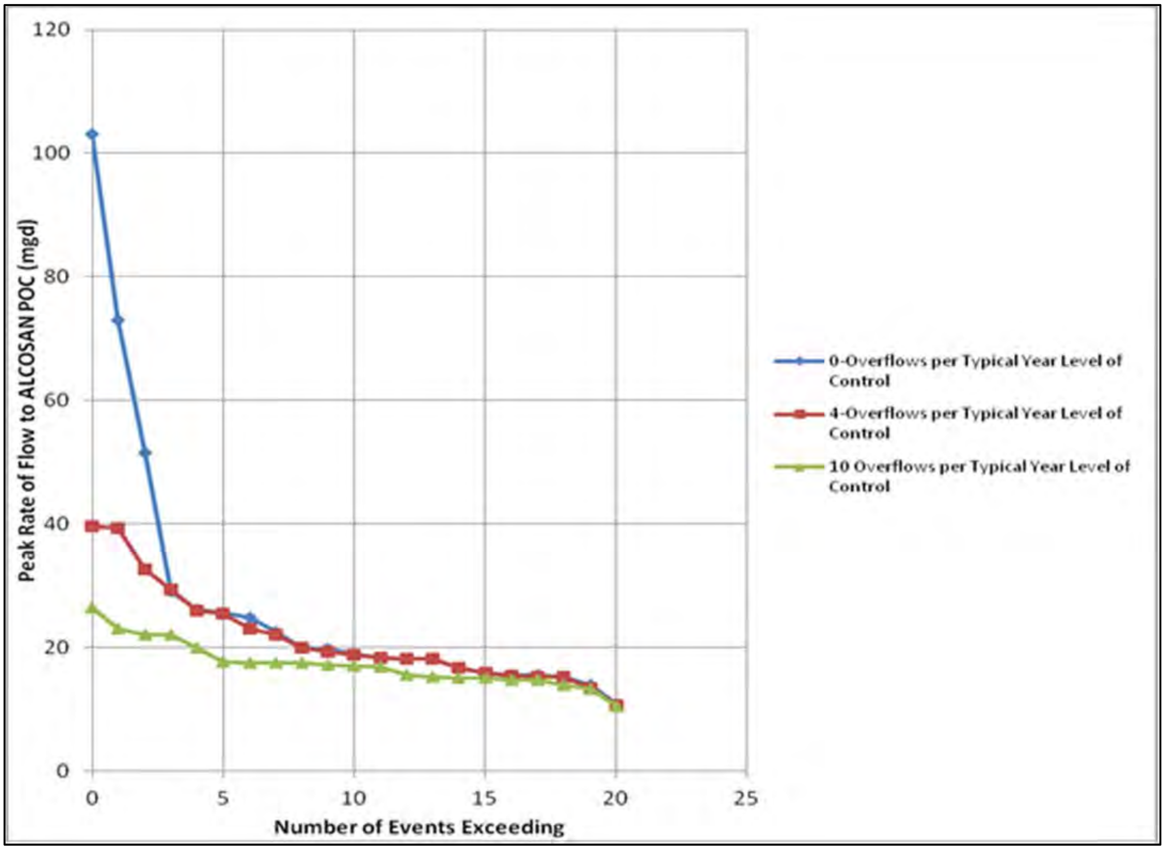


TABLE MH18-5-5: MH-18 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-MH18-C-0	137	163	172	9.7	12.3	14.0
POC-MH18-C-4	44.6	45.6	46.0	7.1	8.2	8.9
POC-MH18-C-10	22.0	24.0	25.0	5.5	6.2	6.8

5.1.5 Recommended Control Alternative Integration

In the spring of 2013, 3 Rivers Wet Weather facilitated a series of meetings between the PWSA and the municipalities tributary to this sewershed. All associated parties in the POC sewershed have participated in these planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements.

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. MOU updates can be found in Addendum MH18-6-1.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-MH18C-0 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through the construction of parallel relief sewers designed to convey flows associated with zero overflows per typical year, under 2-year design storm conditions (0 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the MH-18 sewershed, both before and after implementation of the recommended alternative:

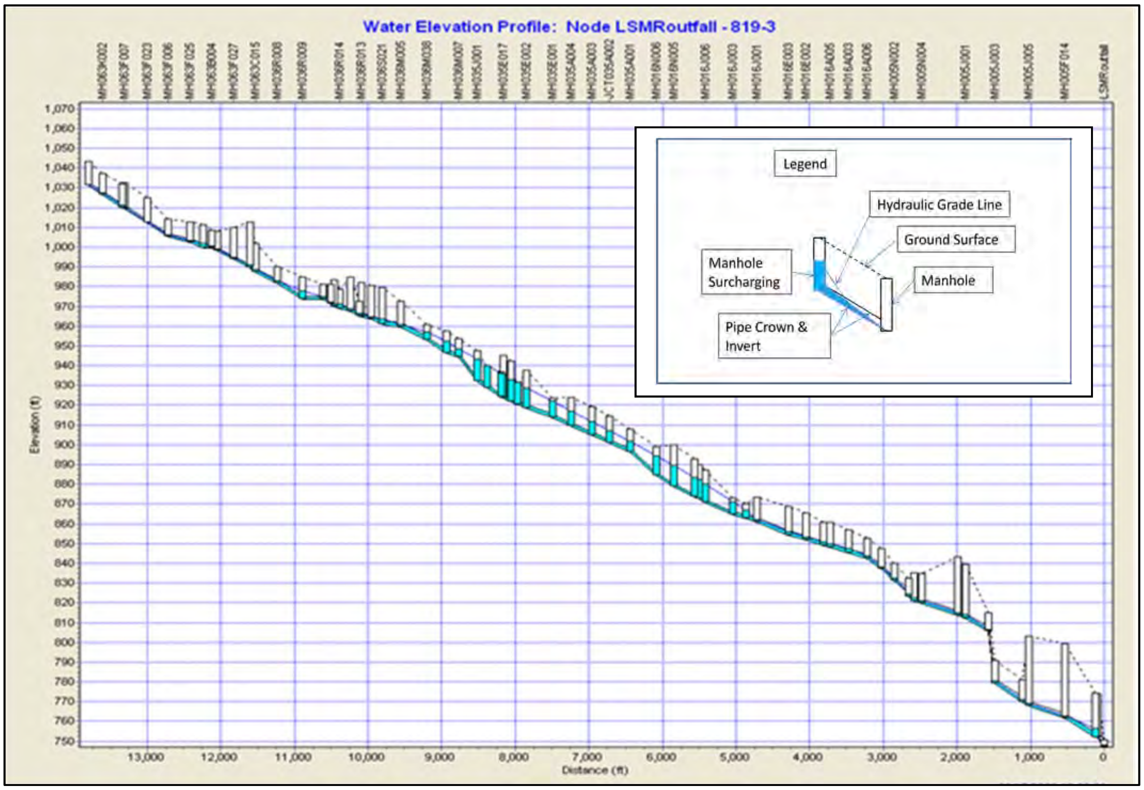
- Peak flow hydraulic grade line (HGL) of the trunk sewer
- 2046 peak flows and volumes to the MH-18 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figure 3 from that report presented a profile of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. This figure is reproduced below as Figure MH18-5-3. Under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging and manhole flooding occurs along the length of the trunk sewer.

The HGL along the main trunk sewer following implementation of alternative POC-MH18-C-0 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, modification of the diversion structures combined with additional conveyance capacity (0 OF/yr; 2-yr storm) will satisfactorily reduce manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE MH18-5-3: MH-18 MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



5.2.2 2046 Peak Flows and Volumes to MH-18 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the PWSA system. ALCOSAN made similar assumptions1, and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, as well as additional consolidation piping to convey increased flows to the MH-18 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the MH-18 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances From ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This contrasts with the PWSA's water quality based decision to recommend a zero OF/yr level of control within the Saw Mill Run planning basin.

However, the control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

intends to retain, store, convey and/or treat all flows delivered to the MH-18 POC under all control scenarios.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from the Borough of Dormont, Mt. Lebanon, Green Tree Borough and Scott Township indicate that each of them plan to convey all their flows to the MH-18 trunk sewer for the duration of the planning period. They have no plans to implement controls that would alter the modeled flows upon which the recommended alternative was based. This information is summarized in Table MH18-5-6.

TABLE MH18-5-6: MH-18 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

Tributary Municipality	Volume*		
	Captured	Treated	Conveyed
Borough of Dormont	N/A	N/A	All modeled flows
Green Tree Borough	N/A	N/A	All modeled flows
Mt. Lebanon	N/A	N/A	All modeled flows
Scott Township	N/A	N/A	All modeled flows

*Following implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, as well as increased conveyance piping to convey increased flows to the MH-18 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first five years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

As the primary flow contributor within this sewershed, the PWSA intends to extend the incorporation of IWP to the entire sewershed. The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of regulator modifications and additional consolidation piping designed to control CSOs from the PWSA diversion structures to zero overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the MH-18 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts in Saw Mill Run and Little Saw Mill Run due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-MH18-C-0 are consolidation piping, CSO screening facilities, and diversion structure modifications. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment MH18-5-1.

5.4.1 Consolidation Piping

In the MH-18 sewershed, additional conveyance capacity was provided through the use of parallel relief sewers to convey flows to the MH-18 POC. As detailed earlier, relief sewers were added to areas of the system that exhibited manhole flooding or surcharging at any time during the 24-hour design storm events. All improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewer.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street

5.4.2 CSO Screening Facilities

It was assumed that each outfall location will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

It was assumed that adjustments to existing regulator settings, including more effective and improved methods of flow control and monitoring, improved access, etc., would be sufficiently extensive as to make it more cost effective to simply replace each structure. The unit cost associated with the installation of each new diversion structure was assumed to be $200,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $360,000.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure MH18-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible “knee of the curve” is evident from this data.

These costs are also presented in a tabular format in Table MH18-5-7.

The selected level of CSO control - 0 OF/yr - was determined based upon water quality considerations. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-MH18-C-0 are summarized in Table MH18-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE MH18-5-4: MH-18 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

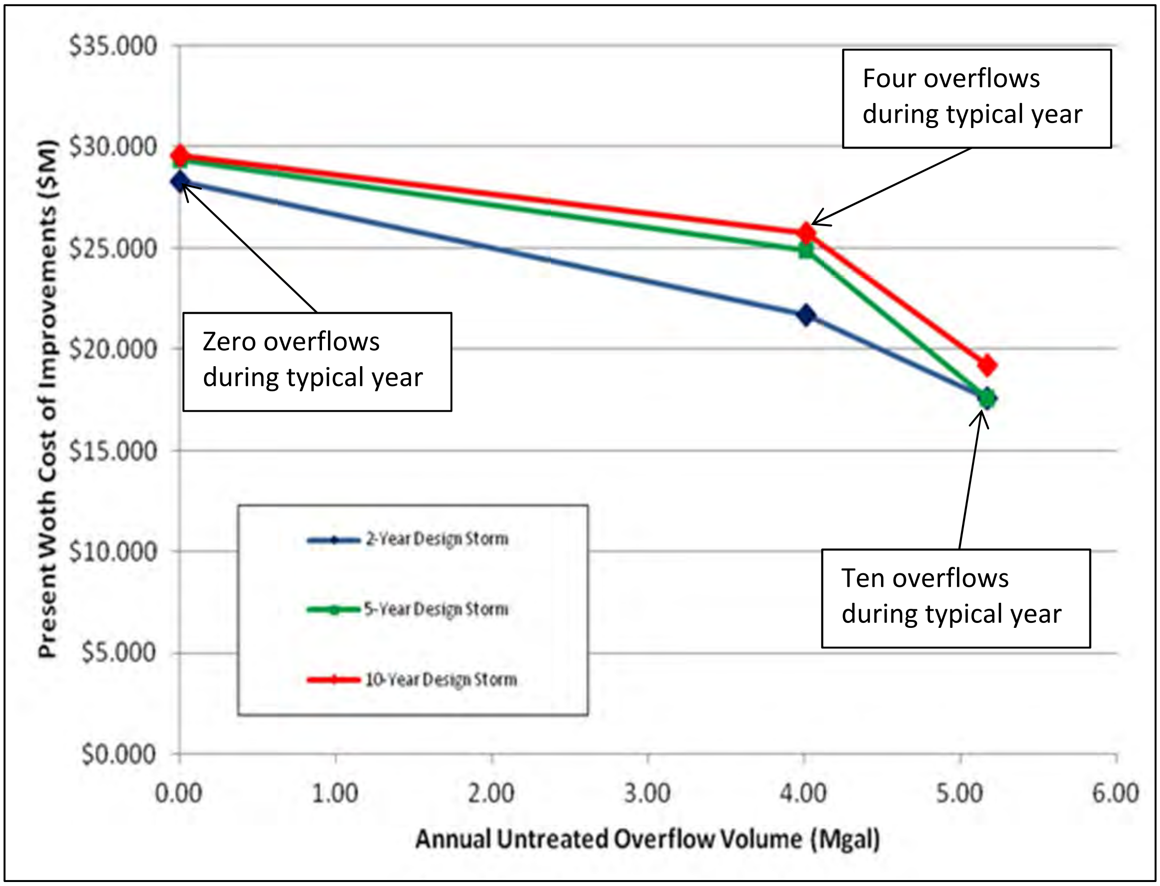


TABLE MH18-5-7: MH-18 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control				
	Untreated CSO Vol. (MG)	CSO Control Level (OF/yr)	PW Capital Cost ($MM)	PW O&M Cost* ($MM)	TPW CSO Control ($MM)
POC-MH18-C-0	0	0	$27.8	$0.5	$28.3
POC-MH18-C-4	4.0	4	$21.3	$0.4	$21.7
POC-MH18-C-10	5.2	10	$17.2	$0.4	$17.6
Alternative Name	SSO Control				
	Untreated SSO Vol. (MG)	SSO Control Level	PW Capital Cost ($MM)	PW O&M Cost ($MM)	TPW SSO Control ($MM)
POC-MH18-C-0	0	2-year	$0	$0	$0
POC-MH18-C-4	0	2-year	$0	$0	$0
POC-MH18-C-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE MH18-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-MH18-C-0

Capital Improvements	Size/ Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Replace diversion structures: DC016A001 DC016N001 DC035A001 DC035E001 DC036M001 DC036P001 DC036R001 DC063B001 DC063B002 DC063F001	0 OF/yr Each	$3.60	$3.60	$3.65
Add screening to diversion structures: DC016A001 DC016N001 DC035A001 DC035E001 DC036M001 DC036P001 DC036R001 DC063B001 DC063B002 DC063F001	1.6 to 37 mgd overflow rates	$4.50	$4.50	$4.55
Conveyance piping	12-in dia.	$0.16	$0.16	$0.16
Conveyance piping	24-in dia.	$2.55	$2.55	$2.61
Conveyance piping	30-in dia.	$0.08	$0.08	$0.08
Conveyance piping	36-in dia.	$5.88	$5.88	$5.99
Conveyance piping	42-in dia.	$3.19	$3.19	$3.25
Conveyance piping	48-in dia.	$7.85	$7.85	$7.98

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA and their tributary municipalities have agreed that the basis of allocation for future operation and maintenance costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the MH-18 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new

wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC MH-18 overflow is not intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the “Selected Plan” to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the “Recommended Plan”. This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the “Selected Plan” is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

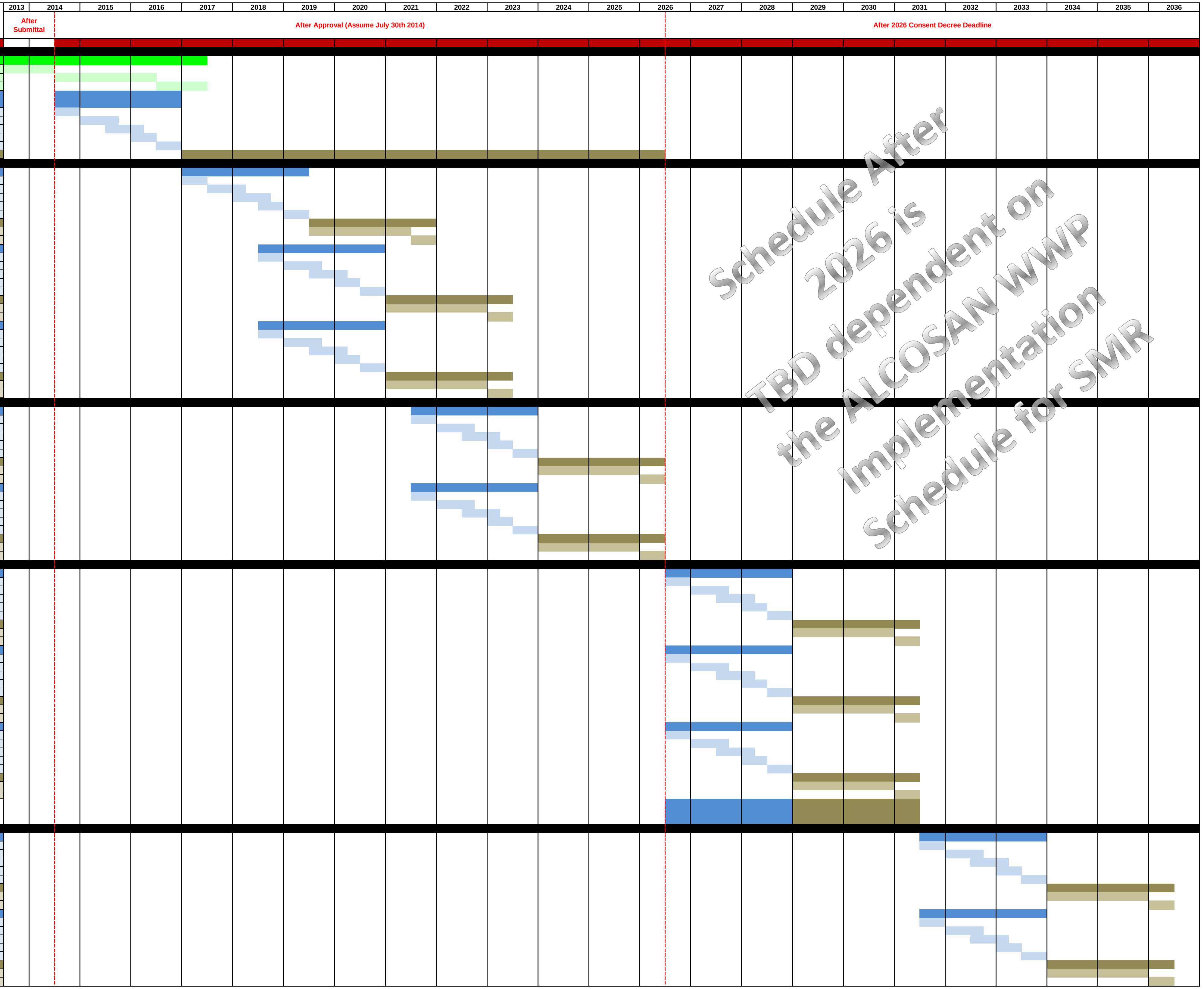
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it’s important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the SMR portion of the regional plan is not being implemented by 2026, and an implementation date is not specified in the plan. Therefore, an implementation schedule for MH-18 improvements cannot be specified at this time as it depends on the ALCOSAN WWP' SMR implementation schedule. The deadline shown in the schedule for MH-18, which is shown in Figure MH18-5-5, is for reference purposes only.

ATTACHMENT B

FIGURE MH18-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the MH-18 sewershed. These considerations include Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Dormont Borough, Green Tree Borough, the Municipality of Mt. Lebanon, Scott Township, and the Pittsburgh Water and Sewer Authority. Other considerations regarding the MH-18 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the “2-year design storm” for the municipal separate sanitary system portions and “4 OF/ typical year” for the PWSA’s combined system outside of Saw Mill Run where “0 OF/ typical year” is proposed.

A set of guiding principles were produced for use in developing cost allocation procedures. These principles form the basis of a DRAFT Memorandum of Understanding by and between Dormont Borough, Green Tree Borough, the Municipality of Mt. Lebanon, Scott Township, and The Pittsburgh Water and Sewer Authority, and include:

- The major goal is to develop a fair and equitable cost allocation process.

- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.
- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.
- Cost allocations should be simple and easy to calculate in the future.
- The final cost allocation methodology should encourage efficiencies between municipalities.
- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.
- Unless agreed to by all parties, existing contracts should not form the only basis for cost allocations.

6.1.1 Cost Sharing Concept and Method

Two distinctive categories of cost allocations will need to be addressed by the PWSA and their tributary municipalities: capital cost allocations and O&M cost allocations. A number of methods for capital cost allocation were considered, based on the following:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution
- Proportion of internal municipal costs

All of these approaches could be modified by the addition of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc. The following discussion describes each of these methodologies.

"Agreed Upon" Basis: This approach could be as simple as each party agreeing to a fixed share of each element of cost or all costs across the board. Negotiation of the

basis of the percent share is left to the discretion of the involved parties. Shares could be fixed for the term of the agreement, or they could be adjustable on a scheduled or otherwise agreed to basis. This approach is usually successful where there are existing agreements or a long history of collaboration between the affected parties.

Capacity Basis: Capacity based cost sharing is predicated on the design capacity of the shared facilities and the portion that is allocable to the various parties to the Agreement. For the types of facilities being evaluated, wet weather flow rate and volume would be the primary capacity parameters. A Design Engineer's Report, normally submitted as part of the construction permitting process, should clearly specify and set forth the flow rate and volumetric design basis, as well as the capacity needs associated with all municipal entities. This information can serve as the basis for pro rata distribution of cost elements such as Debt Service and initial costs. One issue that should be addressed is how and whether unused and/or excess capacity utilized by "others" will be subject to cost reimbursement.

Expected Annual Flow Contribution: This method would utilize estimated flow rates for a predetermined average year as the basis for the evaluation of cost allocations. This may work well for systems where a hybrid approach of wet weather flow rate and volume is desired.

Proportion of Internal Municipal Cost: This approach requires municipalities to evaluate their own internal projects. This evaluation would include outlining control alternatives and selecting the highest ranked alternative for their internal solution. The municipalities' share of the combined project becomes a "not-to-exceed" or proportional value of its internal cost to the total regional cost.

6.1.2 Evaluation and Selection of Capital Cost Allocation Methodology

Four sewersheds, not including the MH-18 POC sewershed, were selected by 3RWW and their PM Team as pilot sewersheds for cost allocation evaluations. Monthly meetings were held at which the meeting attendees selected the methodologies that they thought were appropriate, and the 3RWW/PM Team provided the necessary statistics for use in evaluating and selecting the best methodology.

Statistics intended to support the various allocation methodologies were developed and discussed with each POC participant. Over the course of several meetings, the major point of discussion was the identification of ways to ensure the allocation was

fair and equitable by assigning the costs proportionally to the cost-causative items. In addition, participants agreed with the idea that it would not be fair for downstream municipalities pay for upstream sections of the project, given that they did not contribute flows directly into that sewer.

Following these discussions, the first decision regarded the need to use peak wet weather flows as the basis for the cost allocation. The PM Team evaluated three main types of peak flow based analysis:

Percentage of Flow at POC: In this approach, the total flows at the POC and at each connection point tributary to the POC are obtained from the H&H Model. The flow rate for each connection point is then divided by the total POC flow to obtain its ratio. This represents the connection point's portion of the total cost of the regional project. It should be noted that portions of the project dedicated to a single municipality would be subtracted from the total cost of the regional project.

Percentage by Length of Use: In this approach, the distance from the POC is used as a "weighing factor" in the cost allocation calculation.

Segmental: In this approach, areas that are tributary to a project or a portion of a project would divide the cost based on peak wet weather flow rates from each tributary area.

In all of the cost allocation procedures, the calibrated ALCOSAN H&H Model was the accepted tool for determining peak flow rates. In some cases where two or more municipalities were combined into one loading point, the agreement was to use the model to affect the required split through RTK and area adjustments (if separate) and area adjustment (if combined).

6.1.3 Operation & Maintenance Cost Allocation

In the development of O&M cost allocation methods, it is important to define what constitutes O&M. The following is a general list of those items considered for each POC sewershed:

- Sewer Inspection
- CCTV and cleaning
- Utilities and power requirements for pump stations and storage basins

- Chemical costs for CSO facilities
- Minor repair and rehabilitation
- Staff salaries, wages and fringe benefits
- Replacement costs (sewers and structures - 100 years; mechanical equipment – 25 years)
- SSO Response Plan

The next step was to categorize these expenses into at least groups – those items impacted by peak flow (such as CCTV and sewer cleaning) and those items impacted by volume of wastewater (such as storage basins). Once categorized, various methodologies for O&M cost allocation could be investigated. A number of approaches to O&M cost allocation were considered, and three of those chosen for capital cost allocation were also chosen for O&M cost allocations:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution

As was the case for the capital cost allocation methods, each of these approaches can be modified by the application of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc.

6.1.4 Selected Capital Cost Allocation Method

The selected method of capital cost allocation between the PWSA and their tributary municipalities is based upon the use of peak wet weather flows, as determined using the segmental approach.

Using this approach, areas of each municipality tributary to a section of new consolidation / conveyance piping would divide the cost based on peak wet weather flow rates from each municipal tributary area. The calibrated ALCOSAN H&H Model was the accepted tool for use in determining those peak flow rates.

For the purposes of this Feasibility Study, alternative POC-MH18-C-0 has been divided into nine (9) segments. Seven (7) of these segments receive flows from one or more tributary municipalities, and are subject to the allocation of capital costs. The remaining two (2) segments convey flows generated solely by the City of Pittsburgh. General locations of the nine (9) inter-municipal segments of the recommended alternative are illustrated in Figure MH18-6-1.

It is anticipated that the conceptual capital cost allocation estimates for each segment will be based on the municipal peak wet weather flow percentages shown in Table MH18-6-1.

TABLE MH18-6-1: MUNICIPAL PEAK WET WEATHER FLOW PERCENTAGES

Segment	Percentage (%)				
	PWSA	Borough of Dormont	Green Tree Borough	Mt. Lebanon	Scott Township
1	70.6	11.0	5.6	10.4	2.4
2	78.8	0	21.2	0	0
3	77.9	4.1	13.2	3.9	0.9
4	78.2	4.1	13.0	3.8	0.9
5	100	0	0	0	0
6	85.9	2.9	8.2	2.4	0.6
7	100	0	0	0	0
8	87.7	2.5	7.2	2.1	0.5
9	89.1	2.2	6.5	1.8	0.4

If work is done by a municipality to reduce flow below the flows currently predicted and the municipality wants to revise these percentages, that municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other parties prior to the commencement of design.

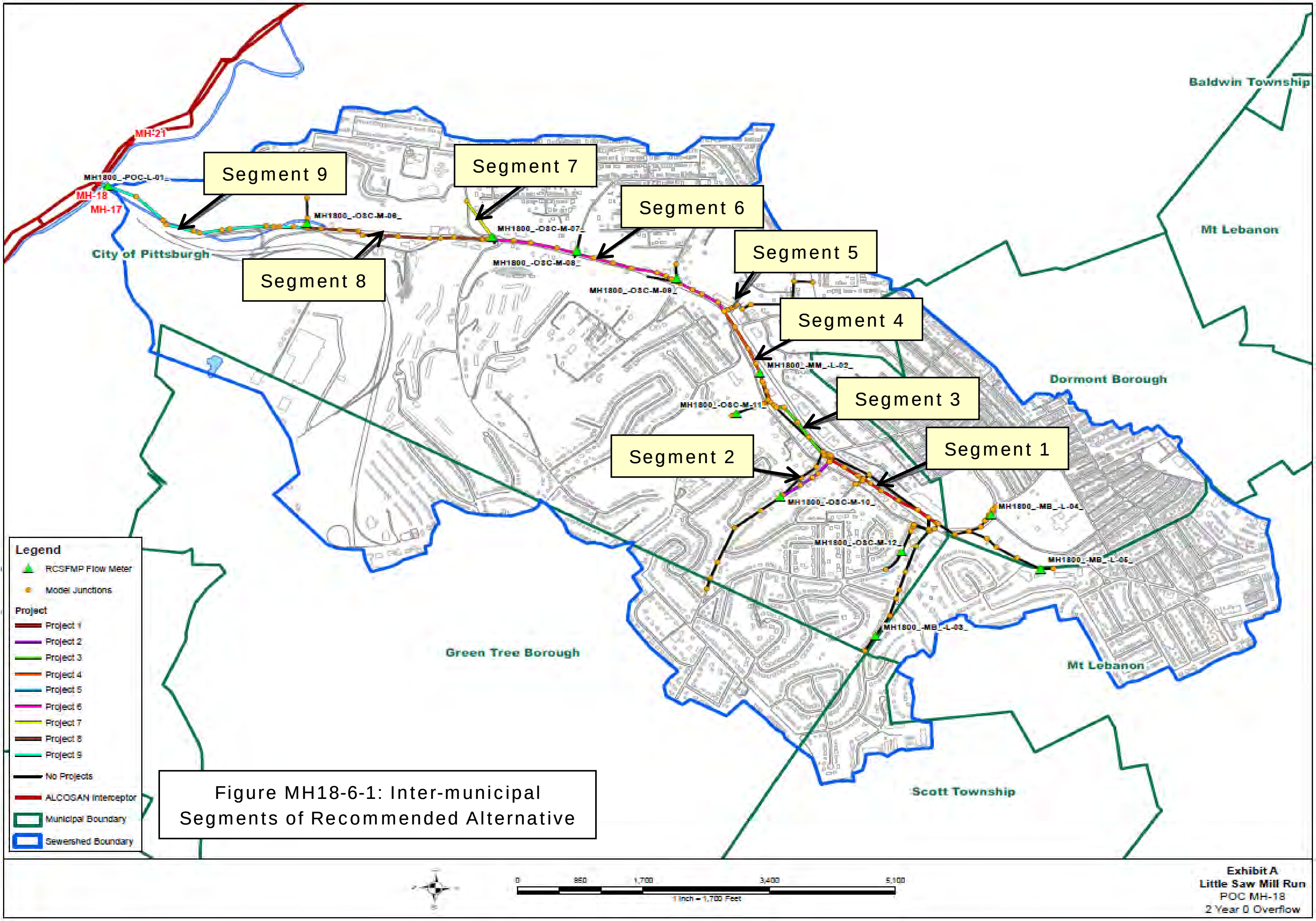


Figure MH18-6-1: Inter-municipal Segments of Recommended Alternative

Exhibit A
Little Saw Mill Run
POC MH-18
2 Year 0 Overflow

6.1.5 Selected O&M Cost Allocation Method

For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

One of the early steps taken to facilitate the development of up-to-date and relevant MOUs and/or inter-municipal agreements was to determine whether or not there were any existing, applicable MOUs or service agreements. 3RWW, working with the University of Pittsburgh, collected many of the existing agreements. The FSWG also formed an inter-municipal agreements subcommittee to review those existing agreements, develop an agreement outline for use by the municipalities, and prepare draft agendas for use in multi-municipal meetings.

The various inter-municipal agreements that have been compiled by 3RWW were reviewed for the purpose of summarizing the provisions that are relevant to allowable flow contributions. The results of this review are presented below. All specific references to “sanitary sewers”, “sanitary sewage” or other characterizations of the tributary sewer systems were extracted and presented below. In addition, specific information regarding cost sharing arrangements was also extracted from the agreements and is presented below.

1. In an agreement dated January 7, 1951, the City of Pittsburgh and Green Tree Borough reached an agreement. Relevant terms of that agreement are as follows:
    - Green Tree is given permission to discharge **“the sewage”** from 36 acres extending from a parcel of land having an area of 36 acres extending north-eastwardly from the Green Tree Borough-Scott Township line between Green Tree Road and the City of Pittsburgh/Green Tree line into the City sanitary sewer on McMonagle Avenue;
    - Green Tree agrees to pay the City $4,447.44 upon connection;
    - “The City agrees to maintain and keep in repair the branch trunk sanitary sewer and the Borough agrees to pay 1.87% of the cost of said maintenance, including reconstruction, repairs and all other work necessary in connection with the said branch trunk sanitary sewer”;

- "The City agrees to maintain and keep in repair the trunk sanitary sewer in Saw Mill Run Drainage Basin from the branch trunk sanitary sewer in Little Saw Mill Run Drainage Basin to the Ohio River and the Borough agrees to pay 0.33% of the cost of said maintenance, including reconstruction, repairs and all other work necessary in connection with the said trunk sanitary sewer."

2. In an agreement dated April 11, 1955, the City of Pittsburgh and Scott Township reached an agreement. Relevant terms of that agreement are as follows:
    - City permits Township to discharge **sewage** from 18 acres extending southwestwardly from the Green Tree Borough/Scott Township line into the City Sewer on McMonagle Avenue.
    - City to maintain and repair the branch trunk sanitary sewer in Little Saw Mill Run from the City/township line at McMonagle Avenue to the Main Saw Mill Run Trunk with the Township to pay 94% [not clear] of the cost of said maintenance, including reconstruction, etc.
    - The City agrees to maintain and repair the trunk sanitary sewer in the Saw Mill Run Drainage Basin from the branch trunk sanitary sewer in the Little Saw Mill Run Drainage Basin to the Ohio River with the Township to pay 0.17% of the cost of maintenance, including reconstruction, etc. with the necessity for the work to be determined by the City.

3. In an agreement dated October 8, 1959, the City of Pittsburgh and Green Tree Borough reached an agreement. Relevant terms of that agreement are as follows:
    - The City and Borough agree to construct a **sanitary** sewer from Short Street in Green Tree Borough along Crane Avenue to the City trunk sewer in Banksville Road.
    - "The City and the Borough agree that all land acquisition costs, fees paid professional engineer, construction costs, maintenance, and other proper costs incidental and necessary in the construction of the sewer shall be borne 66-2/3% by Green Tree Borough and 33-1/3% by the City of Pittsburgh"
    - "It is understood by both parties that the aforesaid apportionment is predicated upon the respective sewer usage by each municipality. It is recognized by both parties hereto that usage by each municipality will vary in proportion to the number of houses located within the service area development of each municipality. The contribution of each municipality

> for maintenance expenses shall be in the aforesaid proportion for the year following the date of completion of the construction of the sewer. The date of completion of construction shall be taken as the date of final payment to the contractor or contractors to construct the sewer. Thereafter on the succeeding year's anniversary date of completion, the sewer usage of each municipality shall be adjusted from data available in the Office of the Superintendent of the Bureau of Building Inspection of the City and the Building Inspector of the Borough to reflect the actual usage by each. The contribution for construction costs shall then be made on the basis of the readjustment of the apportionment as originally established. To the extent that the recomputed usage varies from the basic one/third – two/thirds construction cost contribution ratio, an additional contribution to construction cost shall be made by one municipality to the other. Maintenance expense shall annually be shared in accordance with recomputed sewer usage."

It should be emphasized that these agreements from the 1950s are not anticipated to be used as the inter-municipal agreements for this project. The draft MOU developed per the following subsections would serve as an initial understanding of what would form a new future agreement between the municipalities.

6.2.1 Development of MOU and Inter-Municipal Agreements

When more than one municipality is involved in the design, construction and operation of wet weather control facilities, it is intended that they will develop inter-municipal agreements to outline their mutual understanding of the project as well as their municipal, customer and legal responsibilities. These responsibilities include, but are not limited to, joint permitting, joint ownership, joint cost sharing, and who will operate and maintain the facility on a long term basis.

In addition, it is the PWSA's position that any agreements or MOUs should contain provisions for periodic review and amendment as necessary by the respective parties and their solicitors.

6.2.2 MOU and Inter-Municipal Agreements

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. It is currently being reviewed by each of the parties.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

In summary, the draft MOU states that, for the purpose of submitting the feasibility study, the municipalities agree that the preliminary estimated total cost to be expended on the inter-municipal segments of the recommended alternative, shown in Figure MH18-6-1, is $19,710,000. This cost represents the cost associated with the elements of the required improvements in the sewershed that provide multi-municipal service (i.e. convey or otherwise handle flows generated by more than one municipality). Each municipality shall have the right to void the MOU if the total cost exceeds $23,700,000. The draft MOU also states that the municipalities agree that the basis of allocation for costs of each segment is based on percentage of peak flow contributed to each segment at the time of the MOU, multiplied by the preliminary estimated total cost of each segment agreed to by the municipalities that will share in such costs.

It is intended that an agreement will be entered into by all parties after an implementation order has been issued by the PADEP and/or the ACHD. Such an order would indicate that the cost to each party would be based on the cost of each segment, to be adjusted for changes in costs made during construction.

The draft MOU further states that, for the purpose of submitting the Feasibility Study, the municipalities agree that the preliminary estimate of the percentage and amount of the total cost of implementation of the recommended alternative for each municipality will be as indicated below:

- Dormont Borough 3.30% ($650,000)
- Green Tree Borough 8.68% ($1,710,000)
- Municipality of Mt. Lebanon 2.94% ($580,000)
- The Pittsburgh Water and Sewer Authority 84.37% ($16,630,000)
- Scott Township 0.71% ($140,000)

It is noted that these costs represent the allocated costs for joint conveyance facilities. These costs do not include additional costs that may be associated with other recommended improvements in the sewershed within individual municipalities. The draft MOU is provided in Attachment MH18-6-1. Also, signed copies of the MOU, if provided by the municipality, would be provided in Addendum MH18-6-1. Mt. Lebanon has submitted a signed Addendum on behalf of POC MH-18. While they are in agreement with the preparation of a report on a POC basis that required upstream inter-municipal co-ordination, they are not in agreement and not able to sign the MOU. PWSA received a signed MOU on behalf of Dormont Borough and POC MH-18. A copy of Mt. Lebanon's signed Addendum and Dormont's signed MOU is presented in Addendum MH18-6-1.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended MH-18 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after MH-18 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

Phase I	2013 through 2017
Phase II	2017 through 2023
Phase III	2021 through 2026
Phase IV	TBD
Phase V	TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements, including in MH-18, are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/ Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure MH18-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the MH-18 shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained

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[1] Text is derived from "A Guide for Preparing Act 537 Update Revisions, 2003".

from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

6.3.2 Joint Municipal Planning and Implementation

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. The draft MOU contains provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

The specific municipal tasks and efforts necessary to effect implementation of the Feasibility Study involve the completion of the nine (9) project segments listed above in Table MH18-6-1.

All associated parties in the POC sewershed have participated in planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. Signature pages of executed MOUs or other expressions of agreement as provided by the municipalities are attached as Addendum MH18-6-1 to this POC report.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$27,814,000; $19,710,000 of which would be part of the inter-municipal agreement.
- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance
- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table MH18-6-2. The projected costs per household includes the “normal” current and future PWSA and

ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE MH18-6-2: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	**Annual Costs**		
	Current 2012	**First Year After Alternatives are implemented -2027**[2]	**2046**
City of Pittsburgh[3]	$399	$1,113	$1,638
Borough of Dormont	Not Available	Not Available	Not Available
Municipality of Mt. Lebanon	$492	$1,243	Not Available
Baldwin Township	Not Available	Not Available	Not Available
Scott Township	Not Available	Not Available	Not Available

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure MH18-6-2.

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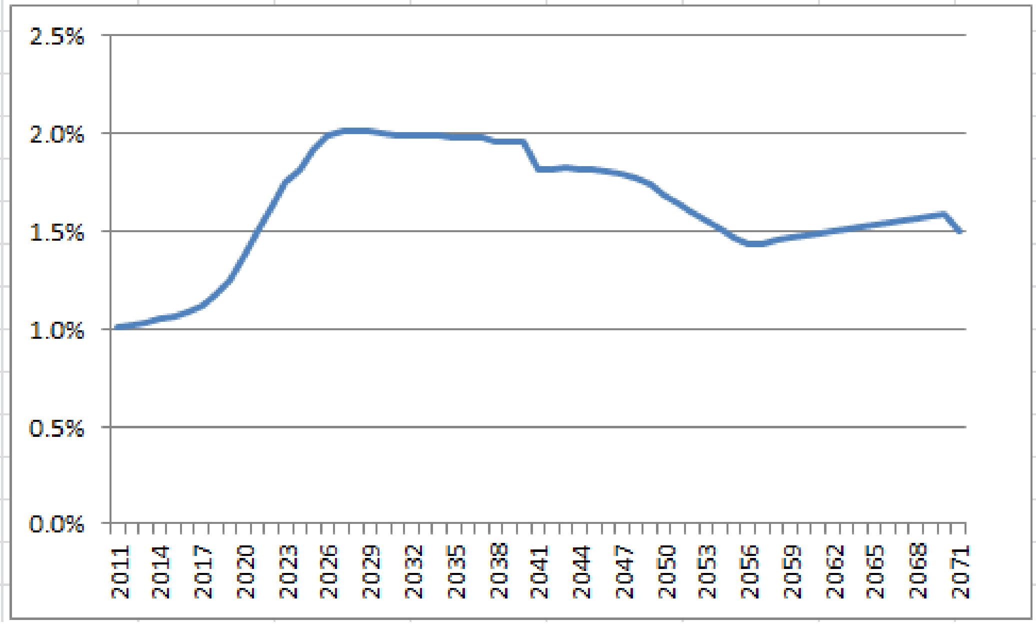
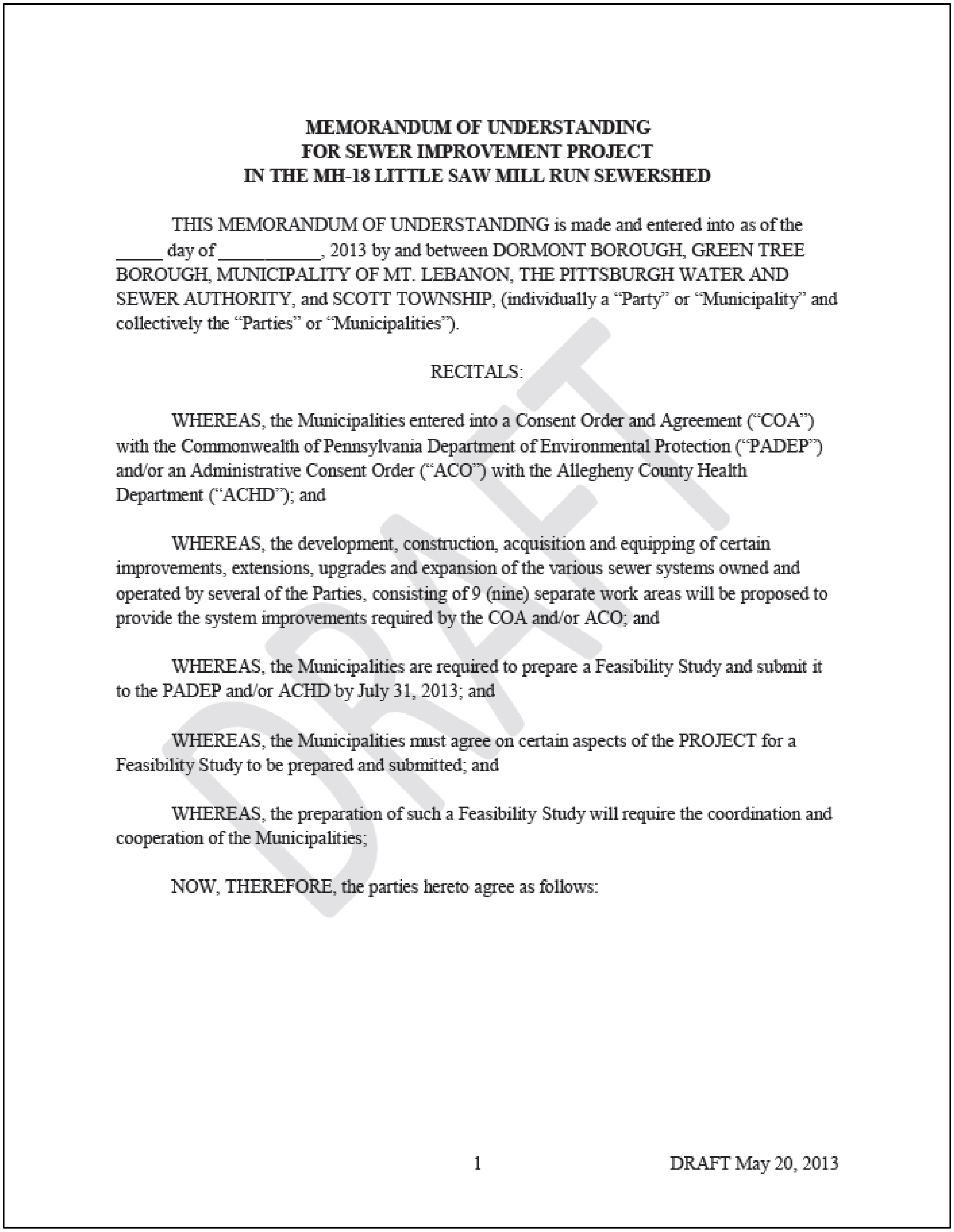
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

FIGURE MH18-6-2 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.



MEMORANDUM OF UNDERSTANDING
FOR SEWER IMPROVEMENT PROJECT
IN THE MH-18 LITTLE SAW MILL RUN SEWERSHED

THIS MEMORANDUM OF UNDERSTANDING is made and entered into as of the _____ day of ___________, 2013 by and between DORMONT BOROUGH, GREEN TREE BOROUGH, MUNICIPALITY OF MT. LEBANON, THE PITTSBURGH WATER AND SEWER AUTHORITY, and SCOTT TOWNSHIP, (individually a “Party” or “Municipality” and collectively the “Parties” or “Municipalities”).

RECITALS:

WHEREAS, the Municipalities entered into a Consent Order and Agreement (“COA”) with the Commonwealth of Pennsylvania Department of Environmental Protection (“PADEP”) and/or an Administrative Consent Order (“ACO”) with the Allegheny County Health Department (“ACHD”); and

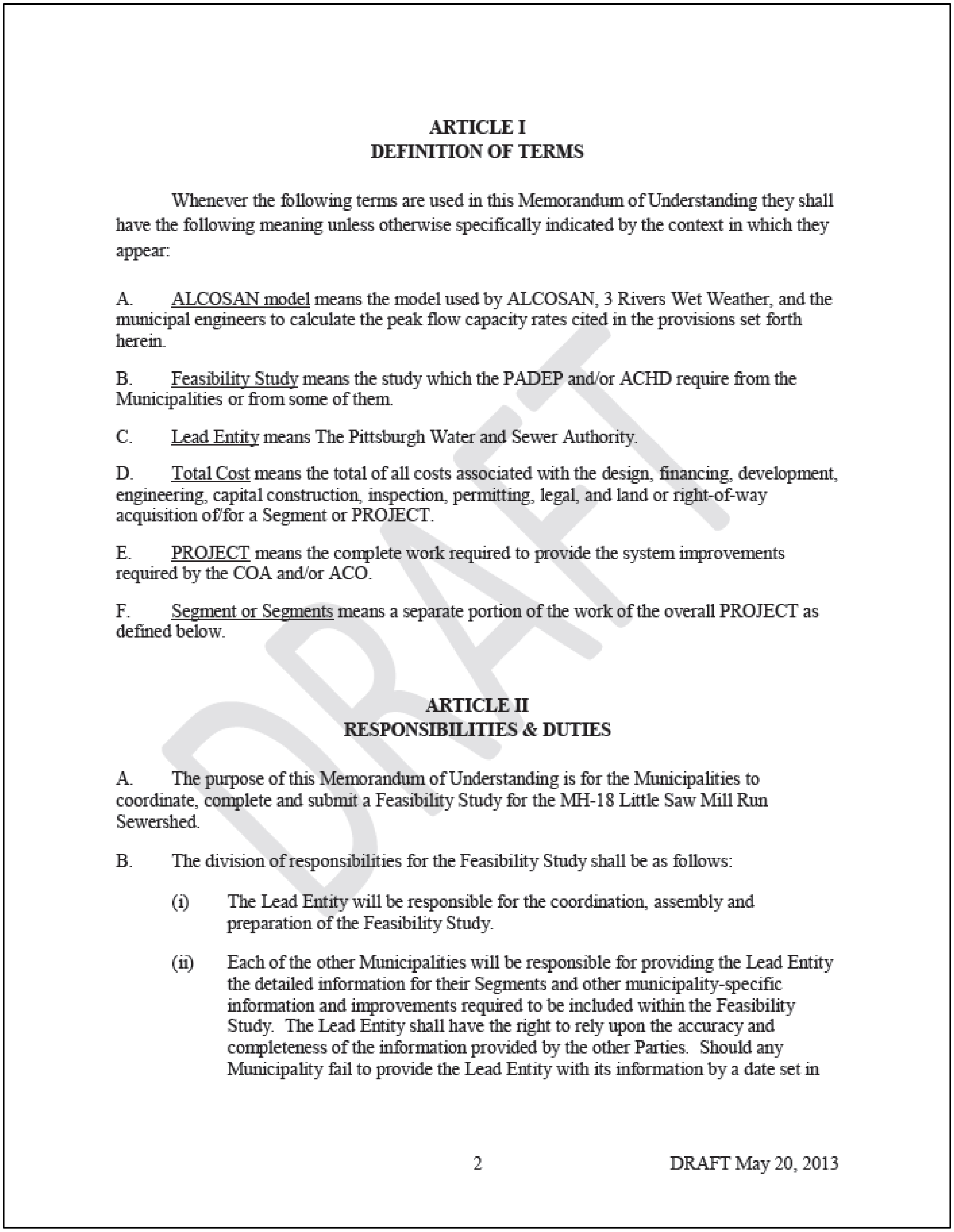
WHEREAS, the development, construction, acquisition and equipping of certain improvements, extensions, upgrades and expansion of the various sewer systems owned and operated by several of the Parties, consisting of 9 (nine) separate work areas will be proposed to provide the system improvements required by the COA and/or ACO; and

WHEREAS, the Municipalities are required to prepare a Feasibility Study and submit it to the PADEP and/or ACHD by July 31, 2013; and

WHEREAS, the Municipalities must agree on certain aspects of the PROJECT for a Feasibility Study to be prepared and submitted; and

WHEREAS, the preparation of such a Feasibility Study will require the coordination and cooperation of the Municipalities;

NOW, THEREFORE, the parties hereto agree as follows:



ARTICLE I
DEFINITION OF TERMS

Whenever the following terms are used in this Memorandum of Understanding they shall have the following meaning unless otherwise specifically indicated by the context in which they appear:

A. ALCOSAN model means the model used by ALCOSAN, 3 Rivers Wet Weather, and the municipal engineers to calculate the peak flow capacity rates cited in the provisions set forth herein.

B. Feasibility Study means the study which the PADEP and/or ACHD require from the Municipalities or from some of them.

C. Lead Entity means The Pittsburgh Water and Sewer Authority.

D. Total Cost means the total of all costs associated with the design, financing, development, engineering, capital construction, inspection, permitting, legal, and land or right-of-way acquisition of/for a Segment or PROJECT.

E. PROJECT means the complete work required to provide the system improvements required by the COA and/or ACO.

F. Segment or Segments means a separate portion of the work of the overall PROJECT as defined below.

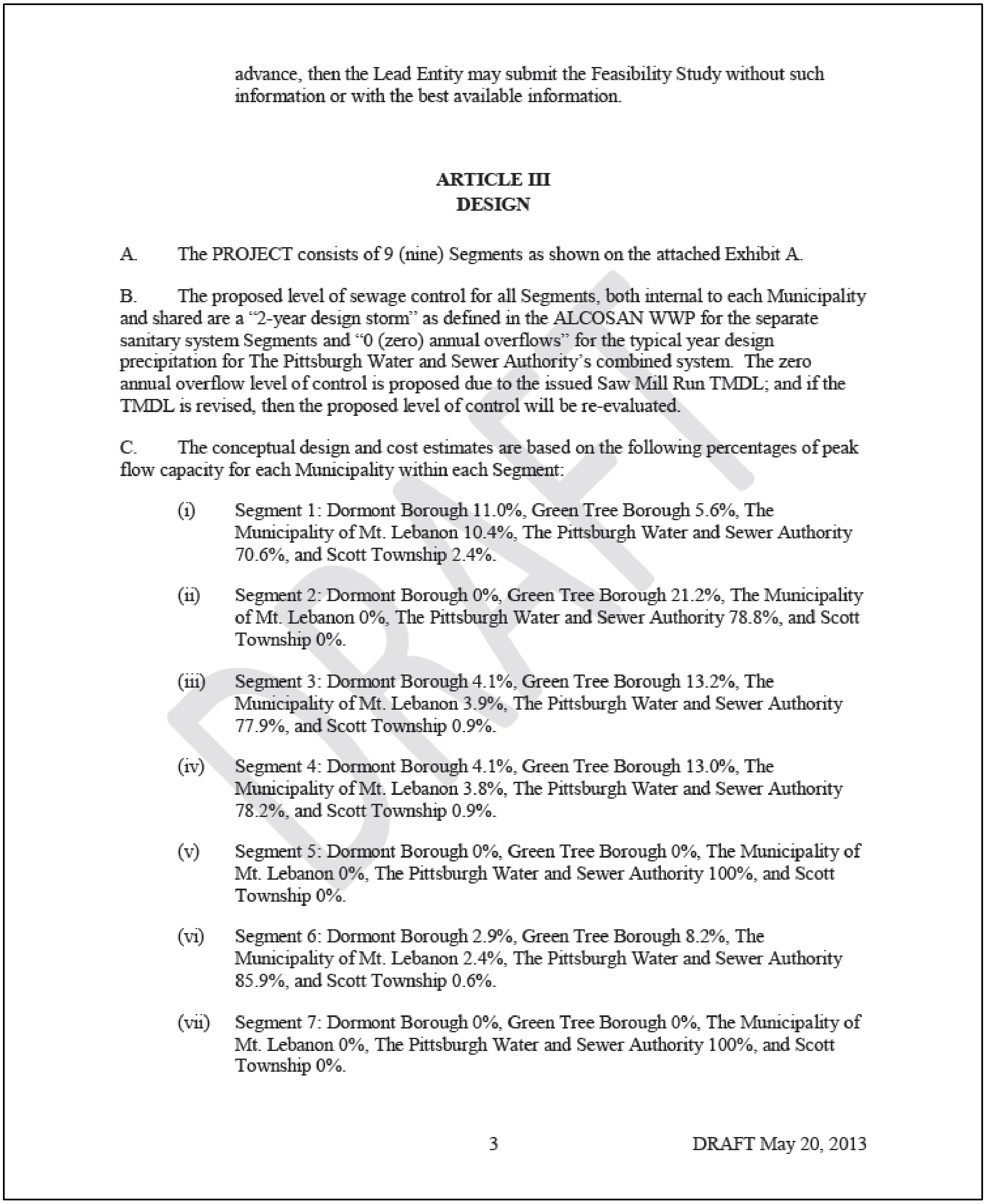
ARTICLE II
RESPONSIBILITIES & DUTIES

A. The purpose of this Memorandum of Understanding is for the Municipalities to coordinate, complete and submit a Feasibility Study for the MH-18 Little Saw Mill Run Sewershed.

B. The division of responsibilities for the Feasibility Study shall be as follows:

(i) The Lead Entity will be responsible for the coordination, assembly and preparation of the Feasibility Study.

(ii) Each of the other Municipalities will be responsible for providing the Lead Entity the detailed information for their Segments and other municipality-specific information and improvements required to be included within the Feasibility Study. The Lead Entity shall have the right to rely upon the accuracy and completeness of the information provided by the other Parties. Should any Municipality fail to provide the Lead Entity with its information by a date set in



advance, then the Lead Entity may submit the Feasibility Study without such information or with the best available information.

ARTICLE III
DESIGN

A. The PROJECT consists of 9 (nine) Segments as shown on the attached Exhibit A.

B. The proposed level of sewage control for all Segments, both internal to each Municipality and shared are a "2-year design storm" as defined in the ALCOSAN WWP for the separate sanitary system Segments and "0 (zero) annual overflows" for the typical year design precipitation for The Pittsburgh Water and Sewer Authority's combined system. The zero annual overflow level of control is proposed due to the issued Saw Mill Run TMDL; and if the TMDL is revised, then the proposed level of control will be re-evaluated.

C. The conceptual design and cost estimates are based on the following percentages of peak flow capacity for each Municipality within each Segment:

(i) Segment 1: Dormont Borough 11.0%, Green Tree Borough 5.6%, The Municipality of Mt. Lebanon 10.4%, The Pittsburgh Water and Sewer Authority 70.6%, and Scott Township 2.4%.

(ii) Segment 2: Dormont Borough 0%, Green Tree Borough 21.2%, The Municipality of Mt. Lebanon 0%, The Pittsburgh Water and Sewer Authority 78.8%, and Scott Township 0%.

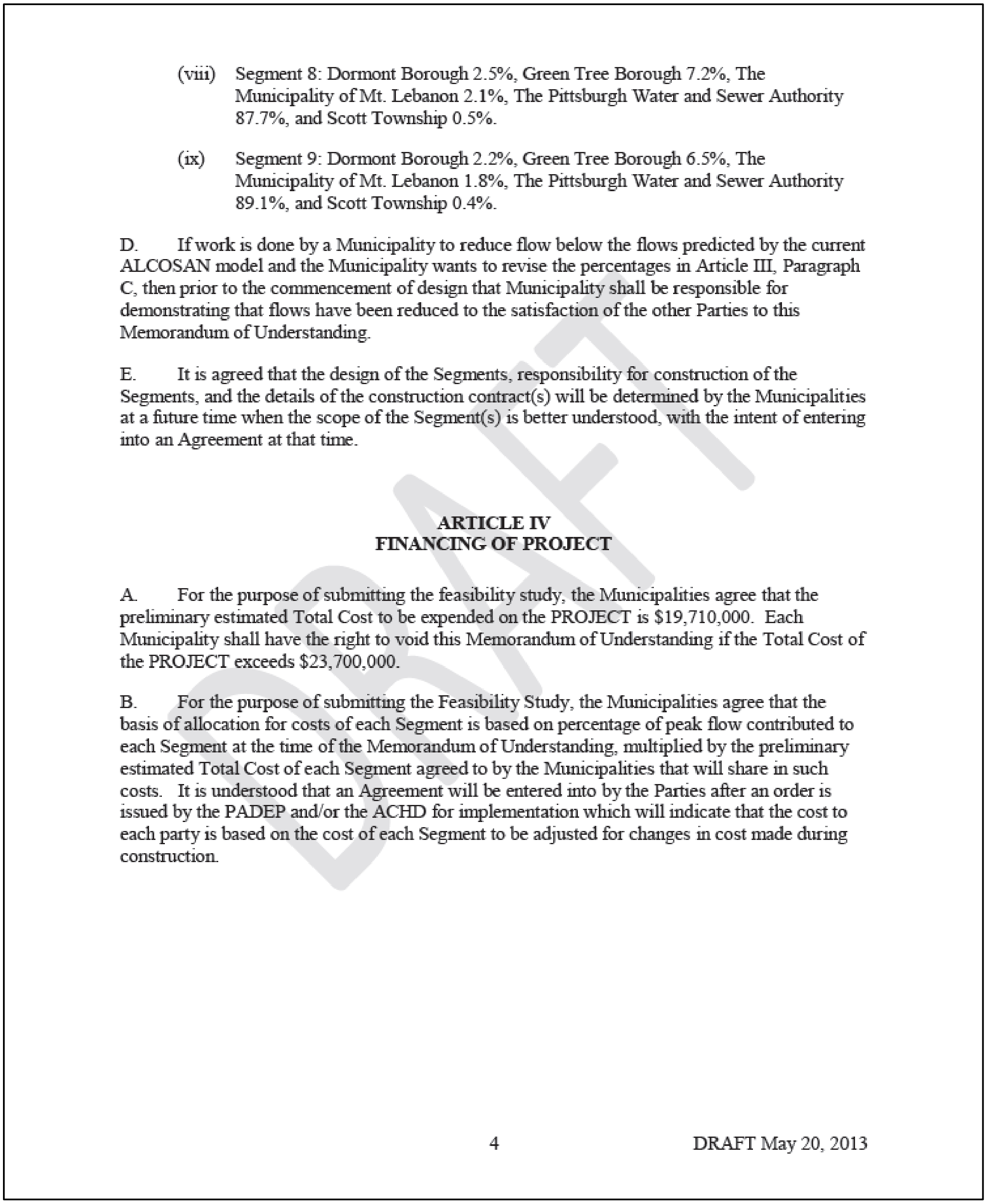
(iii) Segment 3: Dormont Borough 4.1%, Green Tree Borough 13.2%, The Municipality of Mt. Lebanon 3.9%, The Pittsburgh Water and Sewer Authority 77.9%, and Scott Township 0.9%.

(iv) Segment 4: Dormont Borough 4.1%, Green Tree Borough 13.0%, The Municipality of Mt. Lebanon 3.8%, The Pittsburgh Water and Sewer Authority 78.2%, and Scott Township 0.9%.

(v) Segment 5: Dormont Borough 0%, Green Tree Borough 0%, The Municipality of Mt. Lebanon 0%, The Pittsburgh Water and Sewer Authority 100%, and Scott Township 0%.

(vi) Segment 6: Dormont Borough 2.9%, Green Tree Borough 8.2%, The Municipality of Mt. Lebanon 2.4%, The Pittsburgh Water and Sewer Authority 85.9%, and Scott Township 0.6%.

(vii) Segment 7: Dormont Borough 0%, Green Tree Borough 0%, The Municipality of Mt. Lebanon 0%, The Pittsburgh Water and Sewer Authority 100%, and Scott Township 0%.



(viii) Segment 8: Dormont Borough 2.5%, Green Tree Borough 7.2%, The Municipality of Mt. Lebanon 2.1%, The Pittsburgh Water and Sewer Authority 87.7%, and Scott Township 0.5%.

(ix) Segment 9: Dormont Borough 2.2%, Green Tree Borough 6.5%, The Municipality of Mt. Lebanon 1.8%, The Pittsburgh Water and Sewer Authority 89.1%, and Scott Township 0.4%.

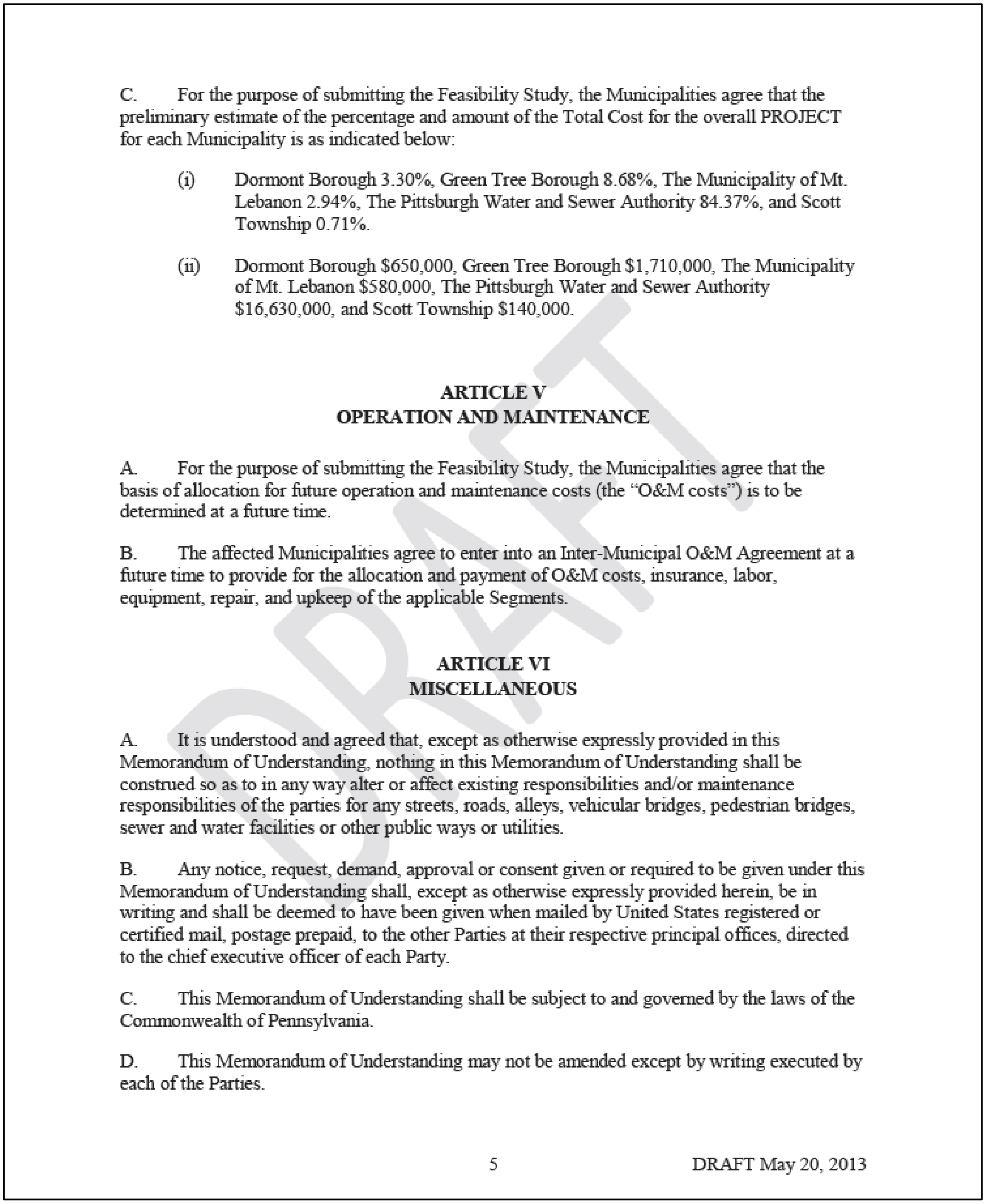
D. If work is done by a Municipality to reduce flow below the flows predicted by the current ALCOSAN model and the Municipality wants to revise the percentages in Article III, Paragraph C, then prior to the commencement of design that Municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties to this Memorandum of Understanding.

E. It is agreed that the design of the Segments, responsibility for construction of the Segments, and the details of the construction contract(s) will be determined by the Municipalities at a future time when the scope of the Segment(s) is better understood, with the intent of entering into an Agreement at that time.

ARTICLE IV
FINANCING OF PROJECT

A. For the purpose of submitting the feasibility study, the Municipalities agree that the preliminary estimated Total Cost to be expended on the PROJECT is $19,710,000. Each Municipality shall have the right to void this Memorandum of Understanding if the Total Cost of the PROJECT exceeds $23,700,000.

B. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for costs of each Segment is based on percentage of peak flow contributed to each Segment at the time of the Memorandum of Understanding, multiplied by the preliminary estimated Total Cost of each Segment agreed to by the Municipalities that will share in such costs. It is understood that an Agreement will be entered into by the Parties after an order is issued by the PADEP and/or the ACHD for implementation which will indicate that the cost to each party is based on the cost of each Segment to be adjusted for changes in cost made during construction.



C. For the purpose of submitting the Feasibility Study, the Municipalities agree that the preliminary estimate of the percentage and amount of the Total Cost for the overall PROJECT for each Municipality is as indicated below:

(i) Dormont Borough 3.30%, Green Tree Borough 8.68%, The Municipality of Mt. Lebanon 2.94%, The Pittsburgh Water and Sewer Authority 84.37%, and Scott Township 0.71%.

(ii) Dormont Borough $650,000, Green Tree Borough $1,710,000, The Municipality of Mt. Lebanon $580,000, The Pittsburgh Water and Sewer Authority $16,630,000, and Scott Township $140,000.

ARTICLE V

OPERATION AND MAINTENANCE

A. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for future operation and maintenance costs (the "O&M costs") is to be determined at a future time.

B. The affected Municipalities agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the applicable Segments.

ARTICLE VI

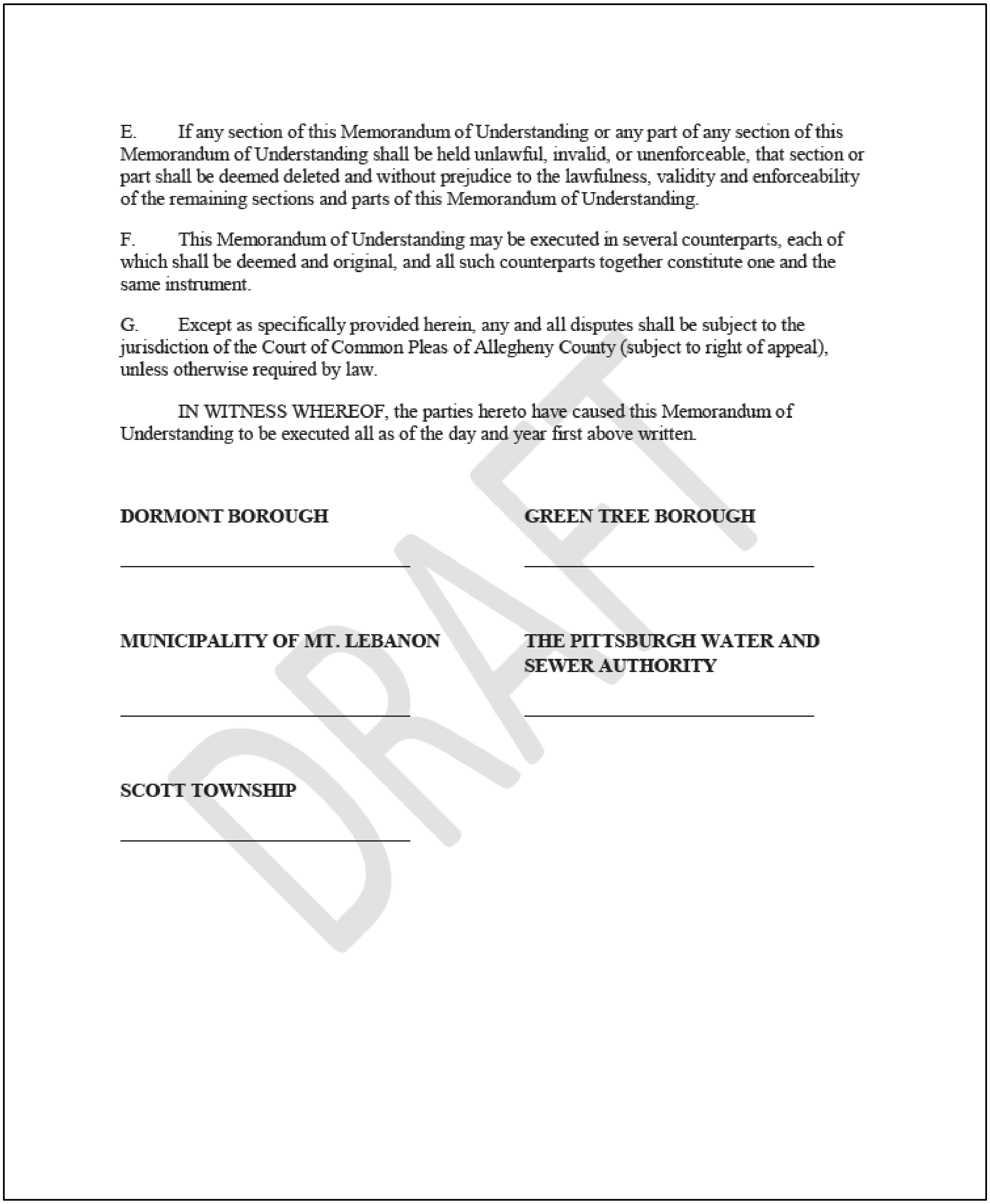
MISCELLANEOUS

A. It is understood and agreed that, except as otherwise expressly provided in this Memorandum of Understanding, nothing in this Memorandum of Understanding shall be construed so as to in any way alter or affect existing responsibilities and/or maintenance responsibilities of the parties for any streets, roads, alleys, vehicular bridges, pedestrian bridges, sewer and water facilities or other public ways or utilities.

B. Any notice, request, demand, approval or consent given or required to be given under this Memorandum of Understanding shall, except as otherwise expressly provided herein, be in writing and shall be deemed to have been given when mailed by United States registered or certified mail, postage prepaid, to the other Parties at their respective principal offices, directed to the chief executive officer of each Party.

C. This Memorandum of Understanding shall be subject to and governed by the laws of the Commonwealth of Pennsylvania.

D. This Memorandum of Understanding may not be amended except by writing executed by each of the Parties.



E. If any section of this Memorandum of Understanding or any part of any section of this Memorandum of Understanding shall be held unlawful, invalid, or unenforceable, that section or part shall be deemed deleted and without prejudice to the lawfulness, validity and enforceability of the remaining sections and parts of this Memorandum of Understanding.

F. This Memorandum of Understanding may be executed in several counterparts, each of which shall be deemed and original, and all such counterparts together constitute one and the same instrument.

G. Except as specifically provided herein, any and all disputes shall be subject to the jurisdiction of the Court of Common Pleas of Allegheny County (subject to right of appeal), unless otherwise required by law.

IN WITNESS WHEREOF, the parties hereto have caused this Memorandum of Understanding to be executed all as of the day and year first above written.

DORMONT BOROUGH ______________________________	**GREEN TREE BOROUGH** ______________________________
MUNICIPALITY OF MT. LEBANON ______________________________	**THE PITTSBURGH WATER AND SEWER AUTHORITY** ______________________________
SCOTT TOWNSHIP ______________________________	

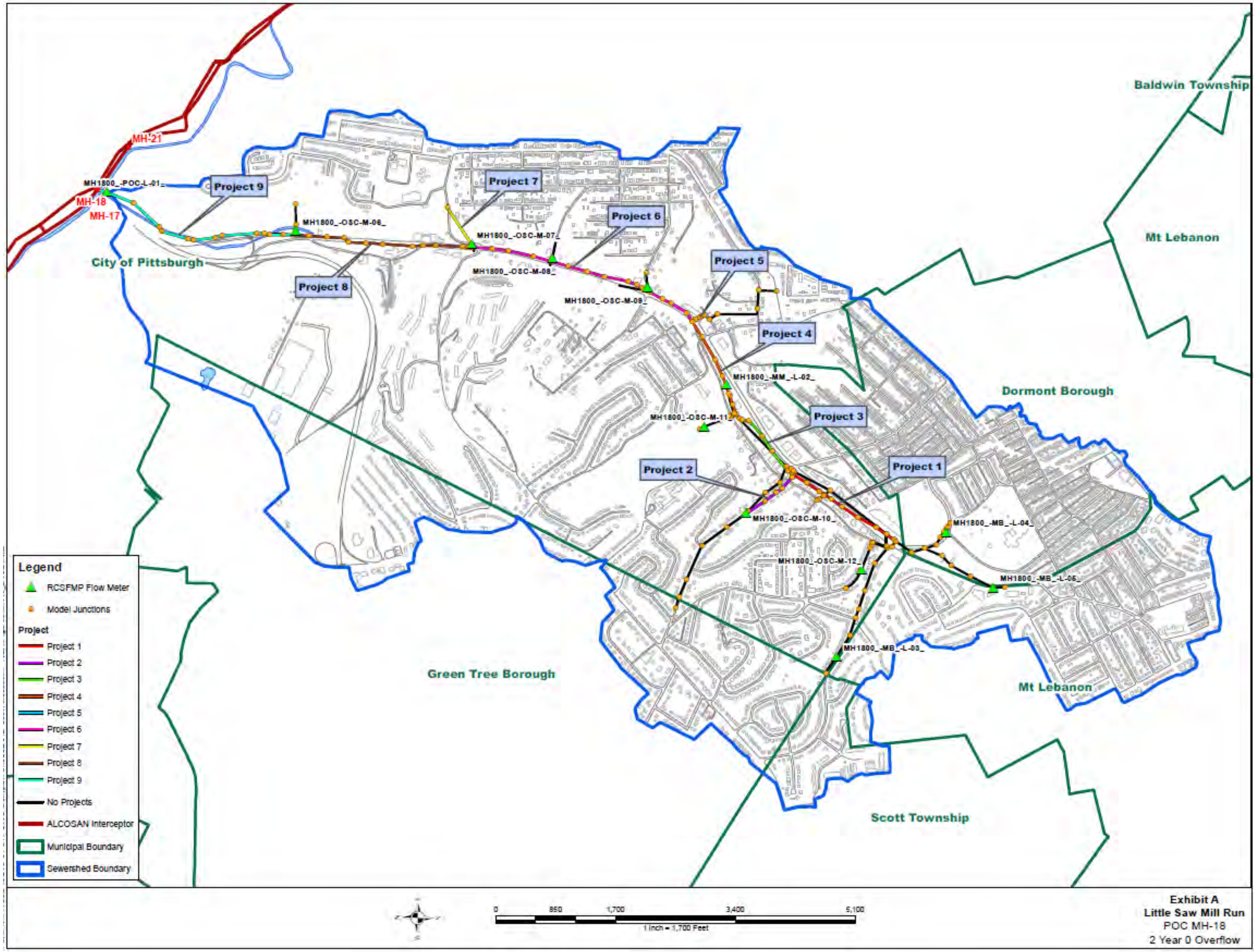


Exhibit A
Little Saw Mill Run
POC MH-18
2 Year 0 Overflow

7.0 STAKEHOLDER INVOLVEMENT

Stakeholder meetings titled POC Sewershed Coordination Meetings, facilitated by 3RWW, were held during the site and technology selection and alternative development processes. These meetings facilitated cooperation, information exchange and consensus building between the PWSA, its stakeholders and tributary municipalities essential to the development of the PWSA Feasibility Study Report and supporting POC-based feasibility studies. For the meetings listed in Table 7-1, POC MH-18 was the focus of the discussion and representatives from municipalities' tributary to the Little Saw Mill Run sewershed were in attendance. Meeting topics included source reduction and green infrastructure, alternatives analysis, affordability and implementation schedule, and cost allocation. Other stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

The Wet Weather Feasibility Study Coordination Meeting, led by the PWSA, facilitated stakeholder participation between the PWSA and Dormont Borough, Green Tree Borough, Municipality of Mt. Lebanon and Scott Township communities tributary to the Little Saw Mill Run watershed. The purpose of this meeting was to coordinate the development of planning information specific to the multi-municipal sewershed, reach a consensus agreement on the recommended improvements and receive authorization to submit the results.

TABLE 7-1: LITTLE SAW MILL RUN MH-18 POC MEETINGS

Title/Purpose	Date	Time	Location
WW Feasibility Study Coordination	4/10/12	2:15 PM	PWSA Office
POC Sewershed Coordination	2/27/13	2:00 PM	PWSA Office
POC Sewershed Coordination	3/19/13	2:00 PM	Green Tree Municipal Building

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
MH-55: TIMBERLAND STREET

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.
- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.
- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.
- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

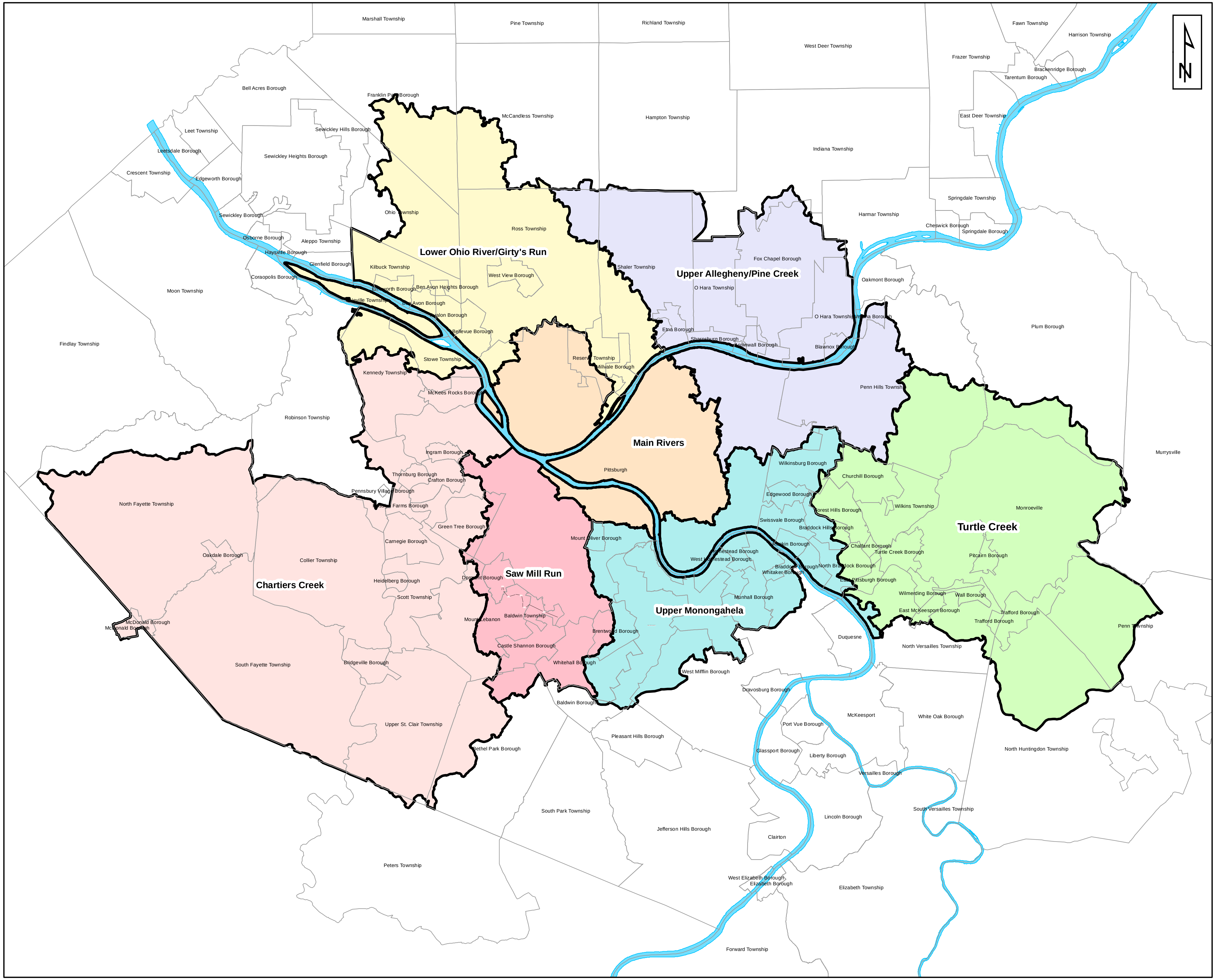
- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.
- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.
- Section 7.0 describes how stakeholders were included in the plan development.

1.2 EXISTING SYSTEM DESCRIPTION

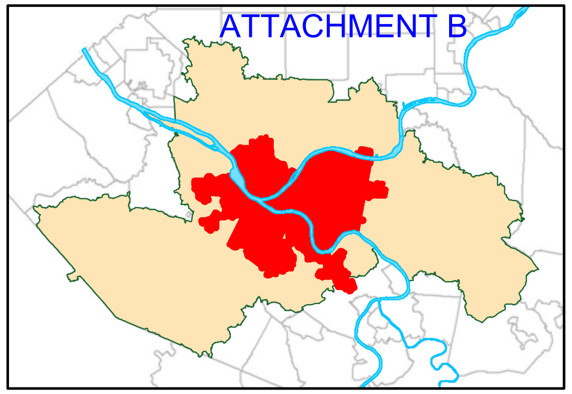
This POC FS Report addresses POC MH-55, also known as Timberland Avenue. The MH-55 sewershed is located in the Saw Mill Run Planning Basin. The Saw Mill Run basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: Miscellaneous Saw Mill Run Sewersheds Existing Facilities Map*. The MH-55 sewershed is served by one main trunk sewer that flows in a westerly direction from Moore Park to Timberland Avenue. The pipe then turns southeast and follows Timberland Avenue before connecting into the existing system at Overbrook Avenue, just west of Saw Mill Run Boulevard. The trunk sewer ranges in size from 8-in to 18-in in diameter.

There is one PWSA CSO diversion chamber in the sewershed that overflows to Saw Mill Run at one permitted CSO. The MH-55 sewershed encompasses approximately 116 acres of the City of Pittsburgh. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to MH-55* for specific information on this POC.



ATTACHMENT B



ALCOSAN Service Area Overview

Legend

- ⬜ Municipal Boundary
- 🟥 Chartiers Creek
- 🟨 Lower Ohio River / Girty's Run
- 🟧 Main Rivers
- 🟥 Saw Mill Run
- 🟩 Turtle Creek
- 🟪 Upper Allegheny / Pine Creek
- 🟦 Upper Monongahela
- 🟦 River

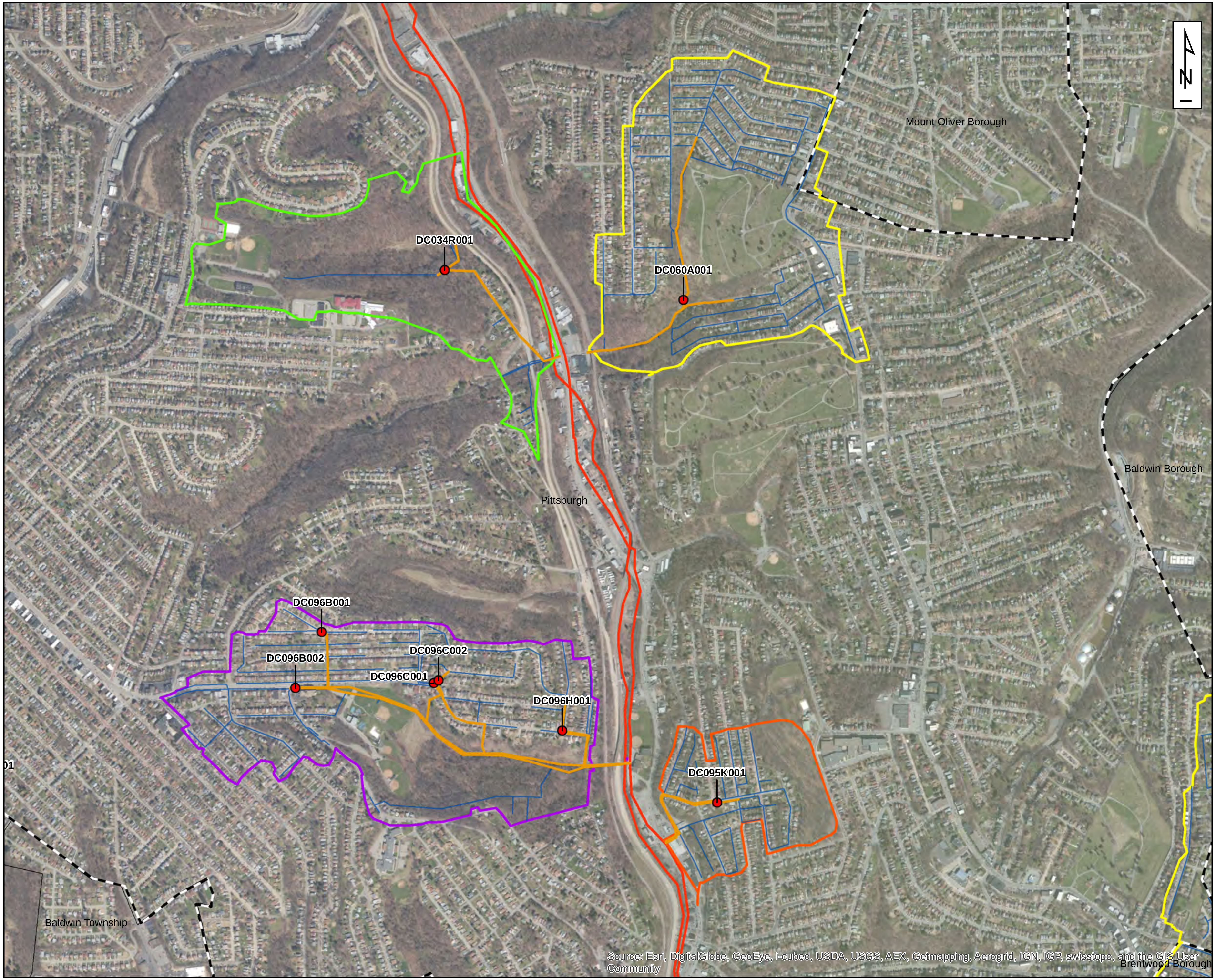
14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

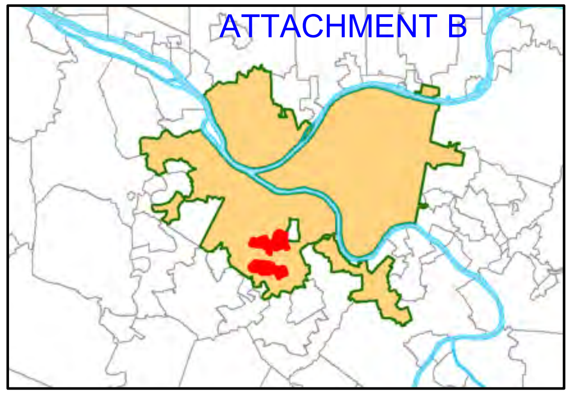
PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



ATTACHMENT B

PWSA Service Area Overview

Figure 1 - 2: MH-55, MH-77, MH-80 & S-23 Miscelaneous Sewersheds Existing Facilities

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 1-2_MiscExisting Overflows.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR AREA TRIBUTARY TO MH-55

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY
	City of Pittsburgh
Tributary Area (Acres)	117
Population	851
Combined	
Inch-Miles	
Linear Feet	
Inch-Miles/Acre	
Separate	
Inch-Miles	
Linear Feet	
Inch-Miles/Acre	

*Inch-Mile and Linear Feet data not available in 3RWW Municipal Data Support web-map.

Combined flows from the upstream PWSA diversion structure ties directly into the Saw Mill Run interceptor at MH55 with no overflow structure. The Saw Mill Run interceptor conveys those flows to ALCOSAN diversion structure O-14.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to MH-55*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO MH-55

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
034R001	DC034R001	CSO034R001	Timberland Avenue	Saw Mill Run

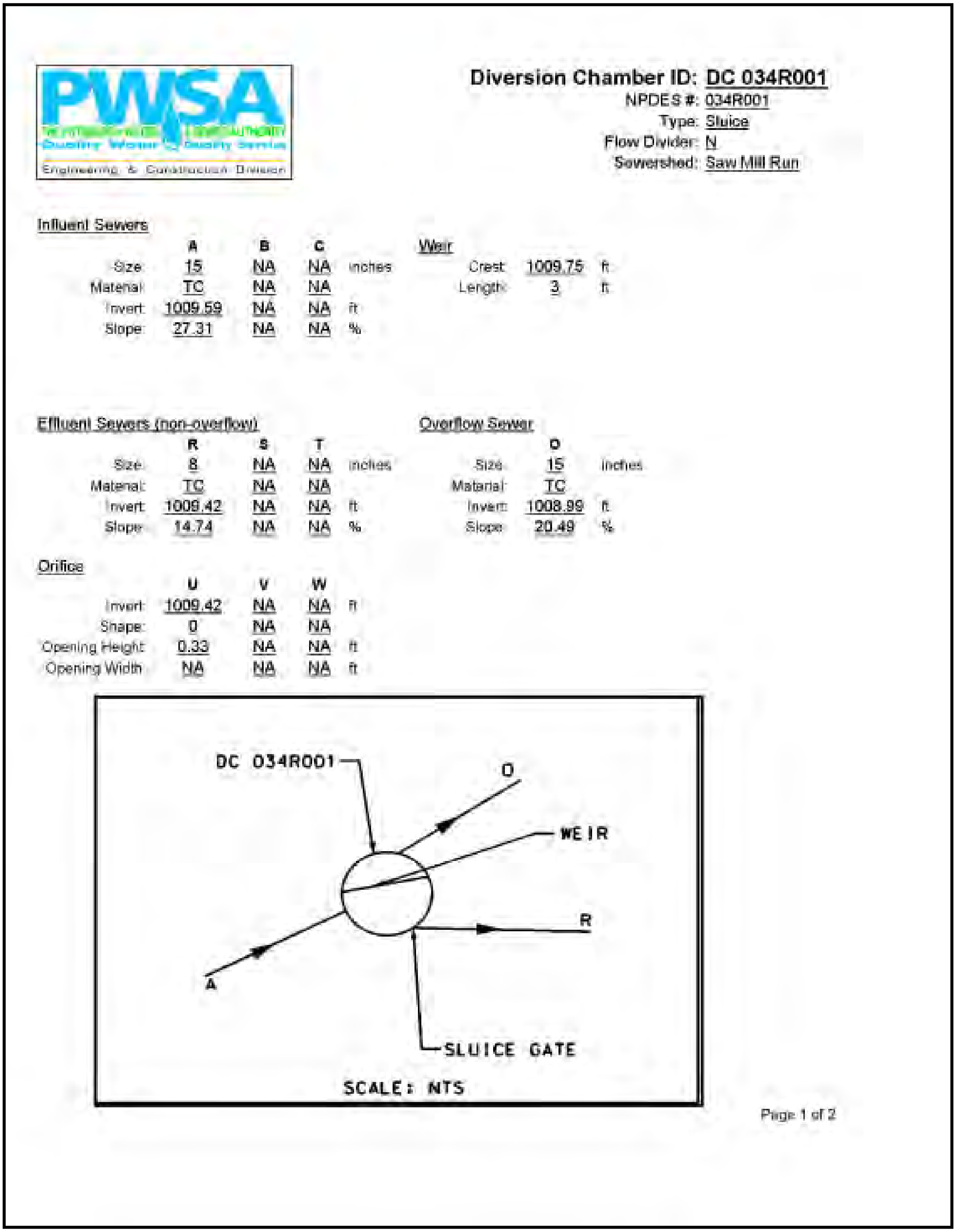
As shown in *Table 1-3: MH-55 Sewershed Typical Year Overflow Statistics*, during the typical year the single structure overflows 51 times. The largest overflow volume is 80,000 gallons per event and the total annual volume is 540,000 gallons.

TABLE 1-3: MH-55 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC034R001	51	0.94	0.38	0.27	0.08	0.04	0.01	0.54
							Total Annual Volume	**0.54**

1.2.1 Diversion Structure Sketches

The following sketches of the MH-55 diversion structure were taken from Appendix A.2 of the PWSA SICR, August 2008.



PWSA
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Quality Water & Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 034R001
NPDES #: 034R001
Type: Sluice
Flow Divider: N
Sewershed: Saw Mill Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1009.59	NA	NA	ft
Slope:	27.31	NA	NA	%

Weir

Crest:	1009.75	ft
Length:	3	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1009.42	NA	NA	ft
Slope:	14.74	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	1008.99	ft
Slope:	20.49	%

Orifice

	U	V	W	
Invert:	1009.42	NA	NA	ft
Shape:	0	NA	NA	
Opening Height:	0.33	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 034R001

Page 2 of 2

2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC MH-55: Timberland Street Sewershed through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Saw Mill Run Basin Planners (SMR_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for MH-55.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The

flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. No flow meters located in the MH-55 sewershed were used in the RCS-FMP. The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).

- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.

- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.

- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the MH-55 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the MH-55 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.

- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process to represent the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table MH55-2-1.

TABLE MH55-2-1: MH-55 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[1]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-55	0.11	0.12	8.3%

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event. RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for MH-55 are presented in Table MH55-2-2.

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[1] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.4

TABLE MH55-2-2: MH-55 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[2]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-55	3.5	3.5	0.0%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year, and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure MH55-2-1 present the computed hydraulic profiles of the existing MH-55 main trunk sewer system under projected 2-year design storm peak flow conditions. As is indicated in the figure, under the current system configuration, including existing CSO diversion chamber settings, no significant surcharging occurs.

Figure MH55-2-2 present the computed hydraulic profiles of the existing MH-55 main trunk sewer system under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, no significant surcharging occurs.

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[2] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.5

Figure MH55-2-3 present the computed hydraulic profiles of the existing MH-55 main trunk sewer system under projected 10-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, no significant surcharging occurs.

Computed flow hydrographs for each of the design storms at POC MH-55 are presented in Figure MH55-2-4.

FIGURE MH55-2-1: MH-55 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

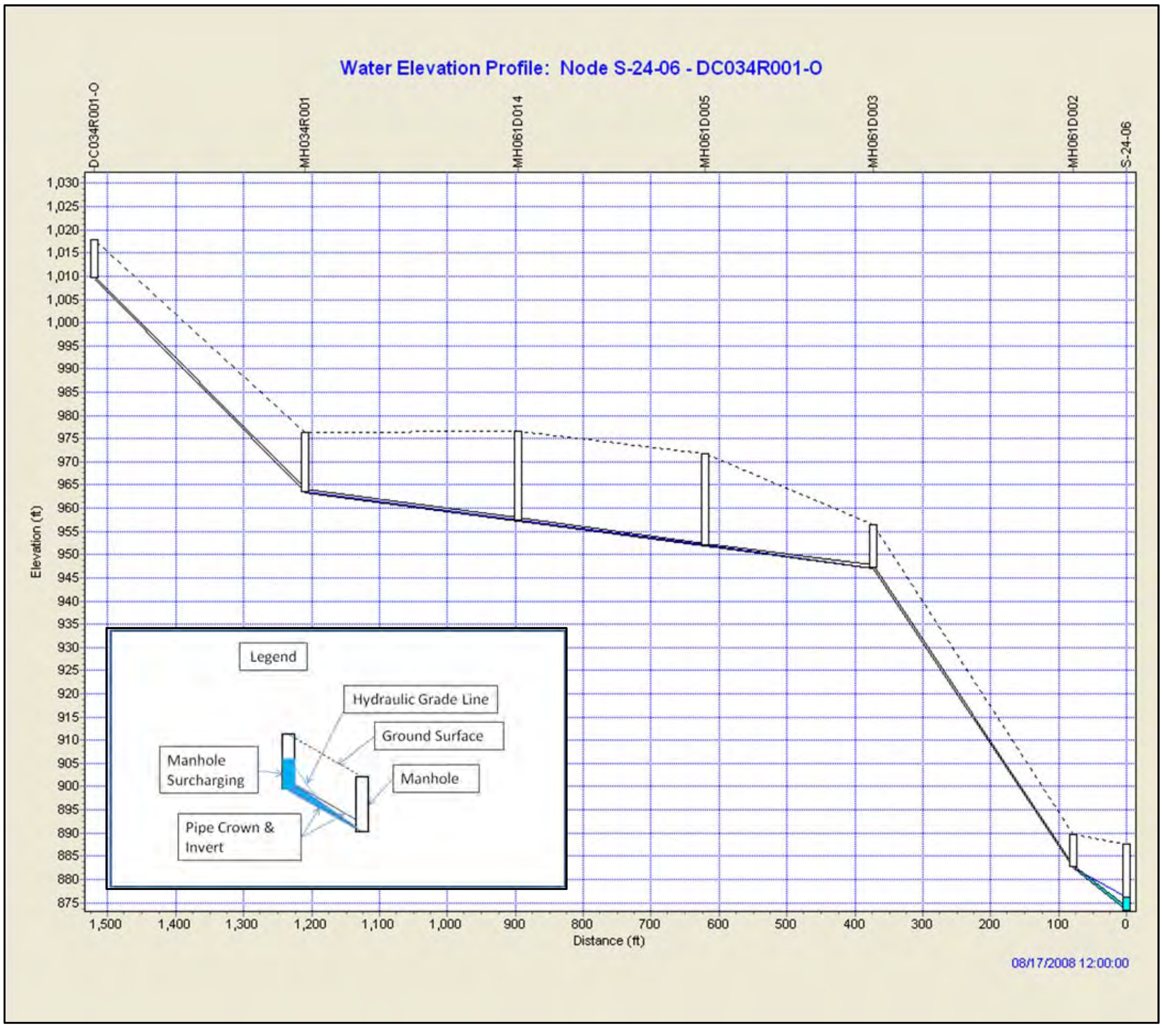


FIGURE MH55-2-2: MH-55 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

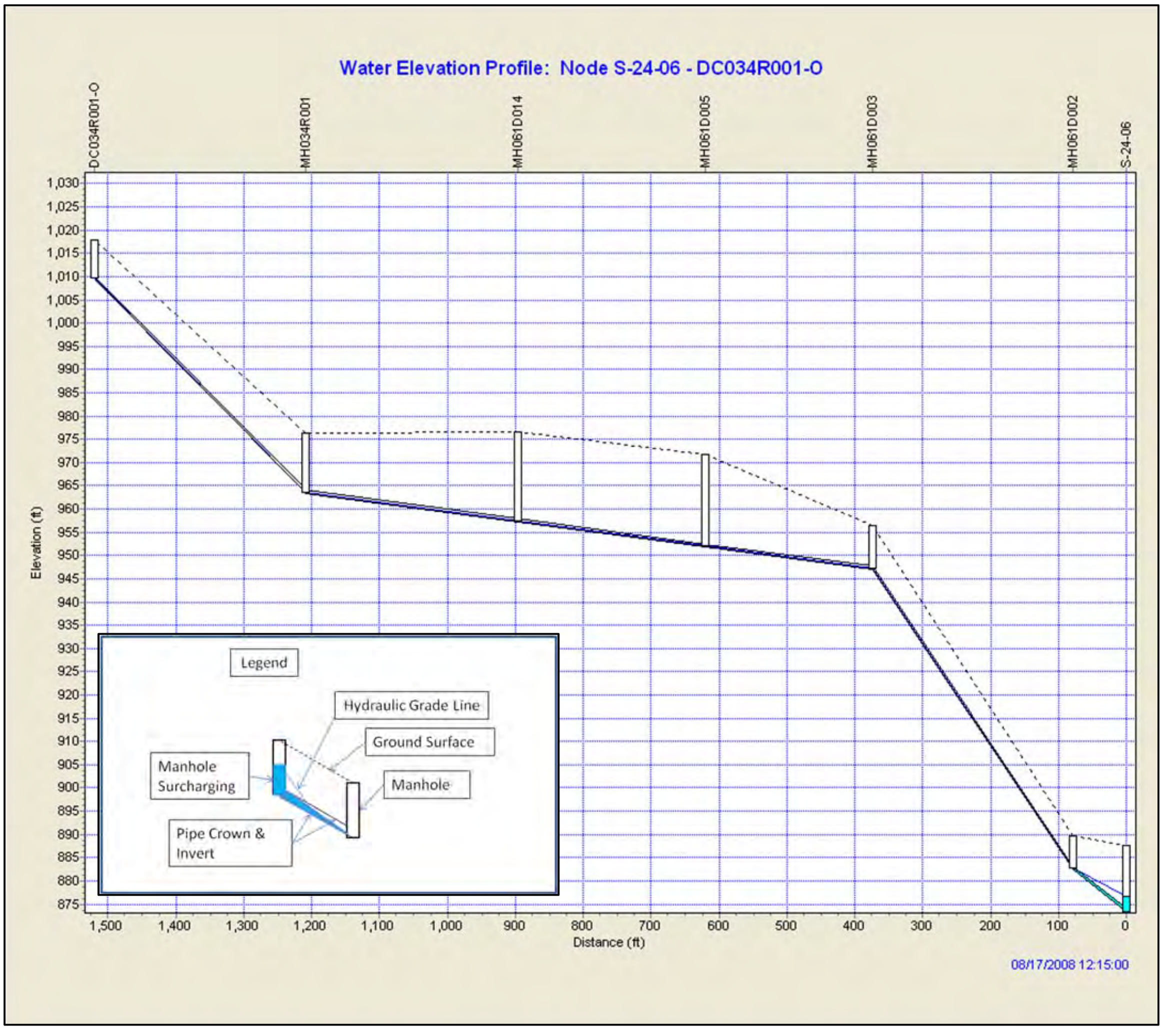


FIGURE MH55-2-3: MH-55 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

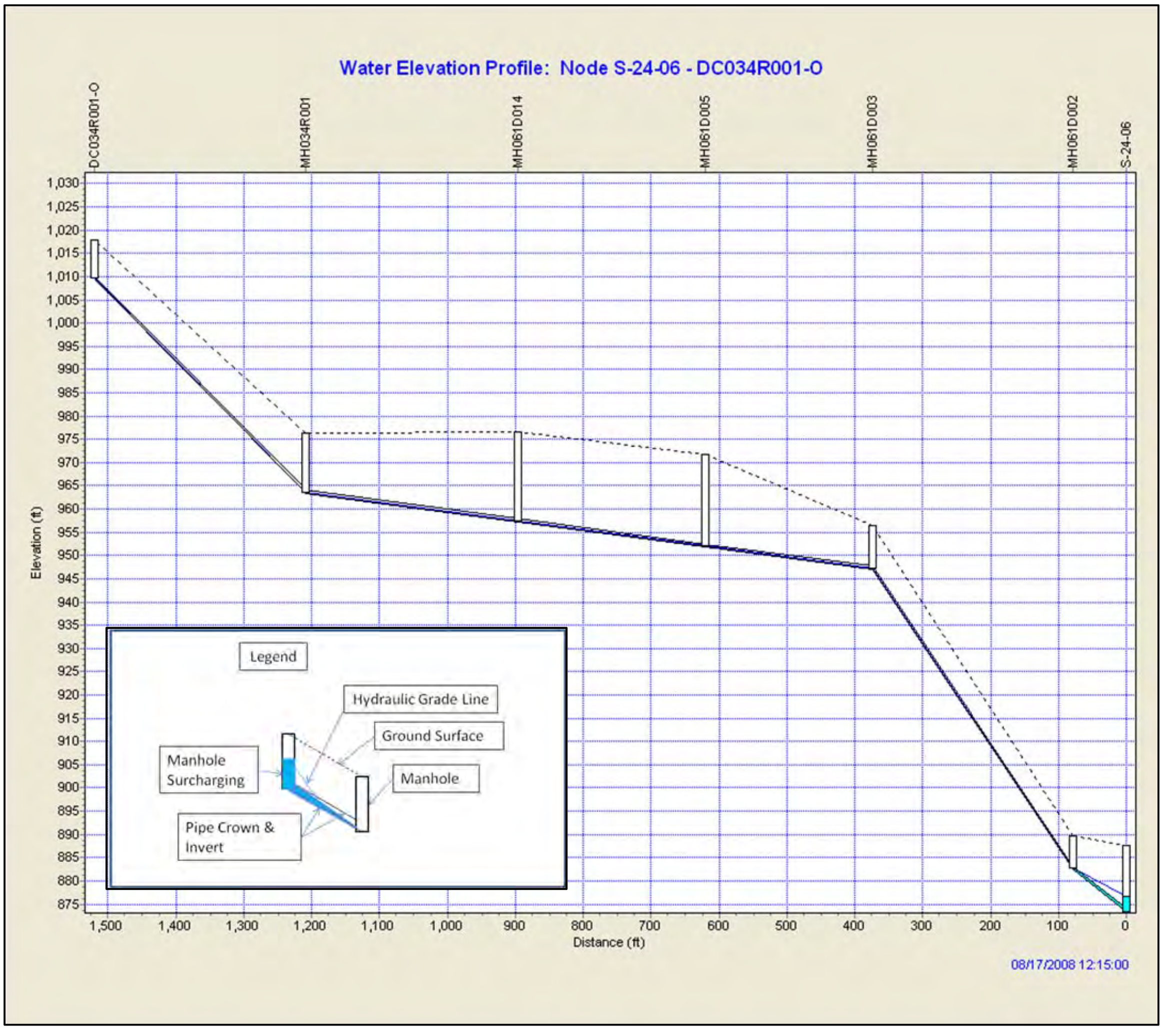
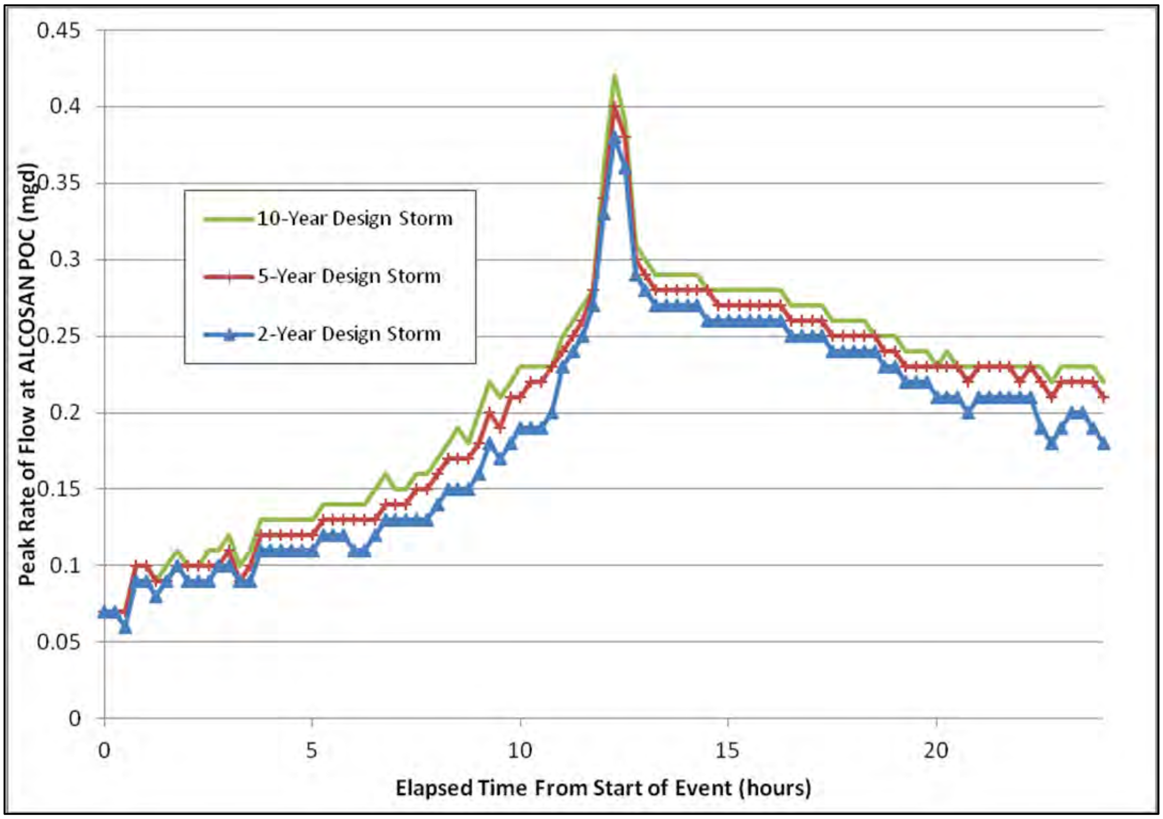


FIGURE MH55-2-4: MH-55 SEWERSHED PEAK FLOW RATES TO THE POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

PWSA investigated but did not locate any chronic basement flooding locations within the PWSA portion of the MH-55 sewershed. The neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. The results are based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the MH-55 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures MH55-2-5 and MH55-2-6. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figures show that under this range of operating conditions, the existing trunk sewer systems does not exhibit surcharging while conveying the required flows to the ALCOSAN point of connection.

FIGURE MH55-2-5: MH-55 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

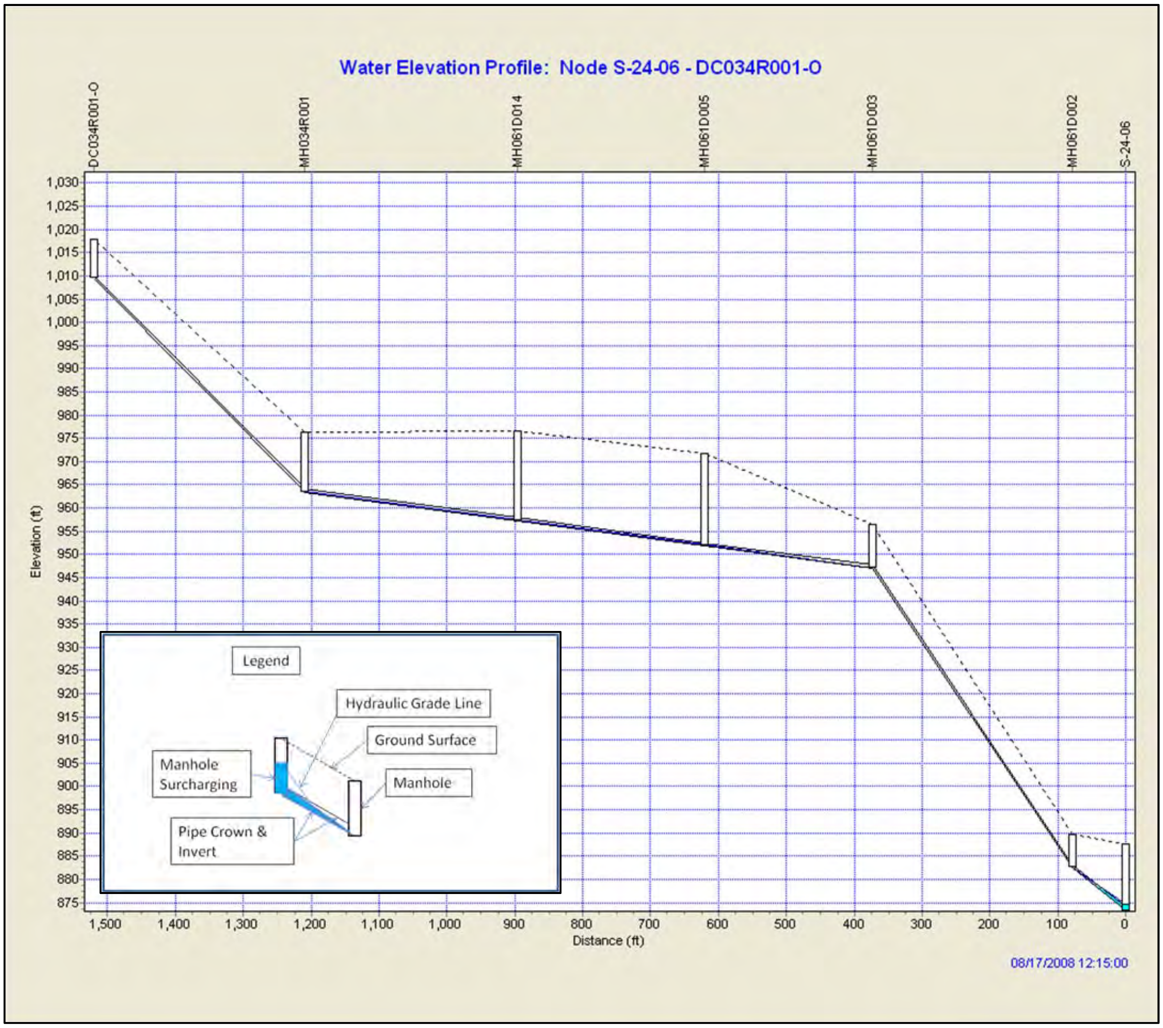
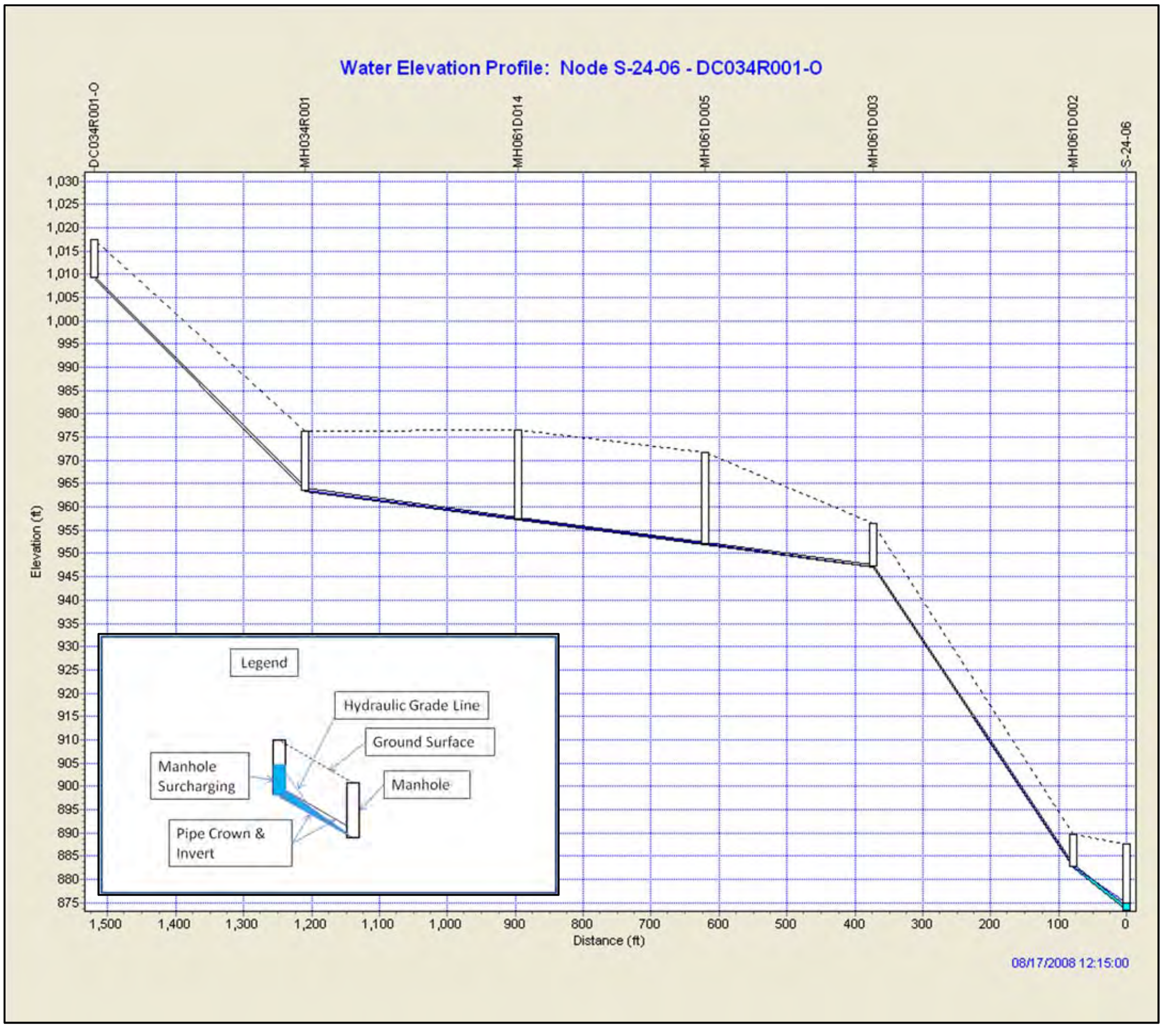


FIGURE MH55-2-6: MH-55 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the MH-55 sewer system performed by PWSA produced the following computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table MH55-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the MH-55: Timberland Street sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. One (1) of these outfalls is found within the MH-55: Timberland Street Sewershed, as shown in Table S15-3-1.

TABLE MH55-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE MH-55: TIMBERLAND STREET SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF034R001	SMR	MH-55	Saw Mill Run	WWF[1]	N	Y

As shown in the table, the one (1) PWSA owned outfall discharges into Saw Mill Run. This is classified as warm water fisheries (WWF) and currently do not meet their assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.

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[1] Warm Water Fishery

- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives.

This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream, including Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

The receiving water characterization field program resulted in certain findings within Saw Mill Run. In general, the DO concentrations for Saw Mill Run did not meet regulatory limits during wet weather which is likely related to CSO discharges during the storm events and/or wet weather discharges from upstream municipalities. Saw Mill Run also showed DO concentrations not meeting standards during dry weather indicating that CSO discharges are not likely causing the condition.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters, including Saw Mill Run and its tributaries within the PWSA limits, with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL. For Saw Mill Run, the concentration during the recreational season exceeded the 200 cfu/100mL limit in 100% of the samples and exceeded the 400 cfu/100mL limit in 80% of the samples.

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

Saw Mill Run has an in-stream target concentration of 0.035 mg/L for total phosphorus (TP) which was exceeded by 75% of the samples. TP appears to be a concern throughout Saw Mill Run, with CSO discharges being a potentially significant source in wet weather.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal Coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS. However for Saw Mill Run, it is judged that a higher level of control is needed due to the need to reduce phosphorus levels (see next section).

3.2.2 Saw Mill Run TMDL Report

A TMDL report was completed for Saw Mill Run and its tributaries which showed phosphorus TMDL results are shown below in Table MH55-3-2.

TABLE MH55-3-2: SAW MILL RUN PHOSPHORUS TMDL RESULTS

Total Phosphorus Load	CSO Load	SSO Load
Existing Load (Ib/Growing Season)	7,161.9	1,950.4
Allocated Load (Ib/ Growing Season)	177.5	0.0
Percent Reduction (%)	98%	100%

The implication of this is that substantial reductions of CSOs and complete elimination of SSOs is necessary for compliance. For CSOs, it is judged that a control level of 0 overflows per year will be required.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, such as Saw Mill Run, pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6

overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs.   At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the MH-55 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated   providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the MH-55 sewershed, Table MH55-3-3 lists the untreated CSO statistics that were computed for each control level.

TABLE MH55-3-3: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE MH-55 SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC034R001	closed	0	closed	0	closed	0

As will be described later in this report, the MH-55 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year and 10-year return frequency events).

Since Saw Mill Run has a TMDL which requires a high level of Phosphorous removal (98%), a higher CSO control level will be required. While 10, 4 and 0 OF/yr are analyzed, it is judged that 0 OF/yr will be necessary for compliance.

A range of design storms (2-yr, 5-yr, and 10-yr) were evaluated for transport of flows. PWSA plans to use the 2-yr storm which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

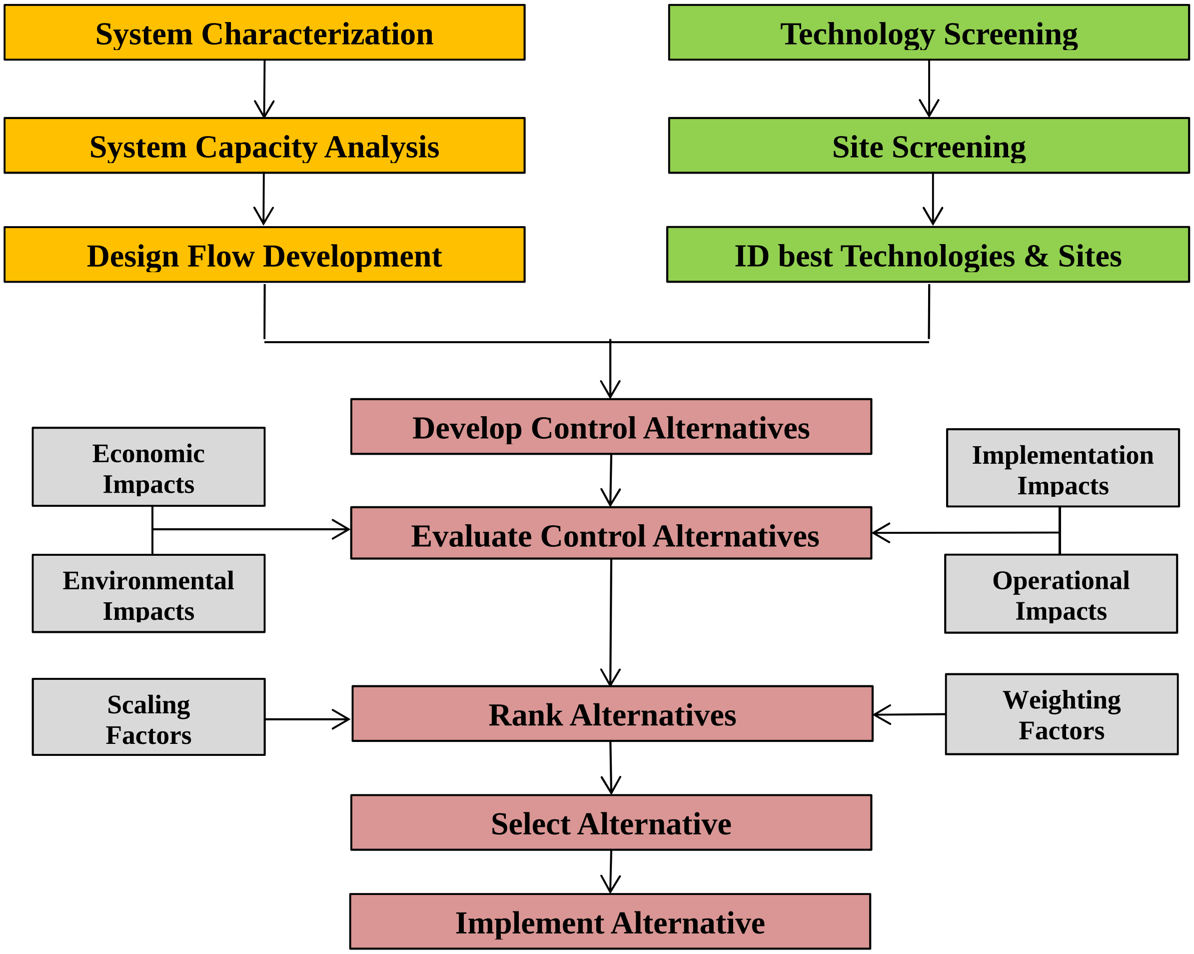
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure MH55-4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE MH55-4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered "feasible" for use in the MH-55 sewershed are shown below in Table MH55-4-1.

TABLE MH55-4-1: MH-55 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered “feasible” if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies were identified for the MH-55 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table MH55-4-2.

There are no other municipalities tributary to the MH-55 sewershed.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning “Objective Scores” to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as the waterways.

TABLE MH55-4-2: MH-55 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 034R001	No activations during the typical year	No Control required
Regional Controls – MH-55 Controls		
None	NA	NA
Sub-system Controls - Saw Mill Run Controls		
Outfall 034R001	SMR-1a: Tunnel Storage[2]	A 2.8 mile long tunnel O-14 to the S-30 POC. The MH-55 CSOs will be controlled using the following outfall-specific and/or regional alternative(s): • 034R001 – Sewer Separation or Sub-Surface Storage
	SMR-1b: Tunnel Storage[2]	
	SMR-2a: Tunnel Storage[2]	A 5.7 mile long tunnel from O-14 to the MH-55 POC. The MH-55 CSOs will be controlled using the following outfall-specific and/or regional alternative(s): • 034R001 – Sewer Separation or Sub-Surface Storage
	SMR-2b: Tunnel Storage[2]	

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

Outfall 034R001: Outfall 034R001 did not activate the typical year, and no control alternatives were required.

4.2.2 Regional Control Alternatives

No regional control alternative includes the MH-55 sewershed.

4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Saw Mill Run sub-system. Table MH55-4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Saw Mill Run subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume

responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE MH55-4-3: SAW MILL RUN SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
SMR-1a	249.3	2.1	272.1
SMR-1b	253.3	1.9	274.0
SMR-2a	246.2	1.6	265.1
SMR-2b	251.8	1.5	269.0

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining "Objective Scores" relative to each evaluation criteria.
- Applying "scaling" and "weighting" factors.
- Determining "Weighted Objective Scores" relative to each evaluation criteria.
- Ranking each alternative based on the sum of its "Weighted Objective Scores".

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a

score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table MH55-4-4.

TABLE MH55-4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13

criteria were determined. The results of the workshop are presented in Table MH55-4-5.

TABLE MH55-4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. This was performed for the System-wide alternative evaluations since the MH-55 POC did not have any outfall specific or regional alternatives evaluated.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 034R001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This “no activation” outfall was not considered further in the alternatives analysis process.

4.4.2 Regional Control Alternatives

No regional control alternative includes MH-55.

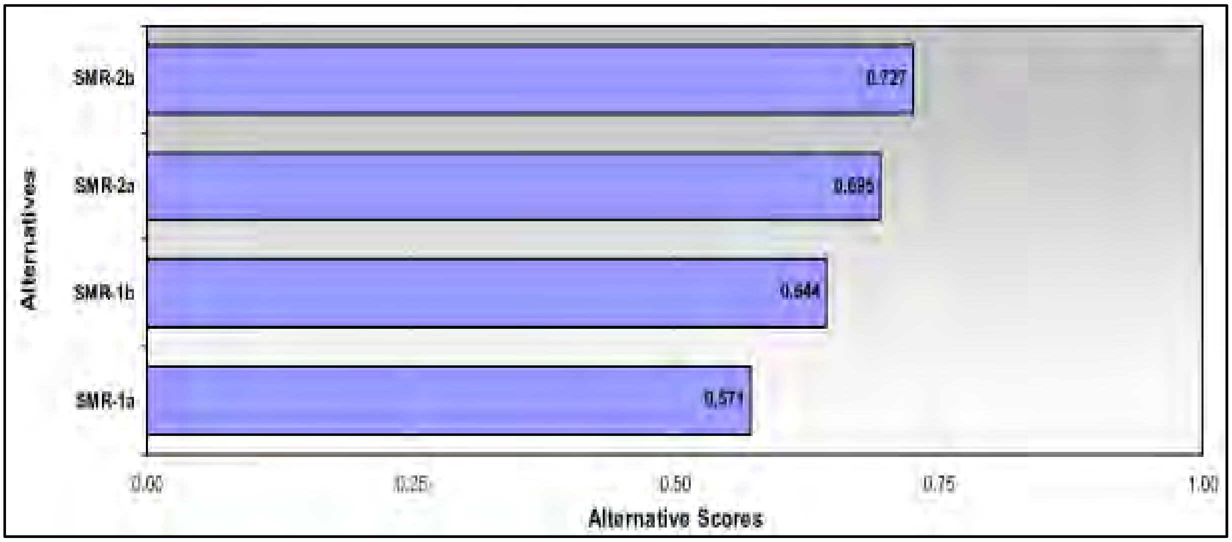
4.4.3 Sub-System Control Alternatives

Saw Mill Run. The results of the sub-system control alternative evaluation process are shown below in Figure MH55-4-2. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative SMR-2b: Tunnel Storage* be carried forward as the Saw Mill Run component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative SMR-2b: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative SMR-2b* included only those components required to deliver flows to the MH-55 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the MH-55 POC would become the responsibility of ALCOSAN.

FIGURE MH55-4-8: MH-55: ALTERNATIVE SCORING – SAW MILL RUN SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the MH-55 would best be accomplished by implementing *Alternative SMR-2b: Tunnel Storage*. Within the MH-55 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the PWSA permitted CSO to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the MH-55 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative SMR-2b* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-MH55-C-0*, *POC-MH55-C-4* and *POC-MH55-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **MH55 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.
- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the MH-55 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008)*, i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the MH-55 sewershed is zero untreated overflows per year. The recommended control alternative for the MH-55 Timberland Street sewershed has been designated as POC-MH55-S-0. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **MH55** The MH-55 POC sewershed is being serviced.
- **S** Sewer separation is the primary control technology.
- **0** The selected level of control is zero untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of zero (0) untreated overflows per year, the required piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-MH55-S-0 are summarized in Table MH55-5-1.

TABLE MH55-5-1: ALTERNATIVE POC-MH55-S-0 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
MH-55	DC034R001	034R001	S	0

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, stream removal projects that may be included, its integration with the ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-MH55-S-4 and/or POC-MH55-S-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

The July 2012 Feasibility Study included four smaller Saw Mill Run sewersheds together and referred to them as the "Miscellaneous Saw Mill Run Sewersheds." The other miscellaneous sewersheds being S-23 Brook Street, MH-77 Brookline Boulevard, and MH-80 Englert Street. As described in Section 4 of this POC report, the *PWSA Feasibility Study Report (October 2008)* determined that the optimal method of increasing the level of control of CSO overflows in the Brook Street, Brookline Boulevard and Englert Street sewersheds would be to adjust the diversion structure controls to reduce the amount of wet weather flows that are diverted from the system as necessary to achieve the target levels of control. However in the Timberland Street system, because there are so few storm water connections above the diversion chamber, it is recommended that the area be separated. To accomplish this, the PWSA municipalities must:

- Separate the system above the diversion chamber DC034R001.
- Close the existing diversion structure via sewer separation to achieve desired level(s) of control.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

Some of the other miscellaneous sewershed diversion structures produce fewer than the control level number of overflows during the typical year. In those cases, sewer separation would not be required and changes to the diversion chamber settings would not be made so as not to increase the current frequency of CSO discharges. The Timberland Street system is to be separated; therefore, the Timberland Street overflow from diversion DC034R001 will be eliminated as presented in Table MH55-5-2.

TABLE MH55-5-2: ALTERNATIVE POC-MH55-S-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC034R001	N/A	Closed	Closed	Closed

5.1.2 Consolidation Piping / Sewer Separation

The H&H model was employed to assess the ability of the existing trunk sewer system to convey the flows that will result from the system modifications.   The modeling was accomplished by modifying the model representation of the diversion structure to simulate sewer separation where indicated and to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

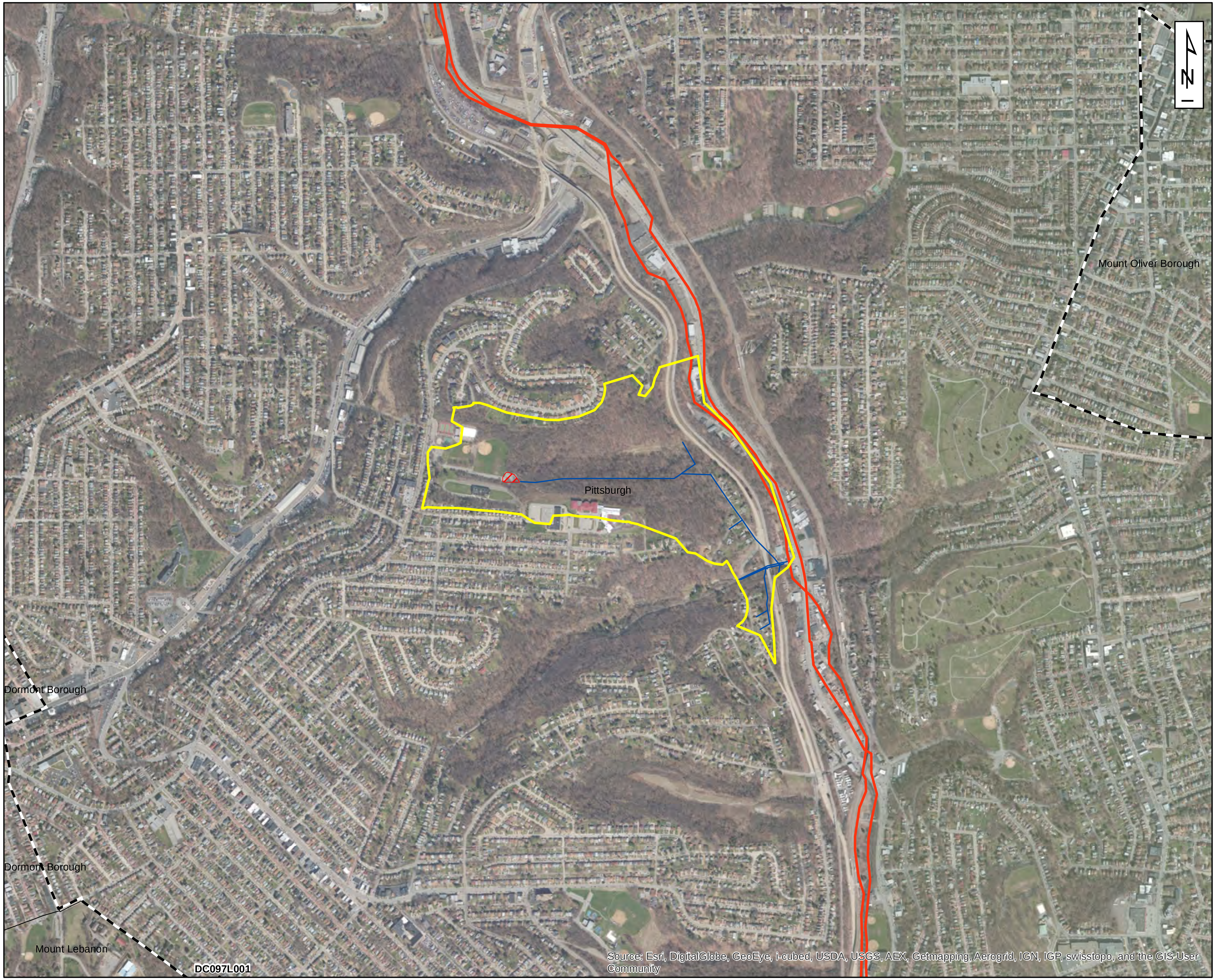
Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the nine conditions. Under this range of operating conditions, it was found that CSO controls levels will be attained in the Timberland Street system through sewer separation.

5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table MH55-5-3. There are no reported values in the table below, since the recommended modification for MH-55 is to close the diversion chamber,.

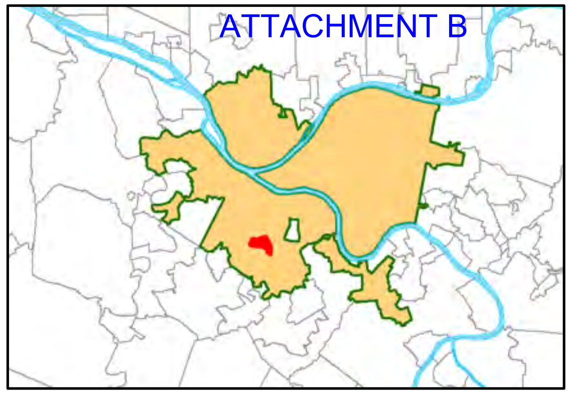
TABLE MH55-5-3: MH-55 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name					
	POC-MH55-S-0		POC-MH55-S-4		POC-MH55-S-10	
	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)
DC034R001	closed	0	closed	0	closed	0
Total Volume		0		0		0



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

- — Collector Sewer
- ▨ Sewer Separation
- ▭ MH-55 Sewershed Boundary
- ▭ PWSA Service Area Boundary
- ▭ Municipal Boundary
- ■ River

Existing ALCOSAN Interceptor

- ‑ ‑ ‑ Deep Tunnel
- — Shallow Cut

1,000 500 0 1,000 Feet

Figure MH55-5-1: POC-MH55-S-0 Sewer Separation

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 5-1_MH55.mxd

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The typical year peak flow rates to the MH-55 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-MH55-S-0, POC-MH55-S-4 and POC-MH55-S-10 are presented in Figure MH55-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the MH-55 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table MH55-5-4.

FIGURE MH55-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE MH-55 POC

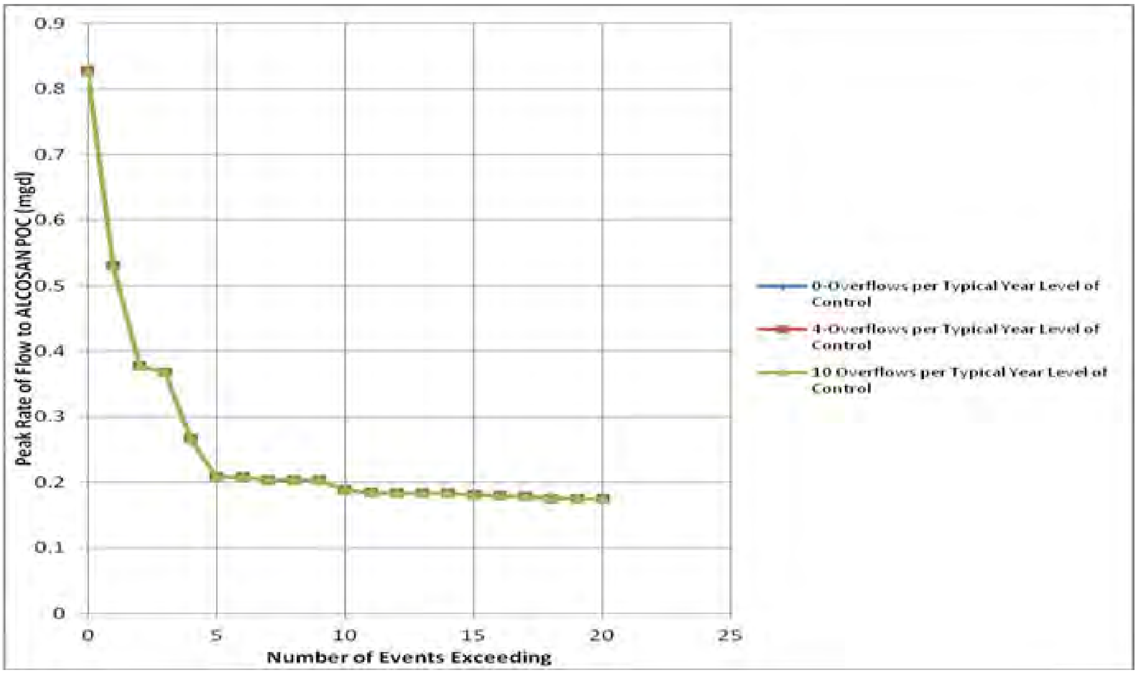


TABLE MH55-5-4: MH-55 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-MH55-S-0	0.2	0.3	0.3	0.1	0.1	0.1
POC-MH55-S-4	0.2	0.3	0.3	0.1	0.1	0.1
POC-MH55-S-10	0.2	0.3	0.3	0.1	0.1	0.1

5.1.5 Recommended Control Alternative Integration

The MH-55 collection system and MH-55 POC does not contain/convey any upstream flow from surrounding municipalities. As a result, integration is limited to PWSA and its downstream sewage treatment provider ALCOSAN which is explained further in Section 5.7 of this POC report.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

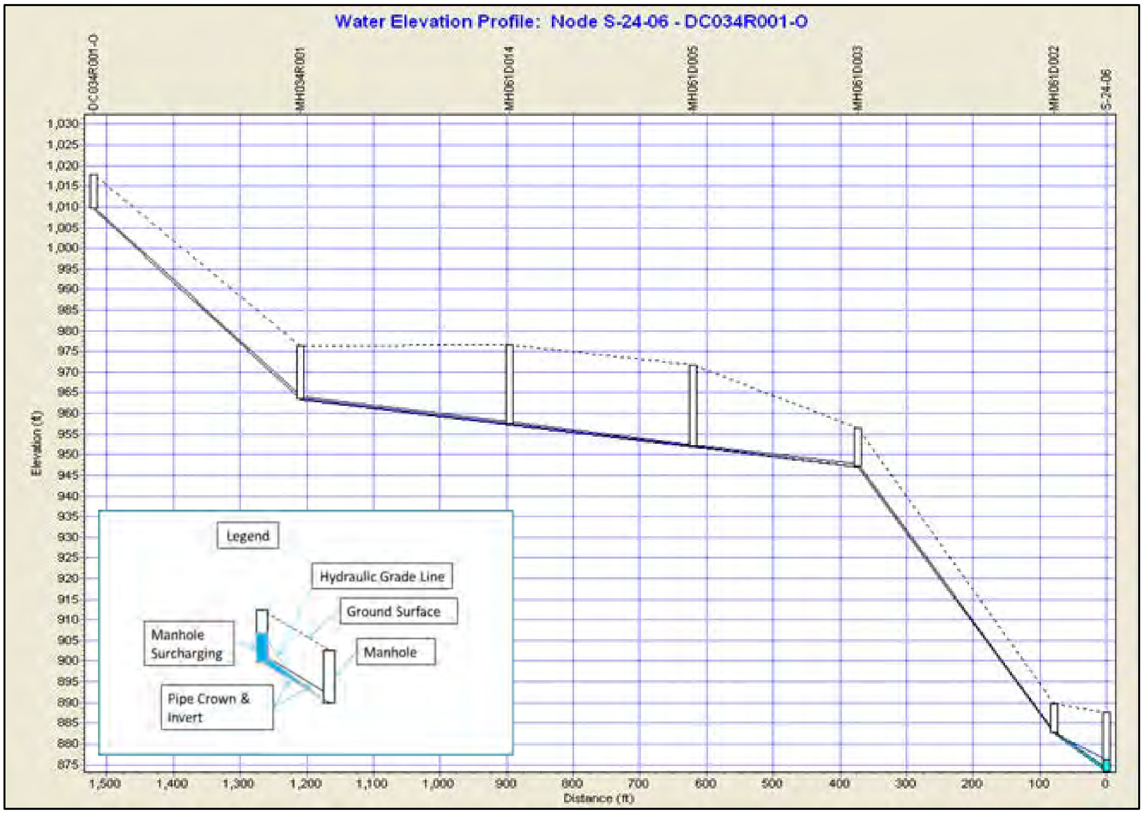
The following paragraphs discuss the hydraulic capacity characteristics of the MH-55 sewershed, both before and after implementation of the recommended alternative:

- Peak flow hydraulic grade line (HGL) of the trunk sewer
- 2046 peak flows and volumes to the MH-55 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figure 3 from that report presented a profile of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. This figure is reproduced below as Figure MH55-5-3.

FIGURE MH55-5-3: MH-55 MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure 3, under the current system configuration, including existing CSO diversion chamber settings, no significant surcharging occurs.

5.2.2 2046 Peak Flows and Volumes to MH-55 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known

municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would “Convey all Flows” to the PWSA system. ALCOSAN made similar assumptions[1], and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves sewer separation and closing of the existing diversion structure to achieve zero overflows per typical year. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the MH-55 sewershed.

The PWSA’s plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances from ALCOSAN WWP

ALCOSAN’s recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This contrasts with the PWSA’s water quality based decision to recommend a zero OF/yr level of control within the Saw Mill Run planning basin.

However, the control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA’s recommended alternative does not vary from ALCOSAN’s WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the MH-55 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

MH-55 is not a multi-municipal POC and therefore has no upstream tributary municipalities.

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves sewer separation and closing of the existing diversion structure to achieve zero overflows per typical year. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes sewer separation and closing of diversion structure DC034R001. At the MH-55 POC, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts in Saw Mill Run due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-MH55-S-0 are sewer main construction/ piping (sewer separation), and diversion structure modifications (closure). A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment MH55-5-1.

5.4.1 Consolidation Piping / Sewer Separation

In the MH-55 sewershed, because there are a very limited number of storm water connections to the Timberland Street system above the diversion chamber, it is recommended that this area be separated. CSO control levels will be attained in the Timberland Street system through sewer separation.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft

- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street
- Other values included in the cost – Trench excavations and backfill, rock excavation, trench wall support, street opening, clearing and grubbing, street restoration, flow maintenance, traffic maintenance

5.4.2 CSO Screening Facilities

As a result of the proposed alternative, sewer separation, diversion chamber DC034R001 will be closed. Therefore CSO screening facilities will not apply.

5.4.3 Diversion Structure Modifications

As a result of the proposed alternative, sewer separation, diversion chamber DC034R001 will be closed. Therefore traditional diversion structure modification costs will not apply.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure MH55-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible “knee of the curve” is evident from this data.

These costs are also presented in a tabular format in Table MH55-5-5.

The selected level of CSO control - 0 OF/yr - was determined based upon water quality considerations. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-MH55-S-0 are summarized in Table MH55-5-6. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE MH55-5-4: MH-55 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

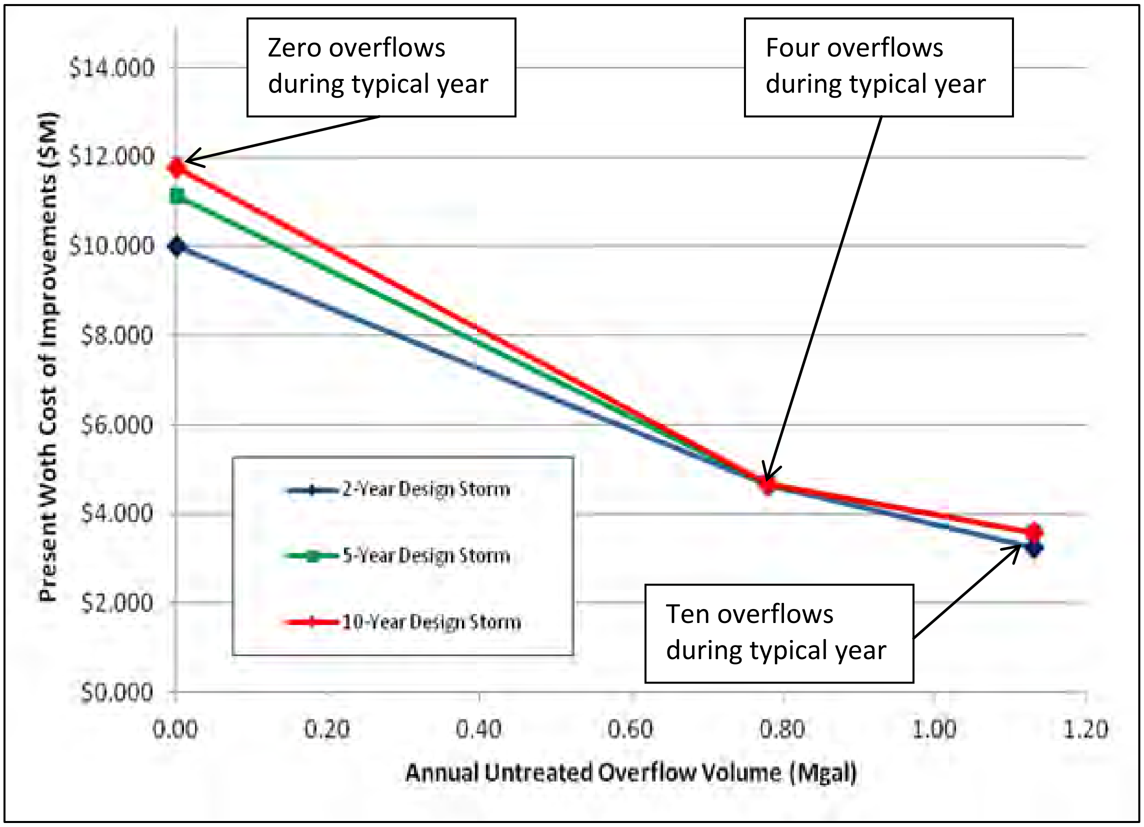


*Figure represents a combination of POCs S23, MH77, MH80 and MH55 curves.

TABLE MH55-5-5: MH-55 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control (DC034R001)				
	Untreated CSO Volume (MG)	CSO Control Level (OF/yr)	PW Capital Cost ($MM)	PW O&M Cost* ($MM)	TPW CSO Control ($MM)
POC-MH55-S-0	Closed	0	$0.14	$0.004	$0.14
POC-MH55-S-4	Closed	4	$0.14	$0.004	$0.14
POC-MH55-S-10	Closed	10	$0.14	$0.004	$0.14
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-MH55-S-0	0	2-year	$0	$0	$0
POC-MH55-S-4	0	2-year	$0	$0	$0
POC-MH55-S-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE MH55-5-6: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-MH55-S-0

Capital Improvements	Size/Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)
Sewer separation/ Close diversion structure: DC034R001	N/A	$0.14	$0.14

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

MH-55 is not a multi-municipal POC and therefore has no upstream tributary municipalities. As a result, an Inter-Municipal O&M Agreement is not required.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the MH-55 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the “Selected Plan” through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC MH-55 overflow is not intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the “Selected Plan” to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the “Recommended Plan”. This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the “Selected Plan” is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

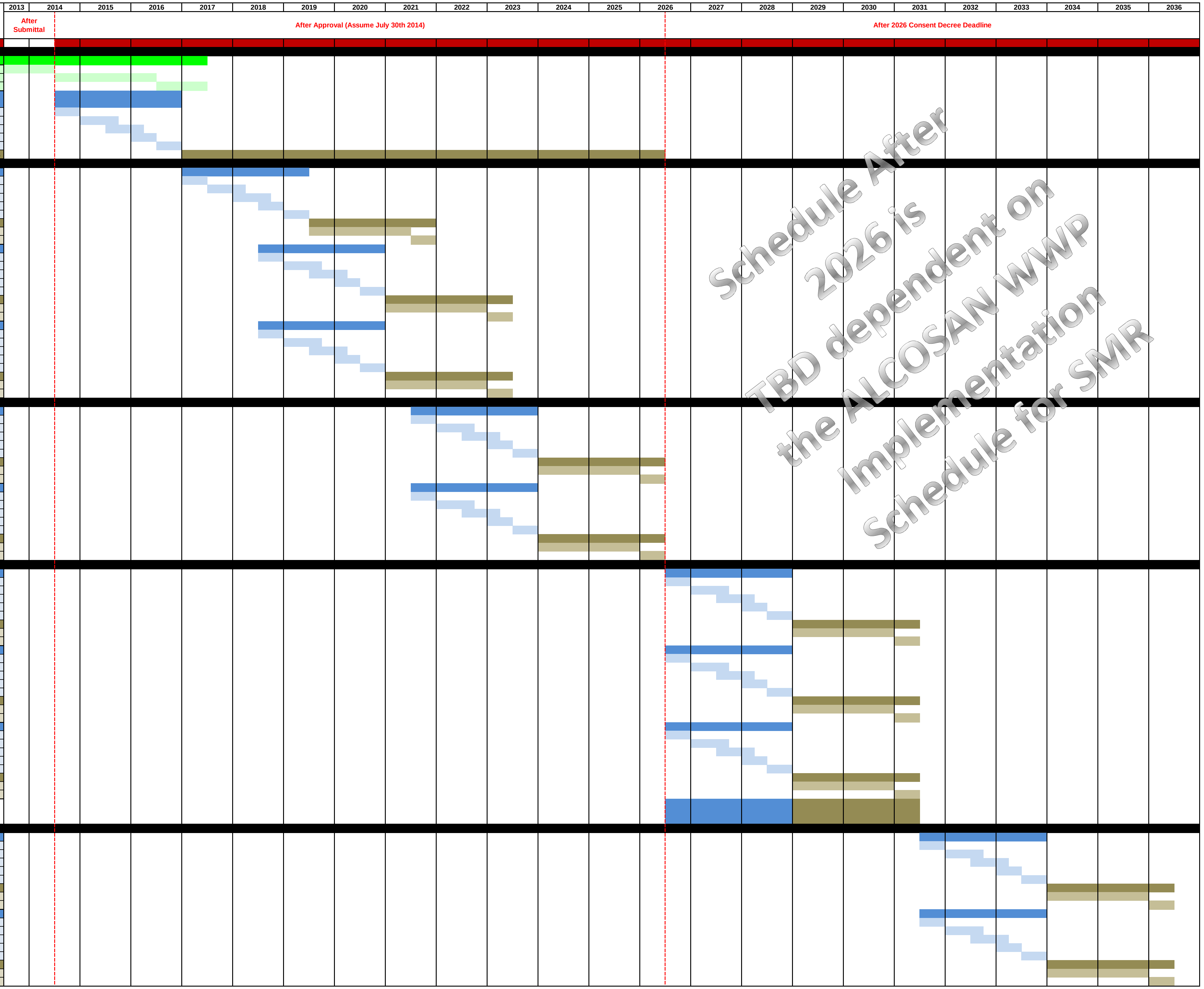
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it’s important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the SMR portion of the regional plan is not being implemented by 2026, and an implementation date is not specified in the plan. Therefore, an implementation schedule for MH-55 improvements cannot be specified at this time as it depends on the ALCOSAN WWP' SMR implementation schedule. The deadline shown in the schedule for MH-55, which is shown in Figure MH18-5-5, is for reference purposes only.

ATTACHMENT B

FIGURE MH55-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the MH-55 sewershed. The PWSA is the only stakeholder municipality/ authority in this sewershed. Therefore Inter-Municipal Agreements are not applicable. The considerations regarding the MH-55 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

There are no cost allocation needs for the improvements in this sewershed.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

There are no inter-municipal agreements needed for the improvements in this sewershed.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this subsection, PWSA provides the plan and schedule for implementing the recommended MH-55 system improvements and the plan to meet regulatory reporting obligations during and after MH-55 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

Phase I	2013 through 2017
Phase II	2017 through 2023
Phase III	2021 through 2026
Phase IV	TBD
Phase V	TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities

that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure MH55-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

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[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

6.3.2 Joint Municipal Planning and Implementation

There are no Joint Municipal Planning and Implementation needs for the improvements in this sewershed.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$135,000.
- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance
- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA collection systems that are not directly attributed to the recommended alternative.

For the purpose of submitting the Feasibility Study, inter-municipal agreements regarding O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative is not needed for the improvements in this sewershed.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table MH55-6-1. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE MH55-6-1: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure MH55-6-1.

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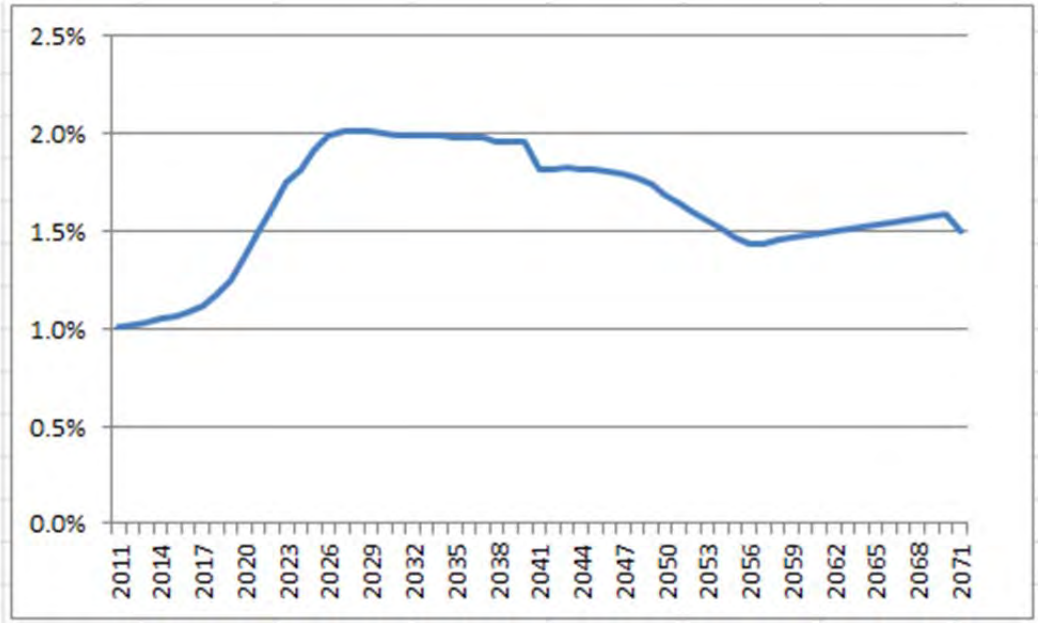
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

FIGURE MH55-6-1 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.

7.0 STAKEHOLDER INVOLVEMENT

For the purpose of developing the PWSA Feasibility Study and this POC-based feasibility study, the PWSA is the sole contributor of flow to the Timberland Avenue sewershed. Due to the absence of flow from neighboring municipalities, PWSA did not lead a Wet Weather Feasibility Study Coordination Meeting to facilitate stakeholder participation. Additionally, stakeholder meetings facilitated by 3RWW, titled POC Sewershed Coordination Meetings, were not held for POC MH-55. Other PWSA stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
MH-77: BROOKLINE BOULEVARD

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

ATTACHMENT B

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6.0 Financial and Institutional Considerations

7.0 Stakeholder Involvement

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically intertwined and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.

- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.

- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.

- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

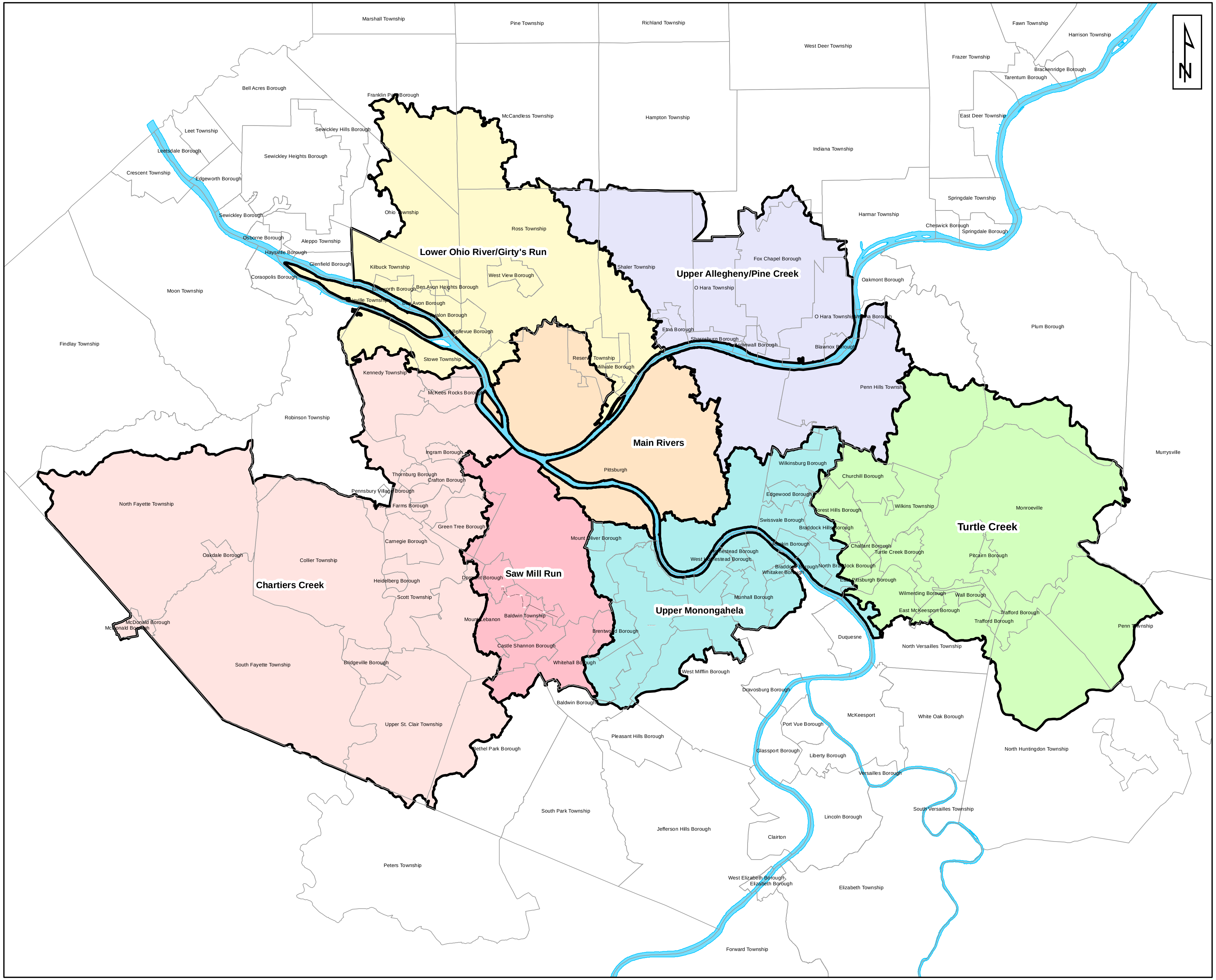
- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.
- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.
- Section 7.0 describes how stakeholders were included in the plan development.

1.2 EXISTING SYSTEM DESCRIPTION

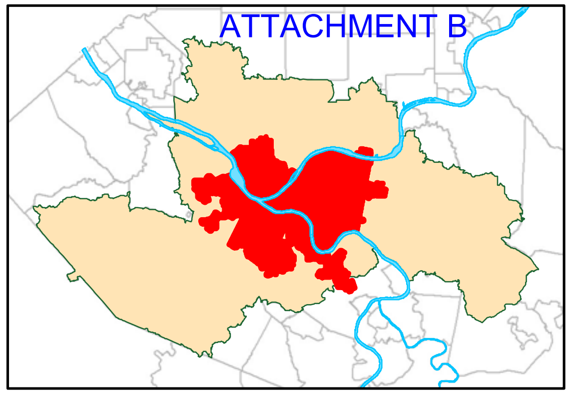
This POC FS Report addresses POC MH-77, also known as Brookline Boulevard. The MH-77 sewershed is located in the Saw Mill Run Planning Basin. The Saw Mill Run basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: Miscellaneous Saw Mill Run Sewersheds Existing Facilities Map*. The MH-77 sewershed is served by one main trunk sewer that connects to ALCOSAN's Saw Mill Run Interceptor at MH-77. Parallel pipes extend from the vicinity of MH-77 in a northwesterly direction adjacent to Brookline Boulevard. One of the parallel pipes receives regulated flow from the PWSA diversion chambers and the other receives excess flow from the PWSA diversion chambers. The effluent pipes range in size from 12 inches to 15 inches diameter and are comprised primarily of reinforced concrete. The overflow pipes range in size from 42 inches to 60 inches reinforced concrete pipe, which ultimately discharge into a private railroad culvert arch near MH-77.

There are five PWSA CSO diversion chambers in the sewershed that overflow to Saw Mill Run at one permitted CSO. The MH-77 sewershed encompasses approximately 196 acres of the City of Pittsburgh. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to MH-77* for specific information on this POC.



ATTACHMENT B



ALCOSAN Service Area Overview

Legend

☐	Municipal Boundary
▨	Chartiers Creek
▨	Lower Ohio River / Girty's Run
▨	Main Rivers
▨	Saw Mill Run
▨	Turtle Creek
▨	Upper Allegheny / Pine Creek
▨	Upper Monongahela
▨	River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

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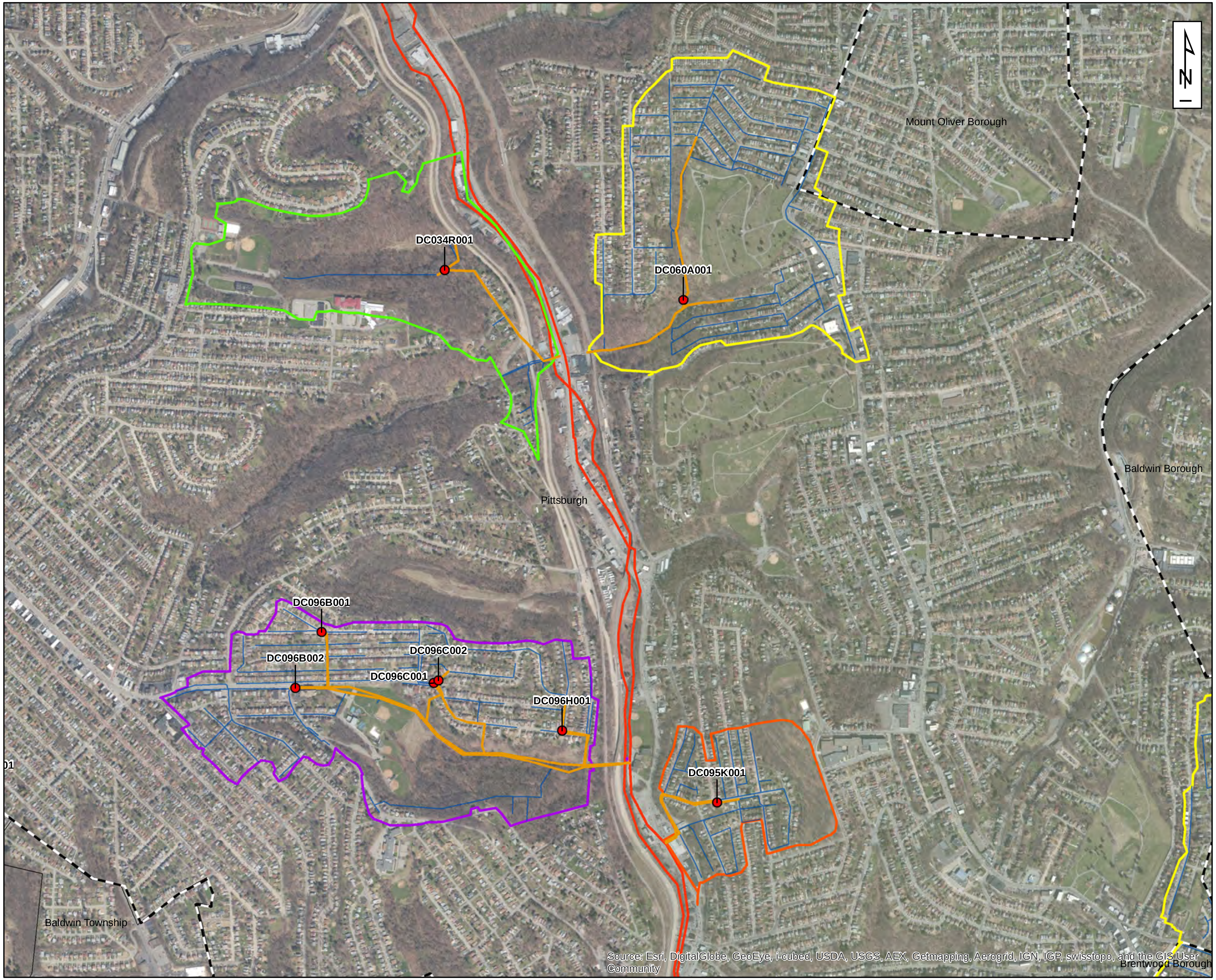
Quality Water Quality Service

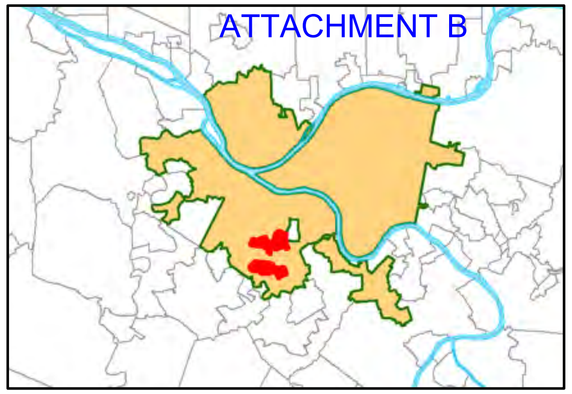
July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd

ATTACHMENT B



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



PWSA Service Area Overview

Legend

- ● PWSA CSO Diversion Structure
- Trunk Sewer
- Collector Sewer
- 🟩 MH-55 Sewershed Boundary
- MH-77 Sewershed Boundary
- MH-80 Sewershed Boundary
- S-23 Sewershed Boundary
- PWSA Service Area Boundary
- ☐ Municipal Boundary
- River

Existing ALCOSAN Interceptor

- Deep Tunnel
- Shallow Cut

1,000 500 0 1,000 Feet

Figure 1 - 2: MH-55, MH-77, MH-80 & S-23 Miscelaneous Sewersheds Existing Facilities

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Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 1-2_MiscExisting Overflows.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR AREA TRIBUTARY TO MH-77

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY
	City of Pittsburgh
Tributary Area (Acres)	196
Population	1,333
Combined	
Inch-Miles	31.6
Linear Feet	13,036
Inch-Miles/Acre	0.16
Separate	
Inch-Miles	49.5
Linear Feet	28,174
Inch-Miles/Acre	0.25

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows from the upstream PWSA diversion structures tie directly into the Saw Mill Run interceptor at MH77 with no overflow structure. The Saw Mill Run interceptor conveys those flows to ALCOSAN diversion structure O-14.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to MH-77*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO MH-77

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
095E001	DC096B001 DC096B002 DC096C001 DC096C002 DC096H001	CSO095E001	Saw Mill Run Boulevard	Saw Mill Run

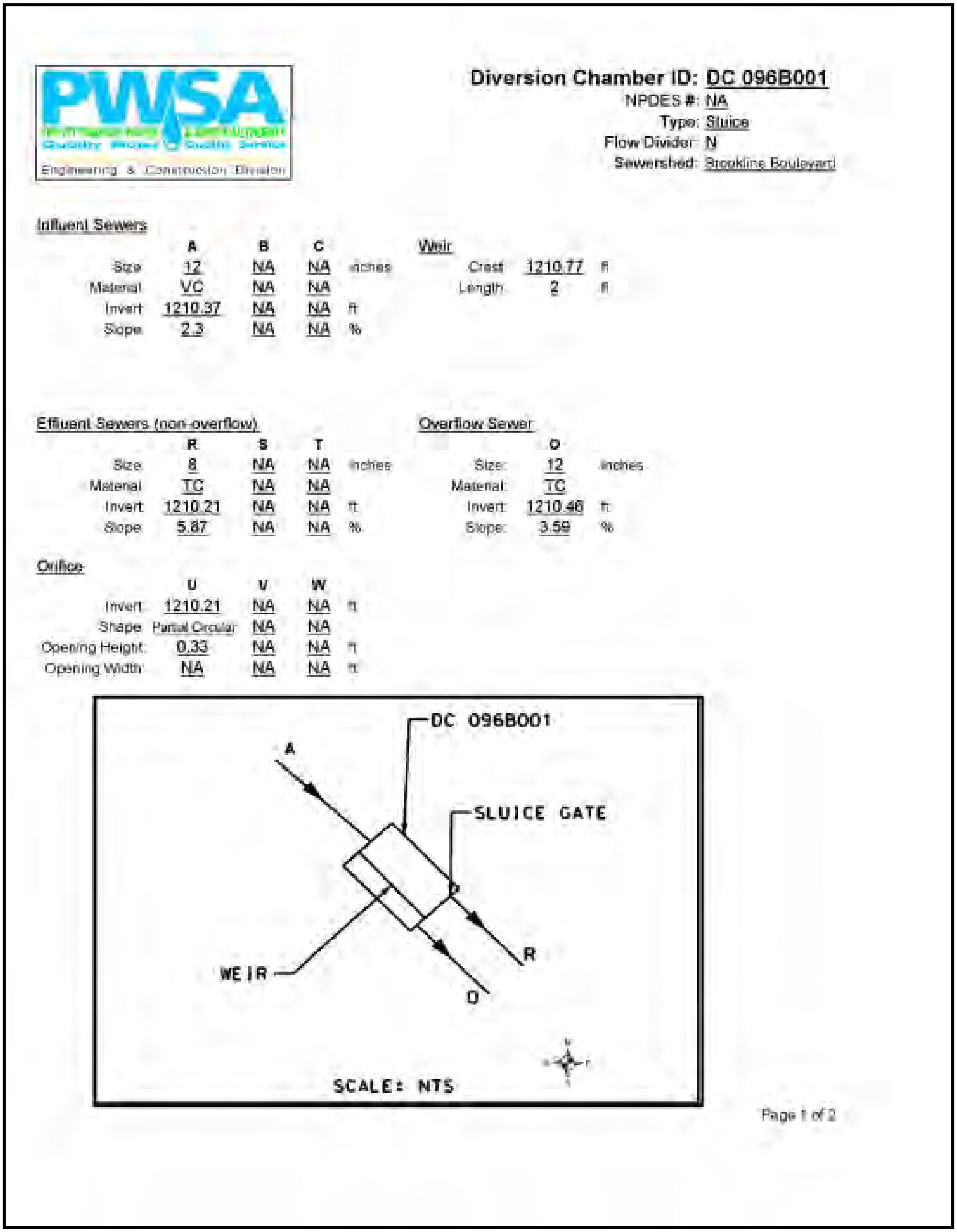
As shown in *Table 1-3: MH-77 Sewershed Typical Year Overflow Statistics*, during the typical year these five structures overflow between four and nine times. Overflow volumes range from 10,000 gallons to 60,000 gallons per event, and from 60,000 gallons to 590,000 gallons annually, on a structure by structure basis. Annual overflow volume for this sewershed is 770,000 gallons.

TABLE 1-3: MH-77 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC096B001	9	1.93	0.24	N/A	0.03	0.00	N/A	0.06
DC096B002	5	1.90	0.23	N/A	0.01	0.00	N/A	0.06
DC096C001	12	0.53	0.10	0.01	0.05	0.00	0.00	0.06
DC096C002	5	2.37	0.01	N/A	0.06	0.00	N/A	0.06
DC096H001	4	2.32	N/A	N/A	0.04	N/A	N/A	0.59
Total Annual Volume								**0.83**

1.2.1 Diversion Structure Sketches

The following sketches of the MH-77 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.



PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 096B001
NPDES #: NA
Type: Sluice
Flow Divider: N
Sewershed: Brookline Boulevard

Influent Sewers

	A	B	C	
Size	12	NA	NA	inches
Material	VC	NA	NA	
Invert	1210.37	NA	NA	ft
Slope	2.3	NA	NA	%

Weir

Crest	1210.77	ft
Length	2	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	TC	NA	NA	
Invert	1210.21	NA	NA	ft
Slope	5.87	NA	NA	%

Overflow Sewer

	O	
Size:	12	inches
Material:	TC	
Invert:	1210.46	ft
Slope:	3.59	%

Orifice

	U	V	W	
Invert	1210.21	NA	NA	ft
Shape	Partial Circular	NA	NA	
Opening Height:	0.33	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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THE PITTSBURGH WATER & SEWER AUTHORITY
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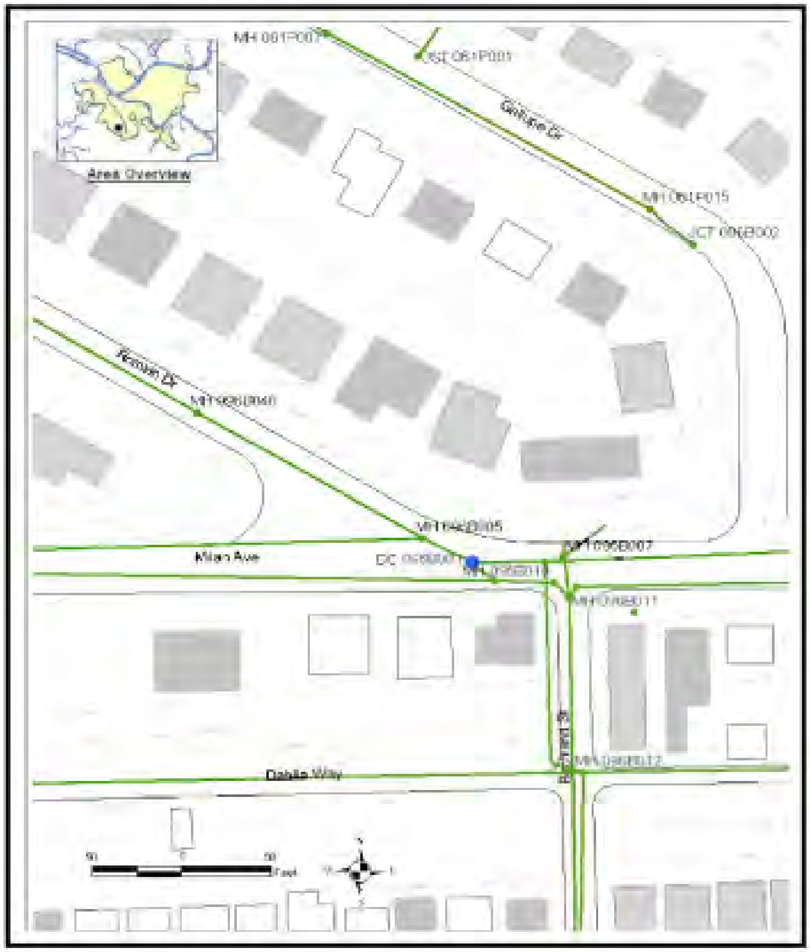
Engineering & Construction Division

Diversion Chamber ID: DC 096B001



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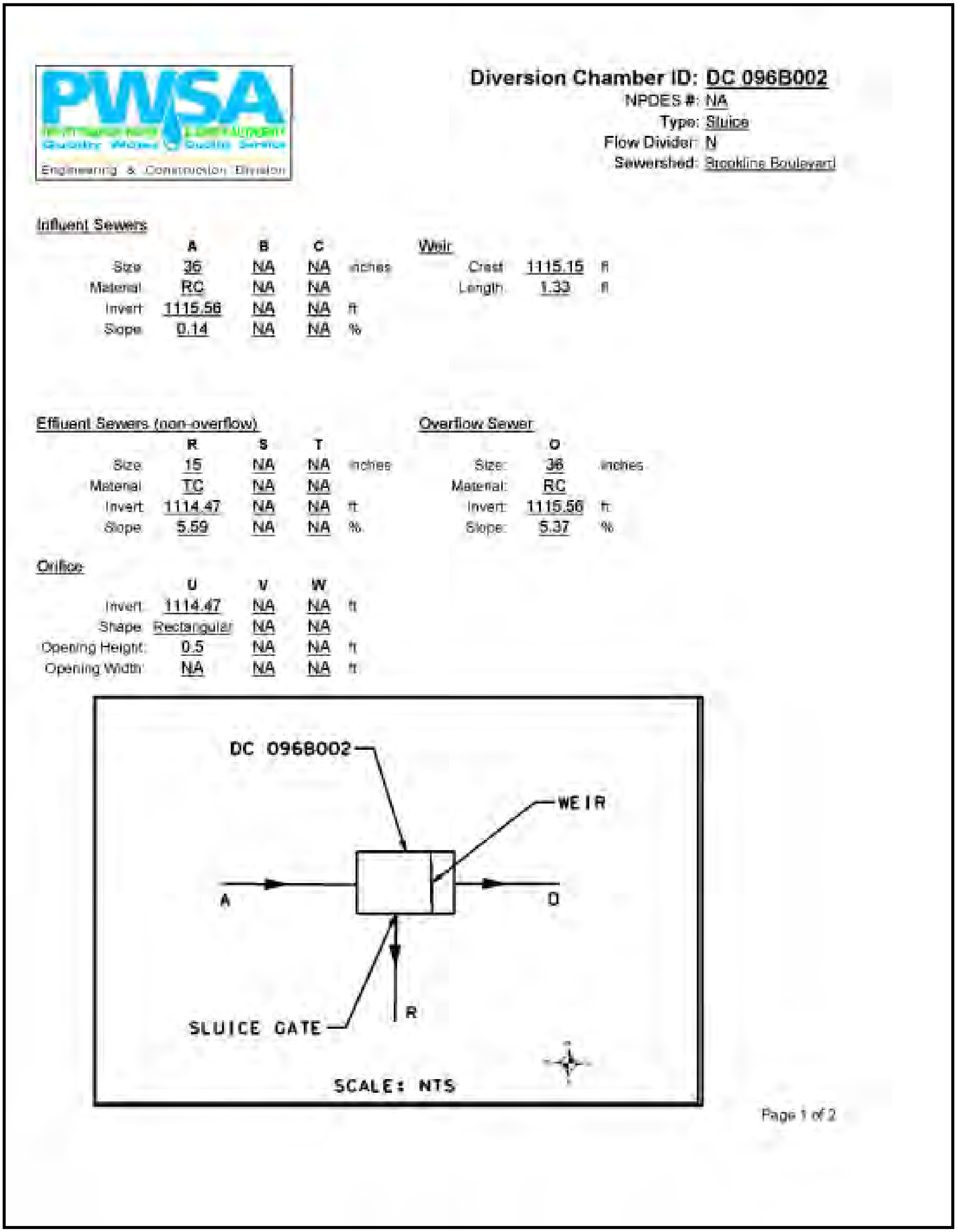

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 096B002
NPDES #: NA
Type: Sluice
Flow Divider: N
Sewershed: Brookline Boulevard

Influent Sewers

	A	B	C	
Size	36	NA	NA	inches
Material	RC	NA	NA	
Invert	1115.56	NA	NA	ft
Slope	0.14	NA	NA	%

Weir

Crest	1115.15	ft
Length	1.33	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	15	NA	NA	inches
Material	TC	NA	NA	
Invert	1114.47	NA	NA	ft
Slope	5.59	NA	NA	%

Overflow Sewer

	O	
Size	36	inches
Material	RC	
Invert	1115.56	ft
Slope	5.37	%

Orifice

	U	V	W	
Invert	1114.47	NA	NA	ft
Shape	Rectangular	NA	NA	
Opening Height	0.5	NA	NA	ft
Opening Width	NA	NA	NA	ft

Page 1 of 2

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 096B002

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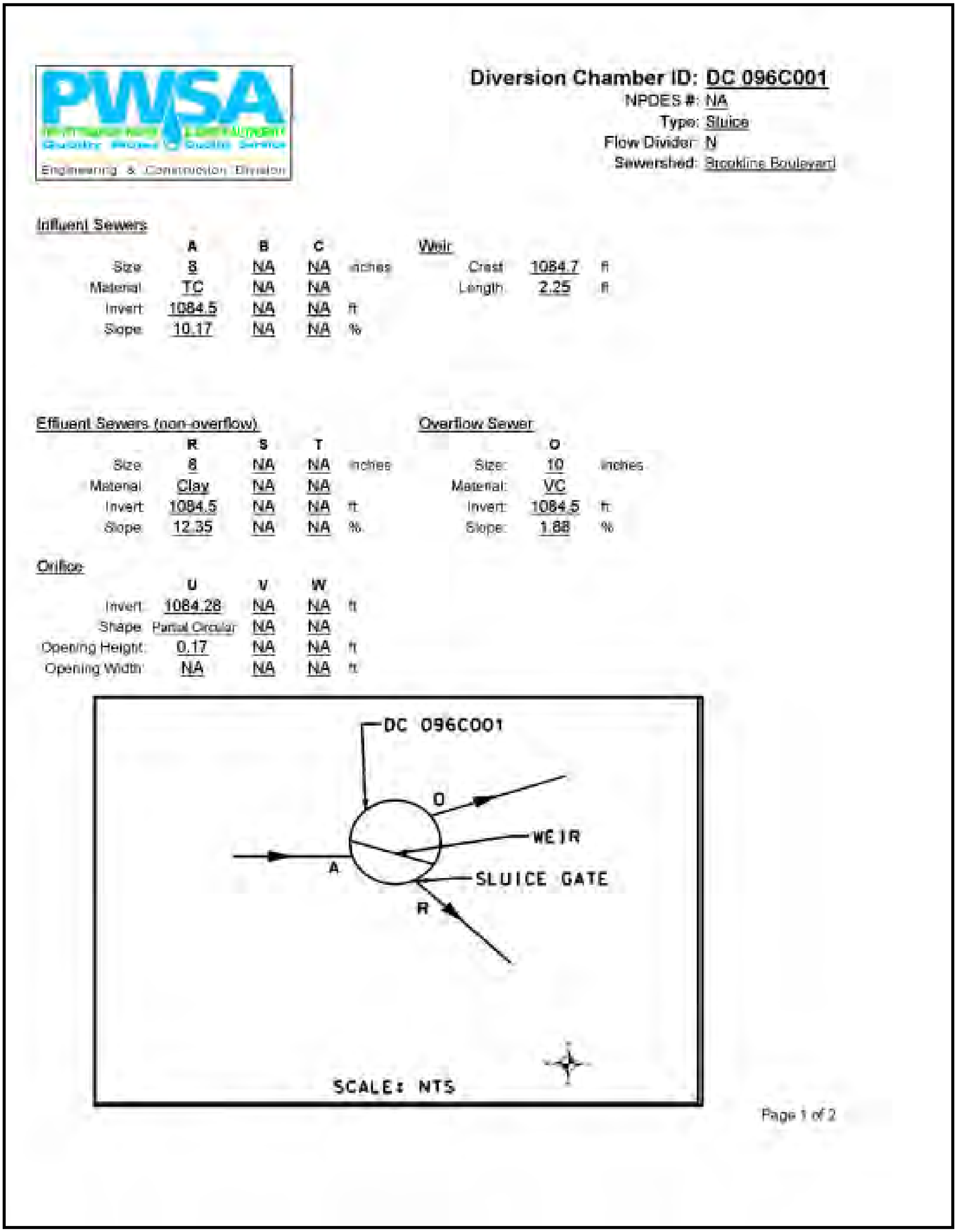

PWSA
PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 096C001
NPDES #: NA
Type: Sluice
Flow Divider: N
Sewershed: Brookline Boulevard

Influent Sewers

	A	B	C	
Size	8	NA	NA	inches
Material	TC	NA	NA	
Invert	1084.5	NA	NA	ft
Slope	10.17	NA	NA	%

Weir

Crest	1084.7	ft
Length	2.25	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	Clay	NA	NA	
Invert	1084.5	NA	NA	ft
Slope	12.35	NA	NA	%

Overflow Sewer

	O	
Size	10	inches
Material	VC	
Invert	1084.5	ft
Slope	1.88	%

Orifice

	U	V	W	
Invert	1084.28	NA	NA	ft
Shape	Partial Circular	NA	NA	
Opening Height	0.17	NA	NA	ft
Opening Width	NA	NA	NA	ft

Page 1 of 2

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 096C001

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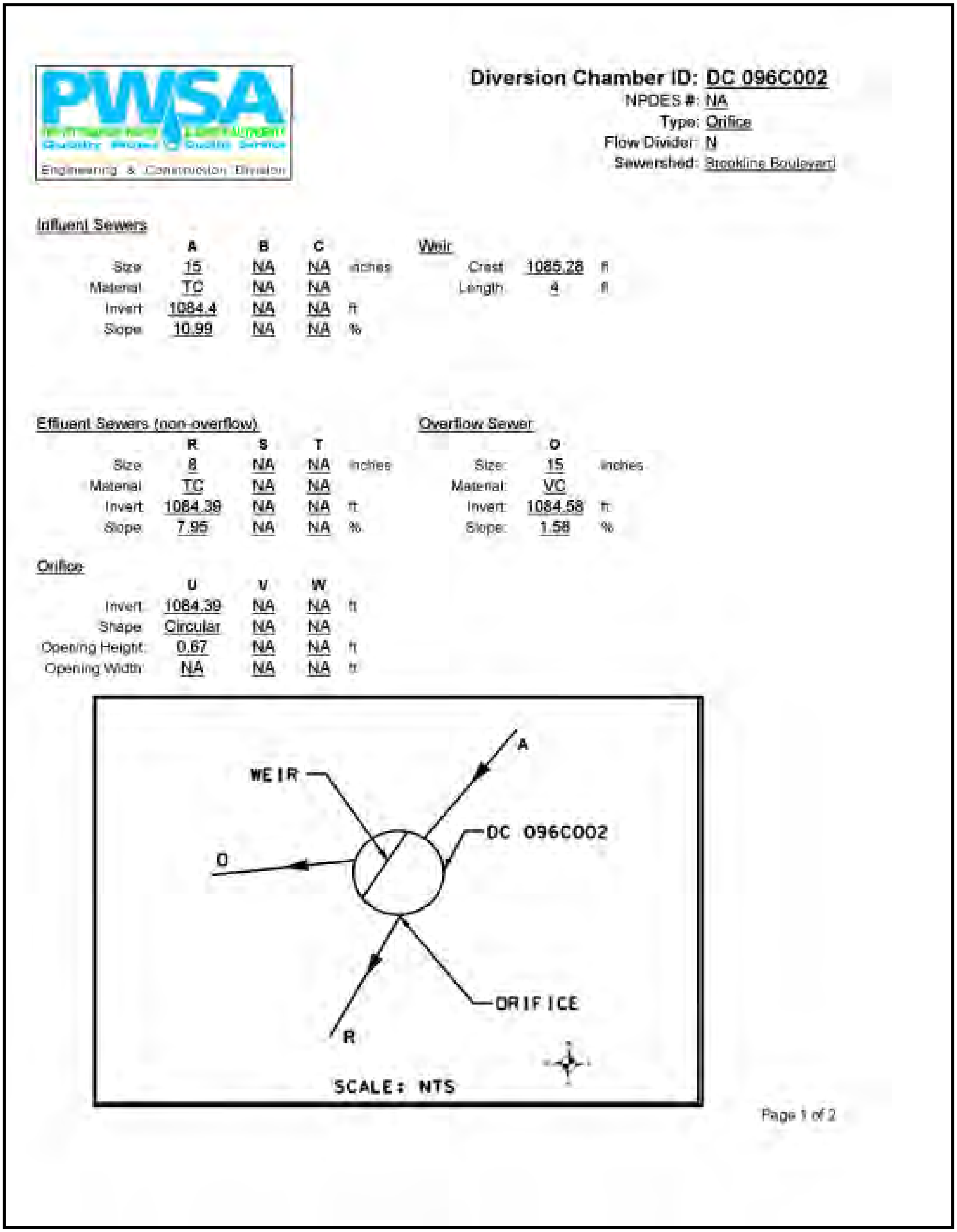

PWSA
Engineering & Construction Division

Diversion Chamber ID: DC 096C002
NPDES #: NA
Type: Orifice
Flow Divider: N
Sewershed: Brookline Boulevard

Influent Sewers

	A	B	C	
Size	15	NA	NA	inches
Material	TC	NA	NA	
Invert	1084.4	NA	NA	ft
Slope	10.99	NA	NA	%

Weir

Crest	1085.28	ft
Length	4	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	TC	NA	NA	
Invert	1084.39	NA	NA	ft
Slope	7.95	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	VC	
Invert:	1084.58	ft
Slope:	1.58	%

Orifice

	U	V	W	
Invert	1084.39	NA	NA	ft
Shape	Circular	NA	NA	
Opening Height:	0.67	NA	NA	ft
Opening Width:	NA	NA	NA	ft

SCALE: NTS

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THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 096C002

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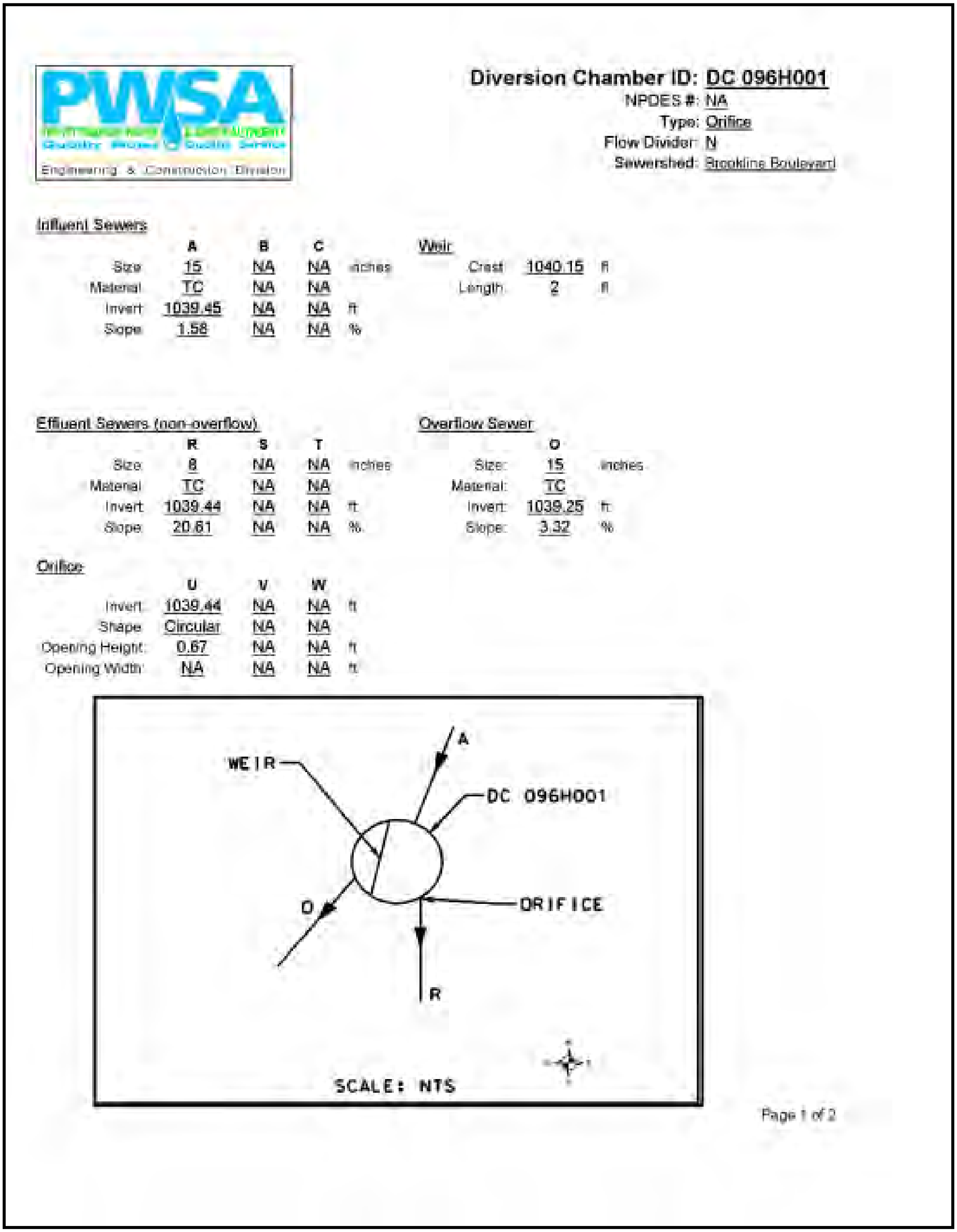

Engineering & Construction Division

Diversion Chamber ID: DC 096H001
NPDES #: NA
Type: Orifice
Flow Divider: N
Sewershed: Brookline Boulevard

Influent Sewers

	A	B	C	
Size	15	NA	NA	inches
Material	TC	NA	NA	
Invert	1039.45	NA	NA	ft
Slope	1.58	NA	NA	%

Weir

Crest	1040.15	ft
Length	2	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	TC	NA	NA	
Invert	1039.44	NA	NA	ft
Slope	20.61	NA	NA	%

Overflow Sewer

	O	
Size	15	inches
Material	TC	
Invert	1039.25	ft
Slope	3.32	%

Orifice

	U	V	W	
Invert	1039.44	NA	NA	ft
Shape	Circular	NA	NA	
Opening Height	0.67	NA	NA	ft
Opening Width	NA	NA	NA	ft

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PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 096H001

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2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC MH-77: Brookline Boulevard Sewershed through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Saw Mill Run Basin Planners (SMR_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for MH-77.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The

flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. No flow meters located in the MH-77 sewershed were used in the RCS-FMP. The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).

- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.

- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.

- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the MH-77 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the MH-77 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.

- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process to represent the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table MH77-2-1.

TABLE MH77-2-1: MH-77 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[1]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-77	0.37	0.37	0.0%

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event. RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for MH-77 are presented in Table MH77-2-2.

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[1] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.4

TABLE MH77-2-2: MH-77 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[2]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-77	5.4	5.4	0.0%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year, and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure MH77-2-1 present the computed hydraulic profiles of the existing MH-77 main trunk sewer system under projected 2-year design storm peak flow conditions. As is indicated in the figure, under the current system configuration, including existing CSO diversion chamber settings, minor surcharging occurs in the middle portion of the trunk sewer.

Figure MH77-2-2 present the computed hydraulic profiles of the existing MH-77 main trunk sewer system under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including

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[2] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.5

existing CSO diversion chamber settings, surcharging occurs in the middle portion of the trunk sewer and minor surcharging begins to develop in the upper and lower portions of the sewer.

Figure MH77-2-3 present the computed hydraulic profiles of the existing MH-77 main trunk sewer system under projected 10-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, surcharging occurs in the middle portion of the trunk sewer and minor surcharging begins to develop in the upper and lower portions of the sewer..

Computed flow hydrographs for each of the design storms at POC MH-77 are presented in Figure MH77-2-4.

FIGURE MH77-2-1: MH-77 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

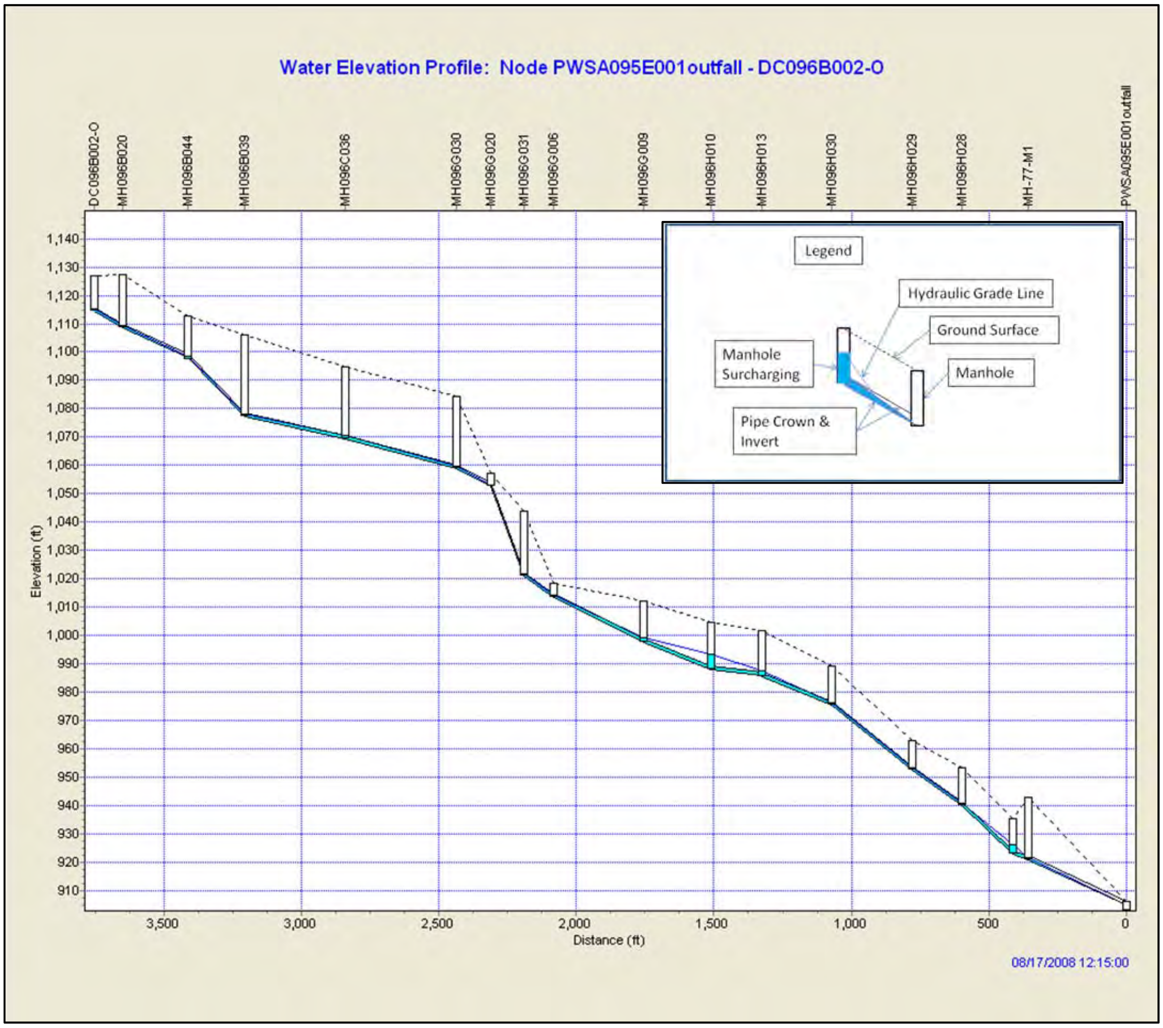


FIGURE MH77-2-2: MH-77 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

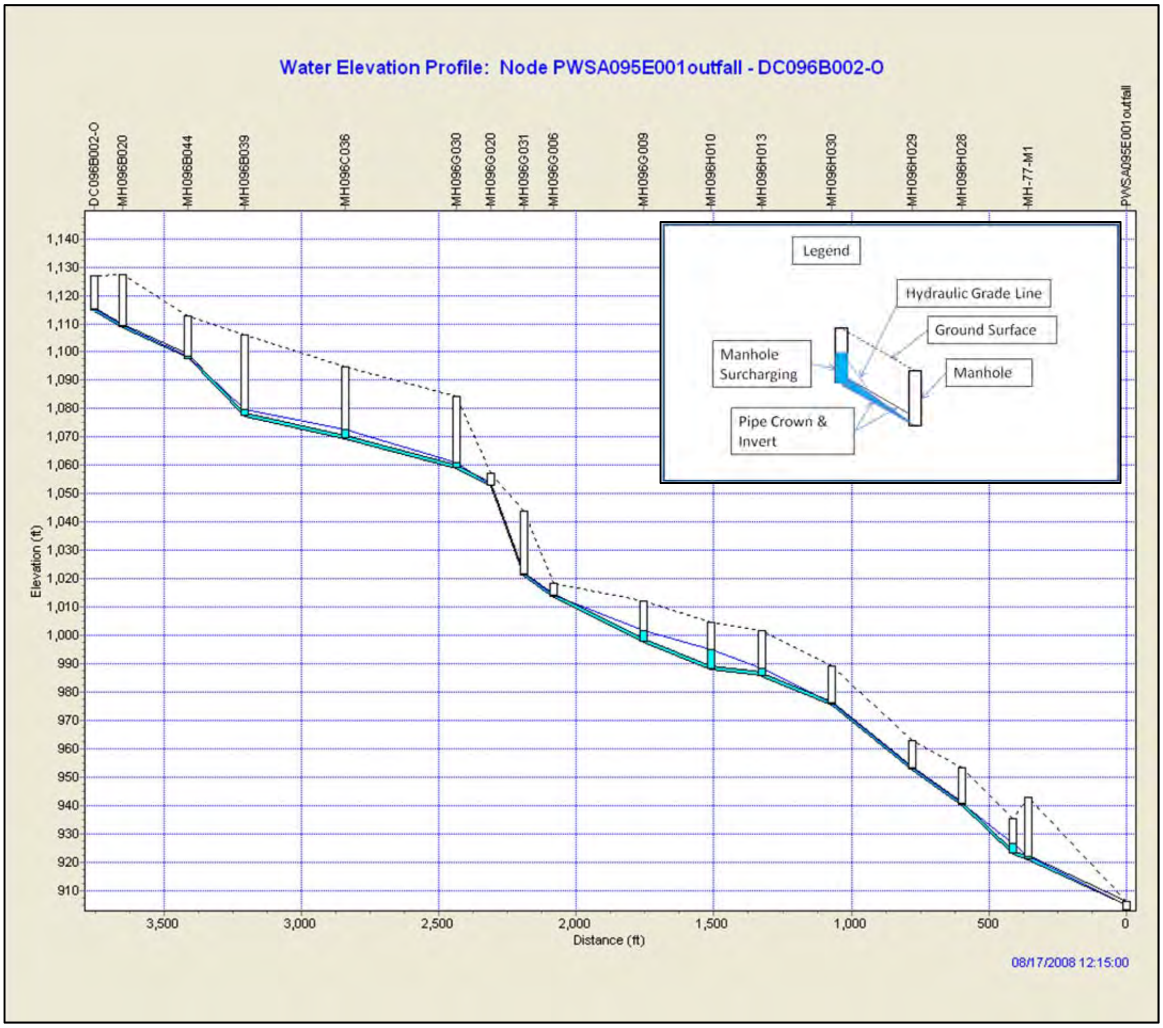


FIGURE MH77-2-3: MH-77 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

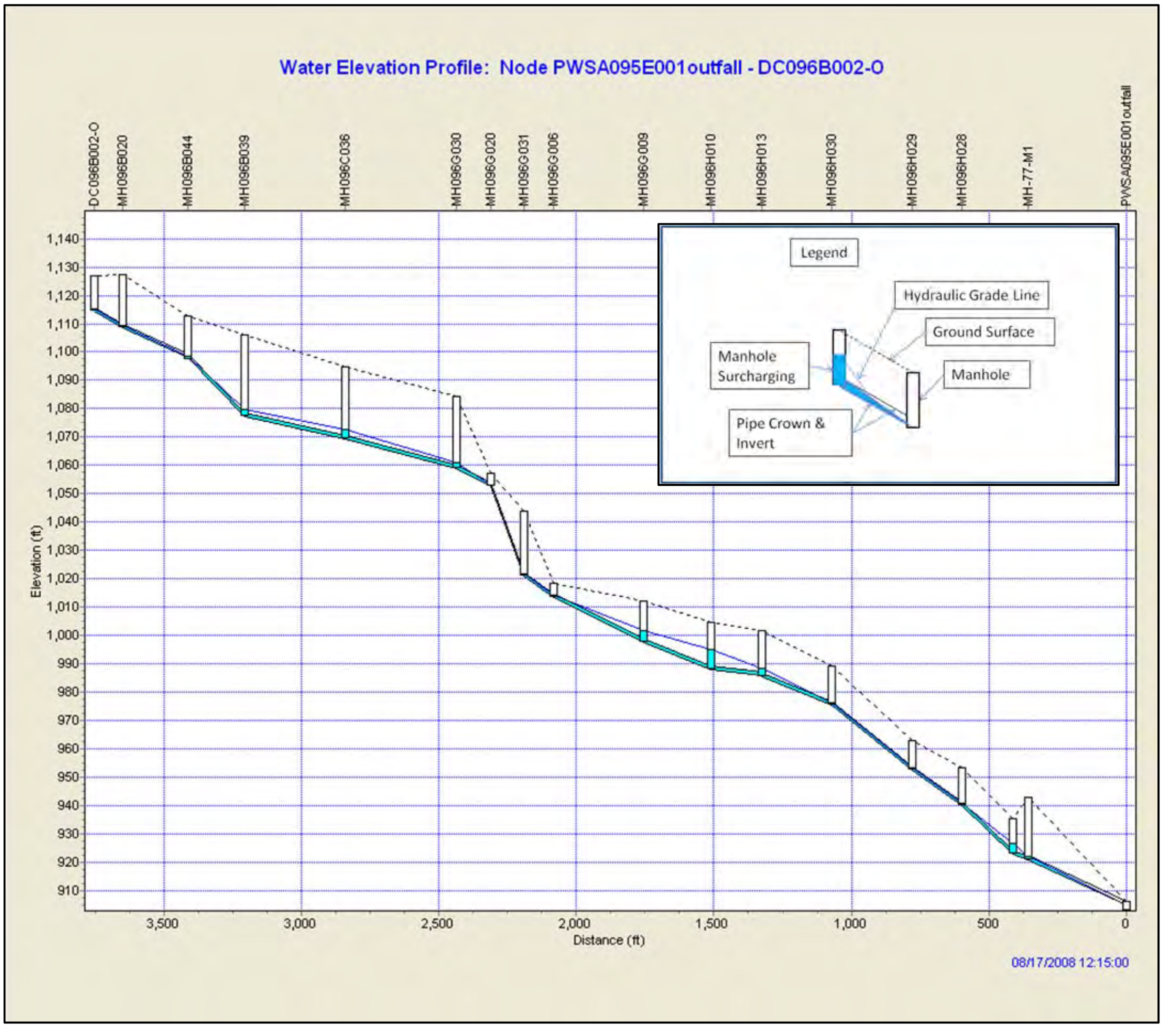
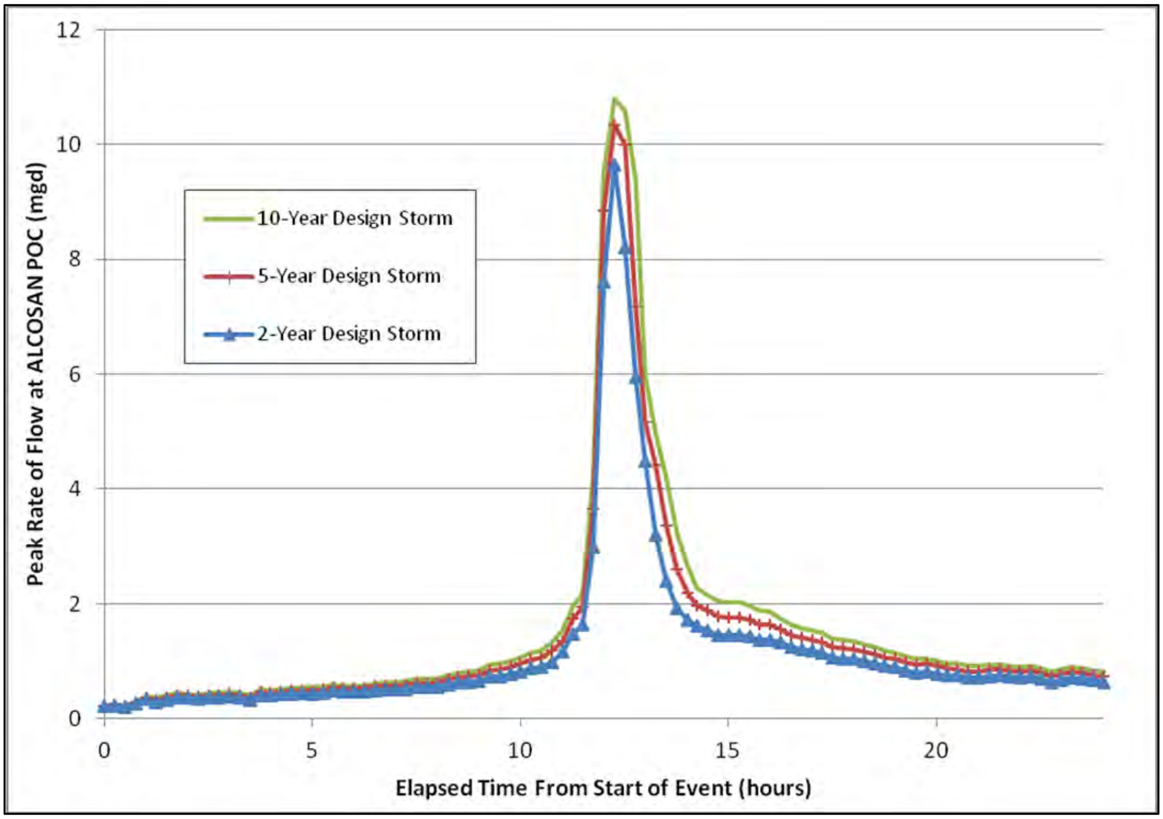


FIGURE MH77-2-4: MH-77 SEWERSHED PEAK FLOW RATES TO THE POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

Table MH77-2-3 presents a summary of the identified chronic basement flooding locations within the PWSA portion of the MH-77 sewershed. The neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. The data presented in Table MH77-2-5 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE MH77-2-3: MH-77 CHRONIC BASEMENT BACKUP LOCATION (PWSA SYSTEM)[3]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
1335 Oakridge Street	7	2005

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the MH-77 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

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[3] Information from analysis of PWSA SAP system

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures MH77-2-5 and MH77-2-6. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figures show that under this range of operating conditions, the existing Brookline Boulevard trunk sewer system does not have sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding.

FIGURE MH77-2-5: MH-77 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

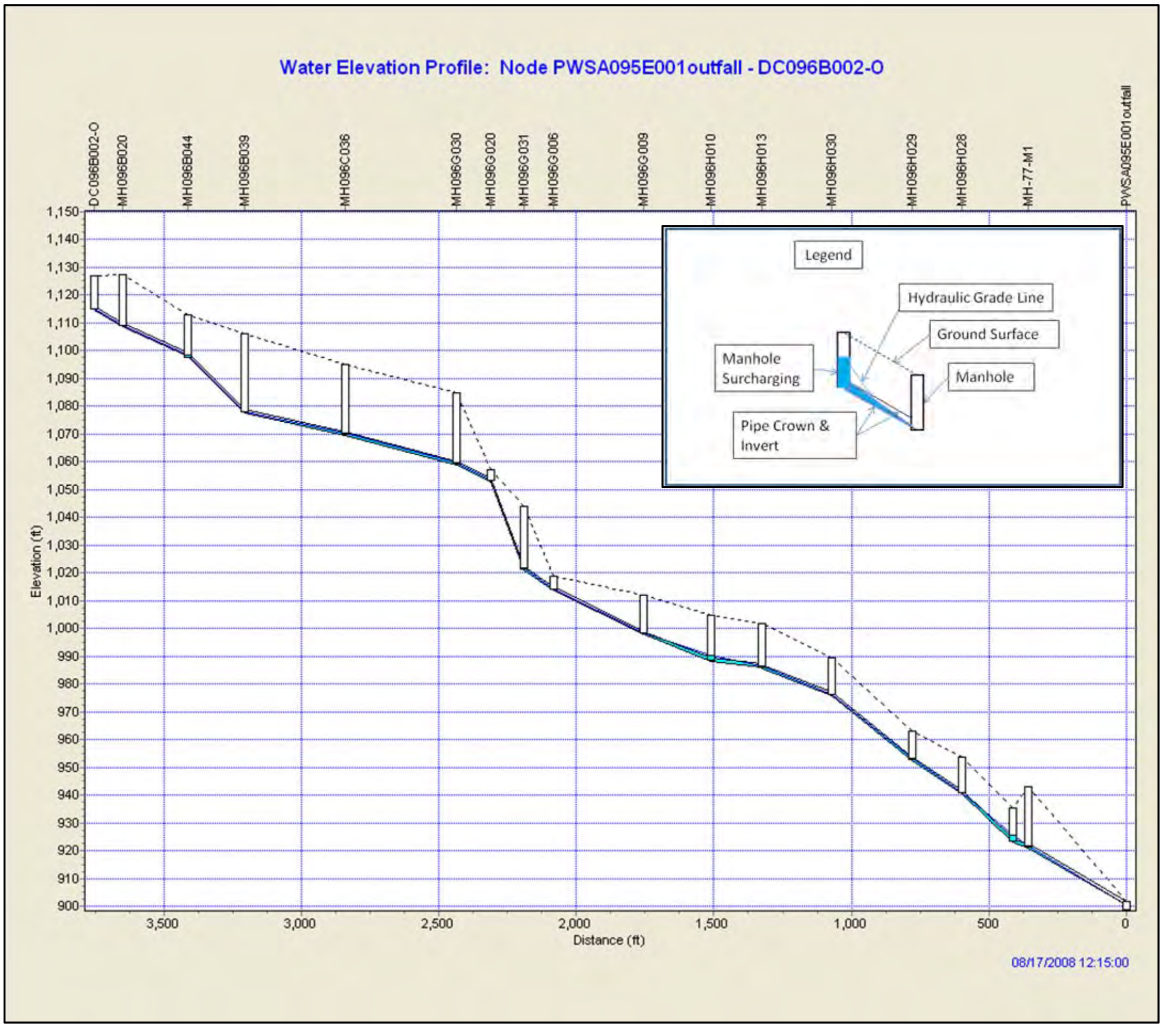
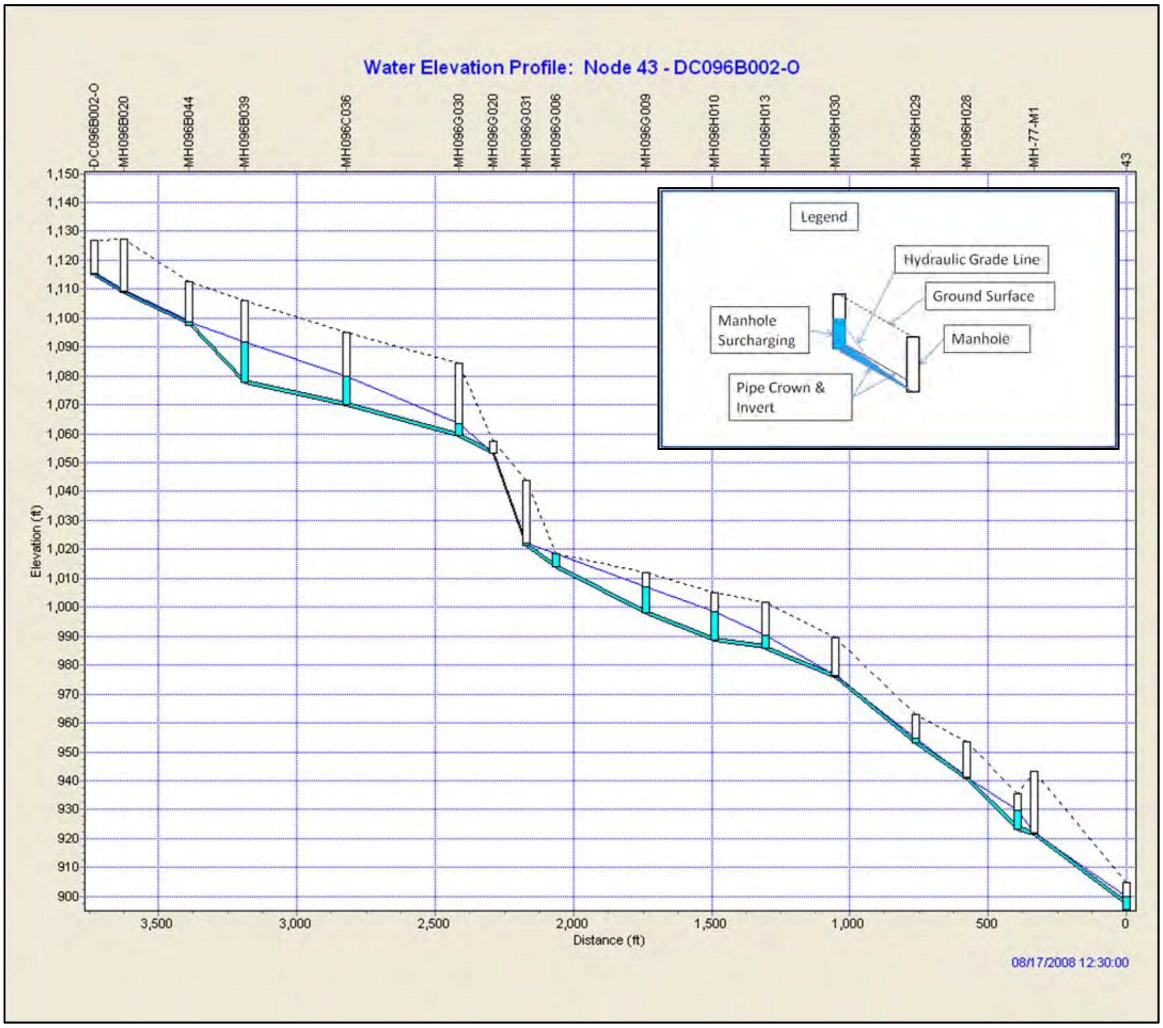


FIGURE MH77-2-6: MH-77 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the MH-77 sewer system performed by PWSA produced the following computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table MH77-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the MH-77: Brookline Boulevard sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. One (1) of these outfalls is found within the MH-77: Brookline Boulevard Sewershed, as shown in Table S15-3-1.

TABLE MH77-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE MH-77: BROOKLINE BOULEVARD SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
CSO095E001	SMR	MH-77	Saw Mill Run	WWF[1]	N	Y

As shown in the table, the one (1) PWSA owned outfall discharges into Saw Mill Run. This is classified as warm water fisheries (WWF) and currently do not meet their assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.

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[1] Warm Water Fishery

- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives.

This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream, including Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

The receiving water characterization field program resulted in certain findings within Saw Mill Run. In general, the DO concentrations for Saw Mill Run did not meet regulatory limits during wet weather which is likely related to CSO discharges during the storm events and/or wet weather discharges from upstream municipalities. Saw Mill Run also showed DO concentrations not meeting standards during dry weather indicating that CSO discharges are not likely causing the condition.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters, including Saw Mill Run and its tributaries within the PWSA limits, with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL. For Saw Mill Run, the concentration during the recreational season exceeded the 200 cfu/100mL limit in 100% of the samples and exceeded the 400 cfu/100mL limit in 80% of the samples.

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

Saw Mill Run has an in-stream target concentration of 0.035 mg/L for total phosphorus (TP) which was exceeded by 75% of the samples. TP appears to be a concern throughout Saw Mill Run, with CSO discharges being a potentially significant source in wet weather.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal Coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS. However for Saw Mill Run, it is judged that a higher level of control is needed due to the need to reduce phosphorus levels (see next section).

3.2.2 Saw Mill Run TMDL Report

A TMDL report was completed for Saw Mill Run and its tributaries which showed phosphorus TMDL results are shown below in Table MH77-3-2.

TABLE MH77-3-2: SAW MILL RUN PHOSPHORUS TMDL RESULTS

Total Phosphorus Load	CSO Load	SSO Load
Existing Load (Ib/Growing Season)	7,161.9	1,950.4
Allocated Load (Ib/ Growing Season)	177.5	0.0
Percent Reduction (%)	98%	100%

The implication of this is that substantial reductions of CSOs and complete elimination of SSOs is necessary for compliance. For CSOs, it is judged that a control level of 0 overflows per year will be required.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, such as Saw Mill Run, pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6

overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the MH-77 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the MH-77 sewershed, Table MH77-3-3 lists the untreated CSO statistics that were computed for each control level.

TABLE MH77-3-3: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE MH-77 SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC096B001	0	0	4	0.01	9	0.06
DC096B002	0	0	3	0.01	3	0.01
DC096C002	0	0	3	0.01	5	0.06
DC096H001	0	0	4	0.06	4	0.06
Total Volume		**0**		**0.09**		**0.19**

As will be described later in this report, the MH-11 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year and 10-year return frequency events).

Since Saw Mill Run has a TMDL which requires a high level of Phosphorous removal (98%), a higher CSO control level will be required. While 10, 4 and 0 OF/yr are analyzed, it is judged that 0 OF/yr will be necessary for compliance.

A range of design storms (2-yr, 5-yr, and 10-yr) were evaluated for transport of flows. PWSA plans to use the 2-yr storm which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

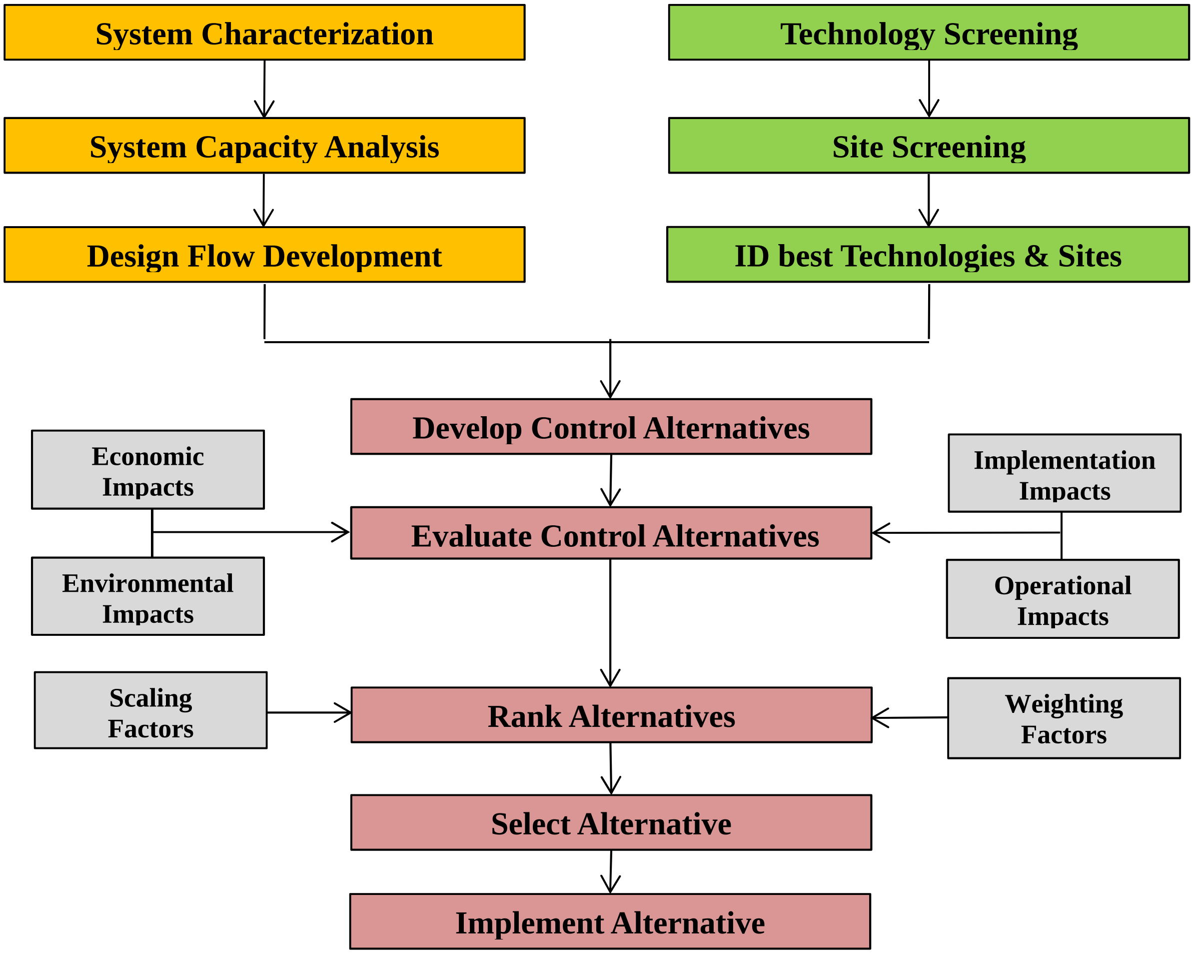
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure MH77-4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE MH77-4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table MH77-8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered “feasible” for use in the MH-77 sewershed are shown below in Table MH77-4-1.

TABLE MH77-4-1: MH-77 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies were identified for the MH-77 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table MH77-4-2.

There are no other municipalities tributary to the MH-77 sewershed.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning "Objective Scores" to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*, and were summarized above.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as the Ohio, Monongahela and Allegheny Rivers.

TABLE MH77-4-2: MH-77 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 095E001	No activations during the typical year.	No control required.
Consolidated Outfalls 095E001 and 095J001	CS4 095E001 and 095J001: Sewer separation	Complete sewer separation of tributary area.
	S2-095E001 and 095J001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-095E001 and 095J001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-095E001 and 095J001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-095E001 and 095J001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-095E001 and 095J001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-095E001 and 095J001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Regional Controls – MH-77: Brookline Blvd Controls		
Outfalls 095E001	CS4-S-18 to CSO 095J001: Sewer Separation	Complete sewer separation of tributary areas.
	S2-S-18 to CSO 095J001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-S-18 to CSO 095J001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-S-18 to CSO 095J001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-S-18 to CSO 095J001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-S-18 to CSO 095J001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-S-18 to CSO 095J001: Screening and Disinfection	A stand-alone screening and disinfection facility.

CSO(s)	Control Alternative(s)	Description
Sub-system Controls - Saw Mill Run Controls		
Outfalls 095E001	SMR-1a: Tunnel Storage[2]	A 2.8 mile long tunnel O-14 to the S-30 POC. The MH-77 CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • S-18 TO 095J001 - Sub-Surface Storage
	SMR-1b: Tunnel Storage[2]	
	SMR-2a: Tunnel Storage[2]	A 5.7 mile long tunnel from O-14 to the MH-77 POC. The MH-77 CSO will be conveyed to a drop shaft near the MH-77 POC.
	SMR-2b: Tunnel Storage[2]	

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

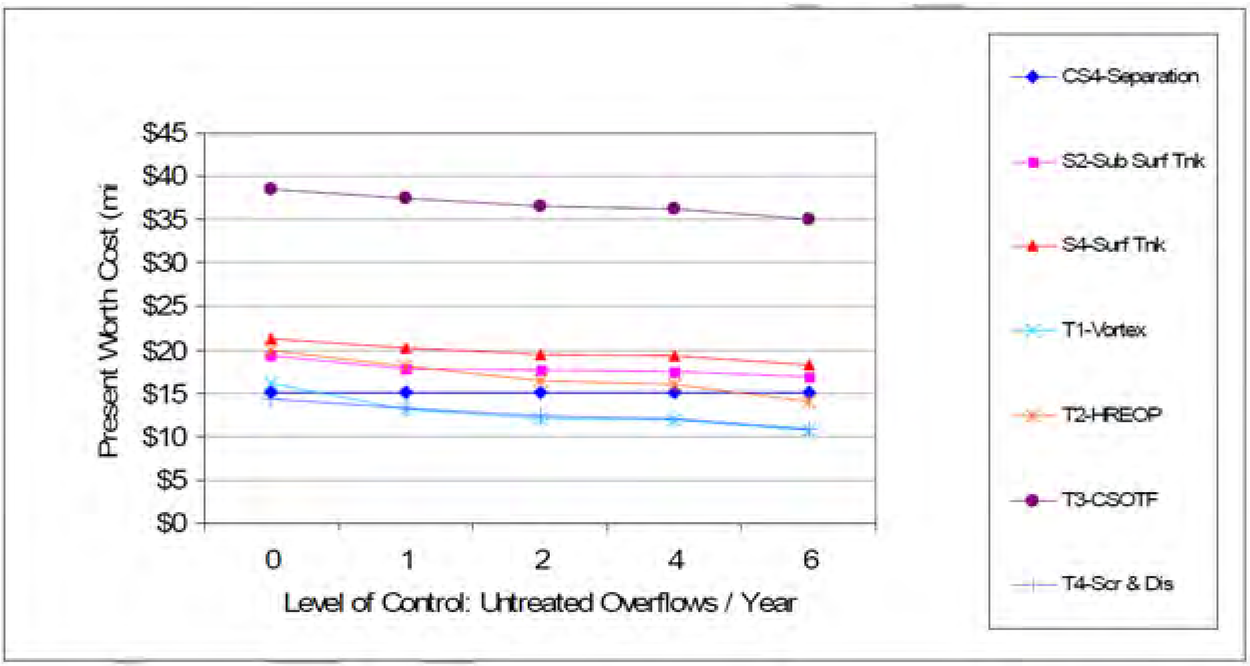
The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

Outfall 095E001: Outfall 095E001 did not activate the typical year, and no control alternatives were required.

Outfall 095E001 TO 095J001: Cost estimates were produced for outfall-specific control alternatives CS4 095E001 TO 095J001: Sewer separation, S2-095E001 TO 095J001: Sub-Surface Storage, S4-095E001 TO 095J001: Surface Storage, T1-095E001 TO 095J001: Suspended Solids Control, T2-095E001 TO 095J001: High Rate End of Pipe Treatment, T3-095E001 TO 095J001: CSO Treatment Facility, and T4-095E001 TO 095J001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure MH77-4-2 illustrates the ranges of estimated present worth costs for these alternatives.

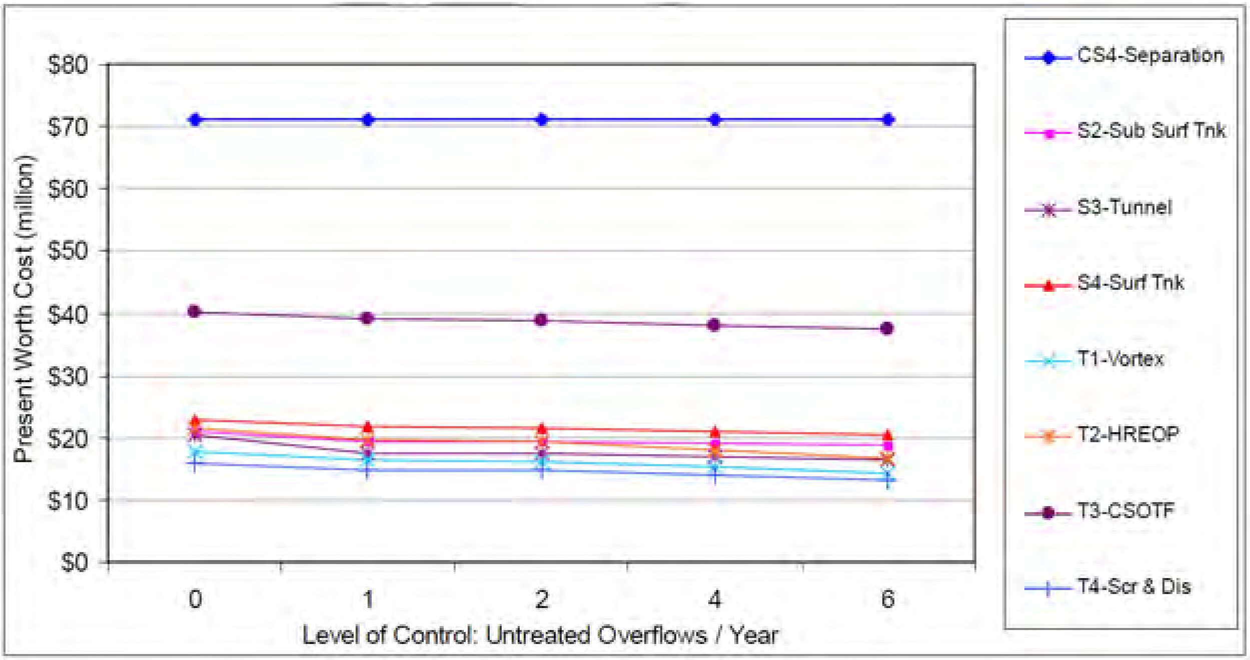
FIGURE MH77-4-2: OUTFALL 095E001 TO 095J001 ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

Cost estimates were produced for regional control alternatives developed for the S-18 to CSO 095J001 Region. Figure MH77-4-3 illustrates the estimated costs for these alternatives. It is important to note that Alternative S3-Tunnel includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE MH77-4-3: S-18 TO CSO 095J001 REGION ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Saw Mill Run sub-system. Table MH77-4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Saw Mill Run subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between “complete” sub-system alternatives. It remains PWSA’s assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of any tunnel storage portions of these control alternatives.

TABLE MH77-4-3: SAW MILL RUN SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
SMR-1a	249.3	2.1	272.1
SMR-1b	253.3	1.9	274.0
SMR-2a	246.2	1.6	265.1
SMR-2b	251.8	1.5	269.0

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining "Objective Scores" relative to each evaluation criteria.
- Applying "scaling" and "weighting" factors.
- Determining "Weighted Objective Scores" relative to each evaluation criteria.
- Ranking each alternative based on the sum of its "Weighted Objective Scores".

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table MH77-4-4.

TABLE MH77-4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

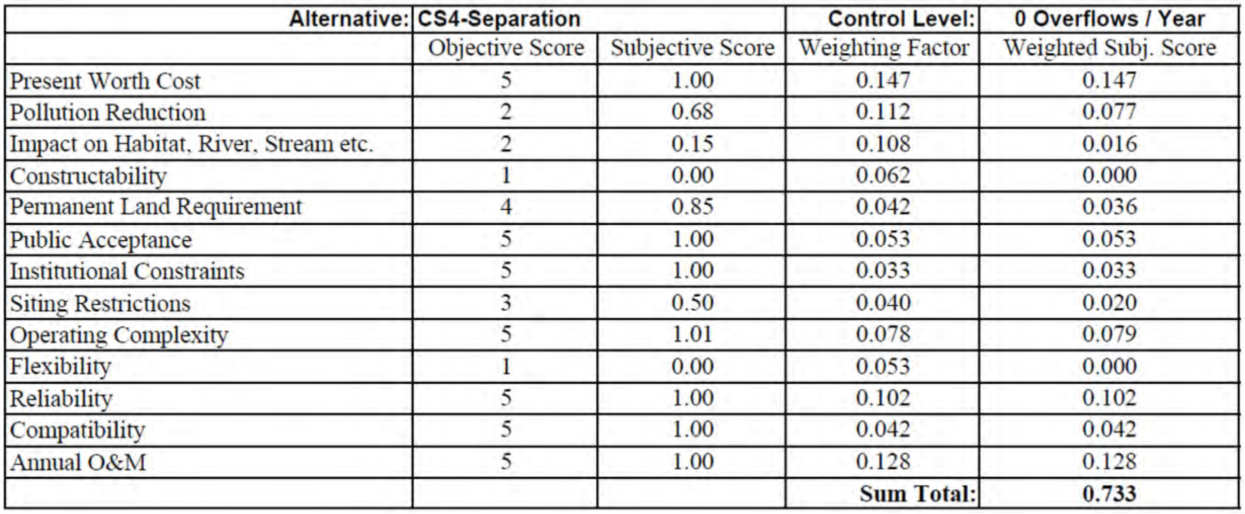
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in Table MH77-4-5.

TABLE MH77-4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 095E001 to 095J001: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in Table MH77-4-6.

TABLE MH77-4-6: WEIGHTED SUBJECTIVE SCORING - CS4 095E001 TO 095J001: SEWER SEPARATION



Alternative:	**CS4-Separation**		**Control Level:**	**0 Overflows / Year**
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	5	1.00	0.147	0.147
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.108	0.016
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	5	1.00	0.033	0.033
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.733**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that

their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

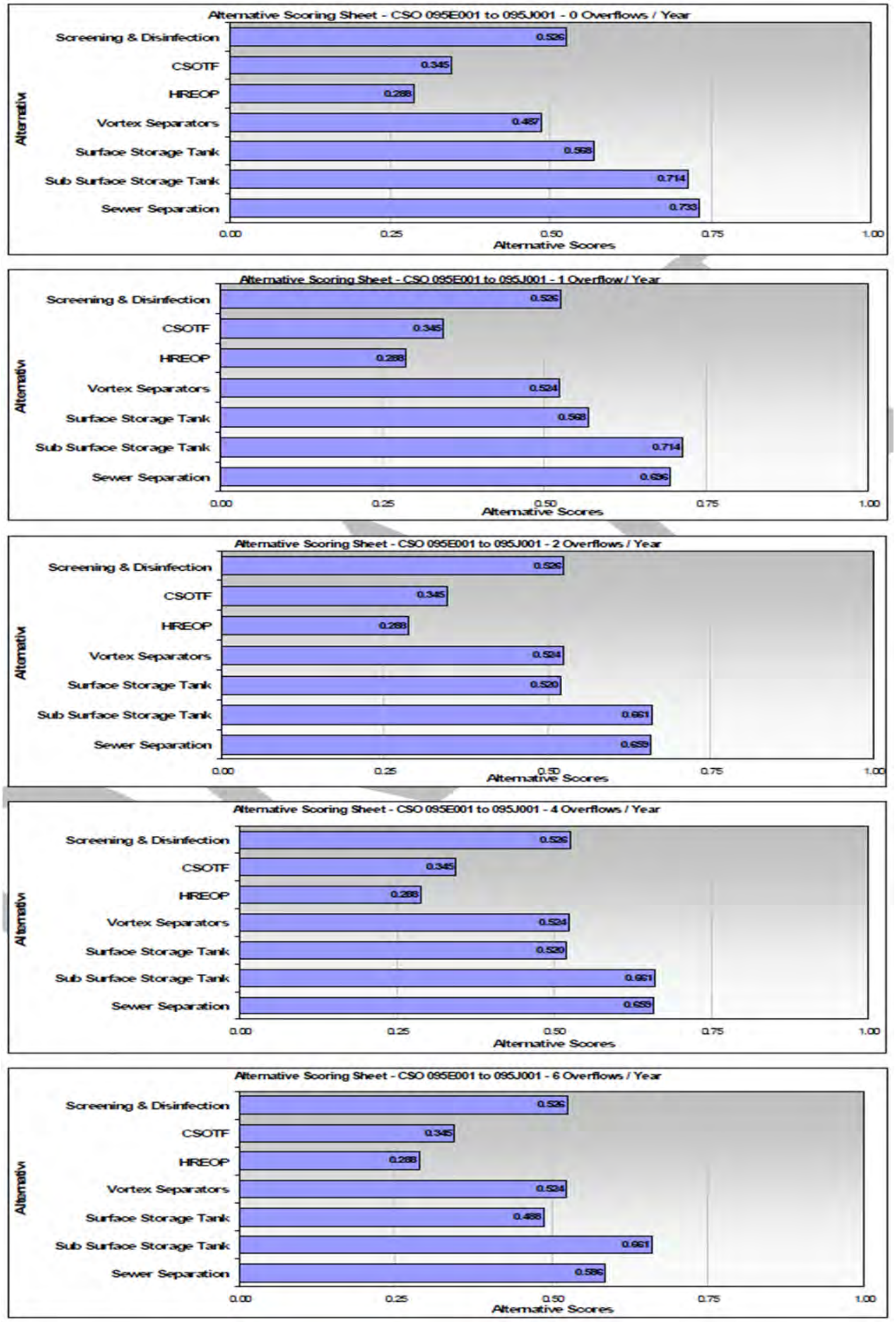
The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 095E001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This “no activation” outfall was not considered further in the alternatives analysis process alone.

Consolidated Outfalls 095E001 TO 095J001: The results of the control alternative evaluation process are shown in Figure MH77-4-4. For control level 0, it is recommended that *Alternative CS4-095E001 to 095J001: Sewer Separation* be carried forward and re-evaluated with the results of the system-wide alternatives analyses. For control levels 1 through 6, it is recommended that *Alternative S2-095E001 to 095J001: Sub-Surface Storage* be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

FIGURE MH77-4-4: ALTERNATIVE SCORING - OUTFALL 095E001 TO 095J001



4.4.2 Regional Control Alternatives

S-18 to CSO 095J001 Region: The results of the regional control alternative evaluation process are shown below in Figure MH77-4-5. For control levels 0, 1, 2, and 4, it is recommended that *S2 – S-18 to CSO 095J001 Region: Sub-Surface Storage* be carried forward and re-evaluated with the results of the system-wide analysis. For control level 6, it is recommended that *CS4-S-18 to CSO 095J001 Region: Sewer Separation* be carried forward and re-evaluated with the results of the system-wide analysis. It should be noted that Sewer Separation is significantly higher in cost compared to the second ranked alternative, Sub-Surface Storage, for these control levels.

4.4.3 Sub-System Control Alternatives

Saw Mill Run. The results of the sub-system control alternative evaluation process are shown below in Figure MH77-4-6. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative SMR-2b: Tunnel Storage* is carried forward as the Saw Mill Run component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative SMR-2b: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative SMR-2b* included only those components required to deliver flows to the MH-77 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the MH-77 POC would become the responsibility of ALCOSAN.

FIGURE MH77-4-5: ALTERNATIVE SCORING - S-18 TO CSO 095J001 REGION

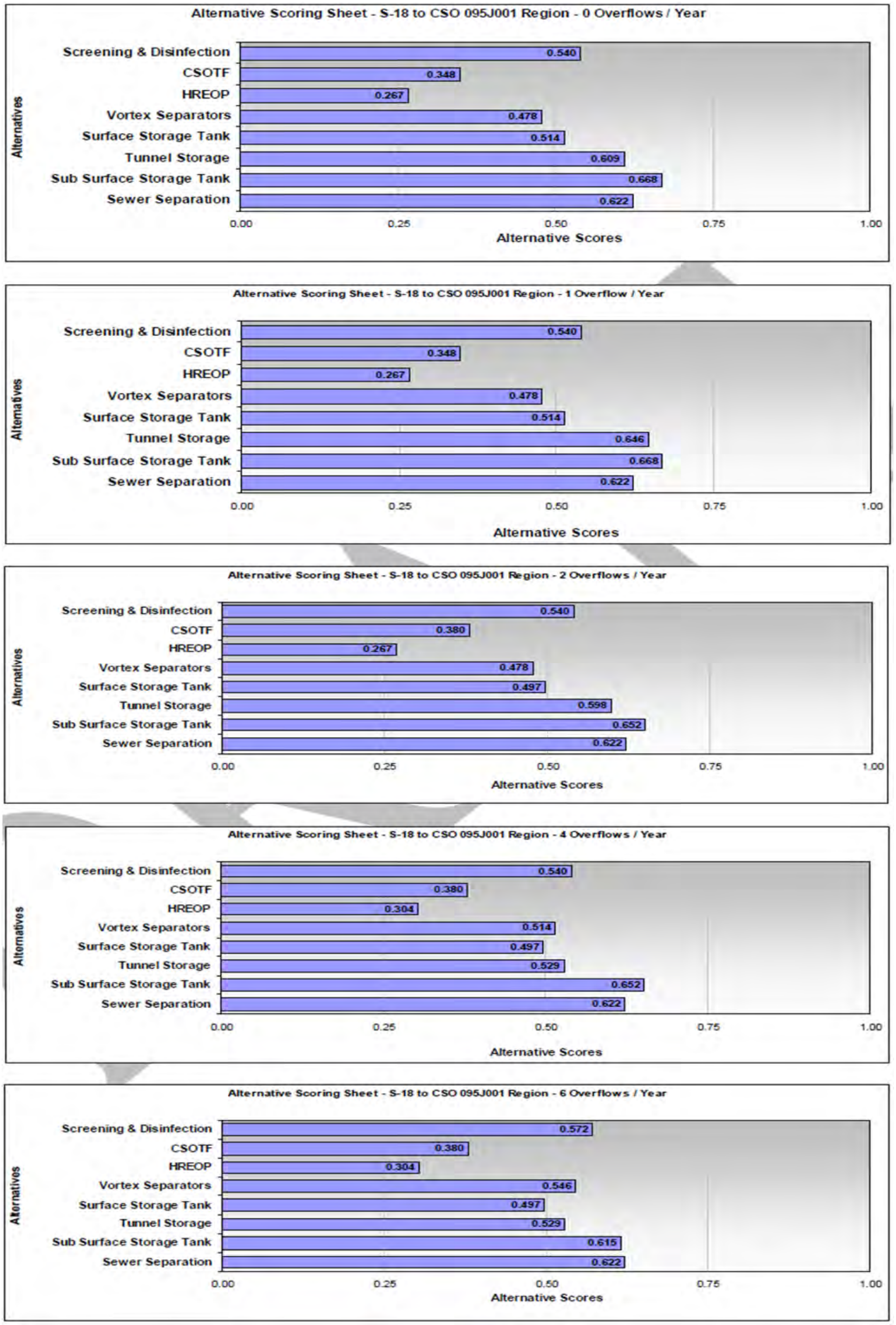
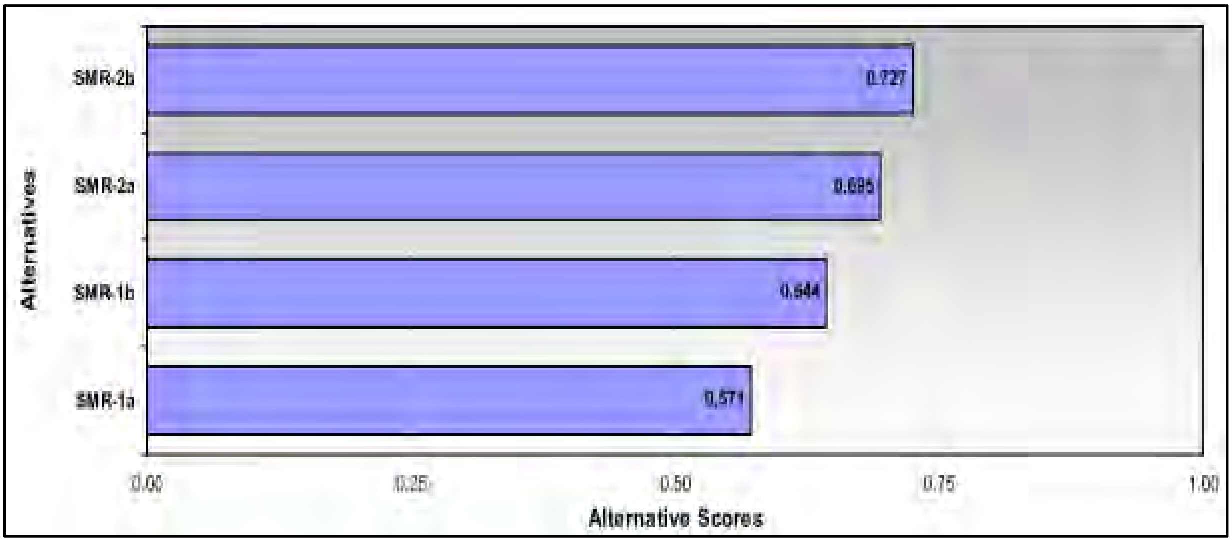


FIGURE MH77-4-6: ALTERNATIVE SCORING – SAW MILL RUN SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Saw Mill Run sewershed would best be accomplished by implementing *Alternative SMR-2b: Tunnel Storage*. Within the MH-77 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the PWSA permitted CSO to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the MH-77 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative SMR-2b* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-MH77-C-0*, *POC-MH77-C-4* and *POC-MH77-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **MH77 -** The POC sewershed serviced.

- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.
- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the MH-77 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the MH-77 sewershed is zero untreated overflows per year. The recommended control alternative for the MH-77 Brookline Boulevard sewershed has been designated as POC-MH77-C-0. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **MH77** The MH-77 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **0** The selected level of control is zero untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of zero (0) untreated overflows per year, the required consolidation / conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-MH77-C-0 are summarized in Table MH77-5-1.

TABLE MH77-5-1: ALTERNATIVE POC-MH77-C-0 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
MH-77	DC096B001 DC096B002 DC096C001 DC096C002 DC096H001	095E001	C*	0

*To be achieved via additional conveyance piping and regulator modifications.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, stream removal projects that may be included, its integration with the ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-MH77-C-4 and/or POC-MH77-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. Both analyses determined that the optimal method of increasing the level of control of CSO overflows in the MH-77 sewershed would be to reduce the number of overflows by conveying the additional wastewater to the ALCOSAN point of connection. To accomplish this, the PWSA must:

- Modify existing diversion structures to achieve desired level(s) of control.
- Construct additional consolidation piping to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

For each of the five diversion structures in the MH-77 sewershed, the H&H model was employed to identify the type and extent of modifications required to achieve zero overflows during the typical year.

The required modifications to the flow diversion settings were determined by the current typical year overflow statistics. Table MH77-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control.

TABLE MH77-5-2: POC-MH77-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC096B001	Diversion structure replacement*	0.9	0.4	No change
DC096B002	Diversion structure replacement*	6.8	3.2	No change
DC096C001	Diversion structure replacement*	1.30	0.20	0.08
DC096C002	Diversion structure replacement*	0.7	0.4	No change
DC096H001	Diversion structure replacement*	3.6	No change	No change

*The installation of screening is planned for all PWSA diversion structures.

As can be seen from the table, new consolidation piping to convey flows at the zero OF/yr level of control must be designed to carry flows ranging from 0.7 to 6.8 mgd.

5.1.2 Consolidation Piping

The H&H model was employed to identify the capacity improvements necessary to consolidate and convey increased flows from the five existing diversion structures to the MH-77 POC. The modeling was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the MH-77 POC without significant manhole surcharging and flooding. These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008)* that anticipated the construction of consolidation / relief sewers to supplement the capacity of the existing trunk sewer system.

It was anticipated that the required increase in conveyance capacity would be achieved by constructing parallel relief sewers designed to convey flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table MH77-5-3 and in Figure MH77-5-1.

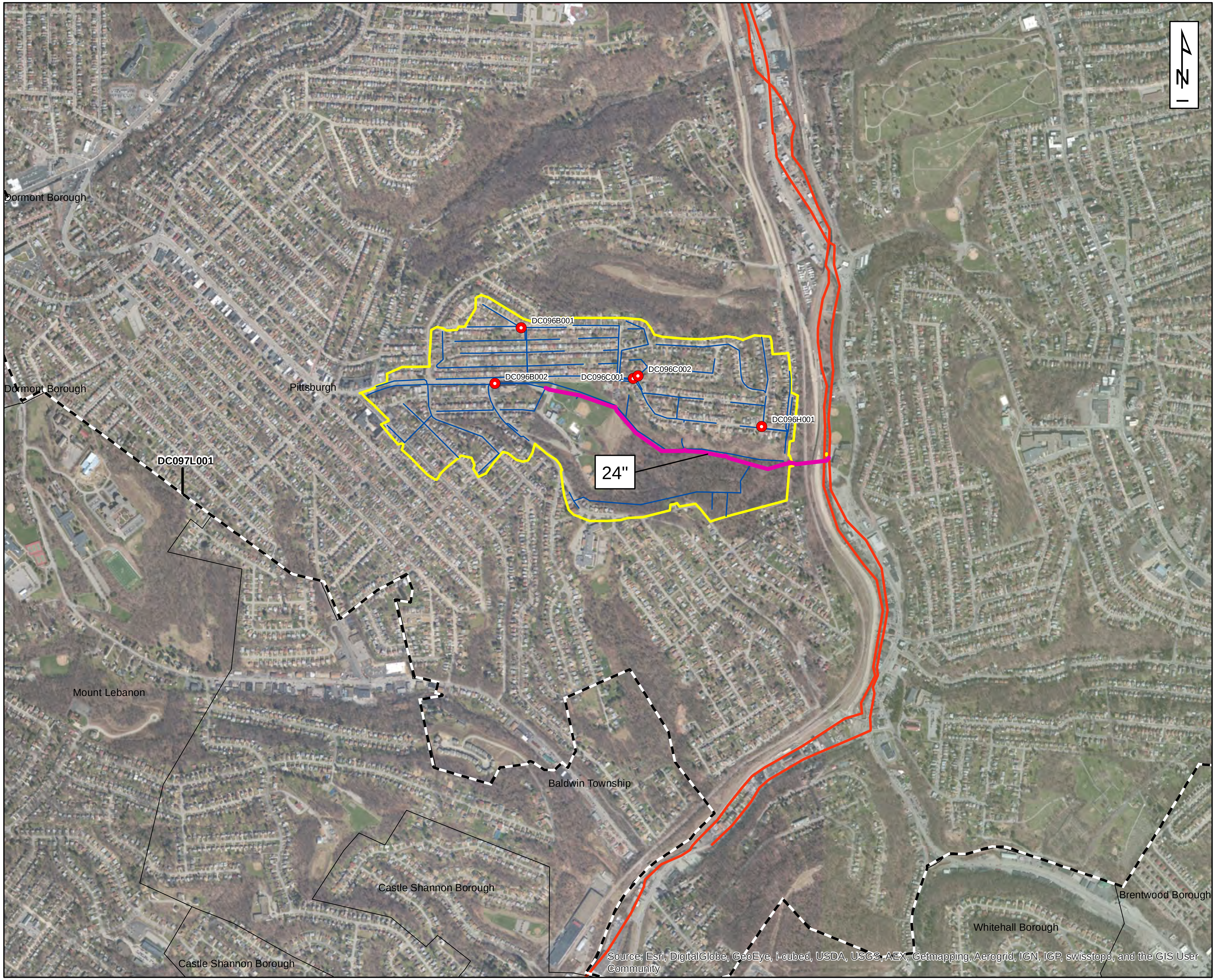
TABLE MH77-5-3: POC-MH77-C-0 CONSOLIDATION PIPING

Diameter (in)	Length (ft)
24	3,233

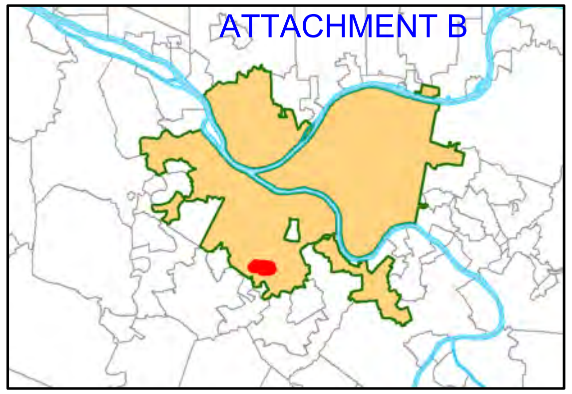
*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA’s diversion structures are provided in Table MH77-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 3.3 MG in the typical year.



ATTACHMENT B



PWSA Service Area Overview

Legend

- ● PWSA Diversion Chambers Modififcation
- ▬ Relief/Consolidation Sewers
- — Collector Sewer
- ☐ MH-77 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ╍ Deep Tunnel
- — Shallow Cut

Figure MH77-5-1: POC-MH77-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 5-1_MH77.mxd

TABLE MH77-5-4: MH-77 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name					
	POC-MH77-C-0		POC-MH77-C-4		POC-MH77-C-10	
	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)
DC096B001	0	0	4	0.01	9	0.1
DC096B002	0	0	3	0.01	3	0.01
DC096C001	0	0	4	0.01	10	0.01
DC096C002	0	0	3	0.01	5	0.1
DC096H001	0	0	4	0.1	4	0.1
Total Volume		0		0.1		0.3

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The combination of regulator modifications and additional consolidation piping will result in increased flow rates and volumes to the MH-77 POC. Peak flow rates to the MH-77 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-MH77-C-0, POC-MH77-C-4 and POC-MH77-C-10 are presented in Figure MH77-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the MH-77 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table MH77-5-5.

FIGURE MH77-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE MH-77 POC

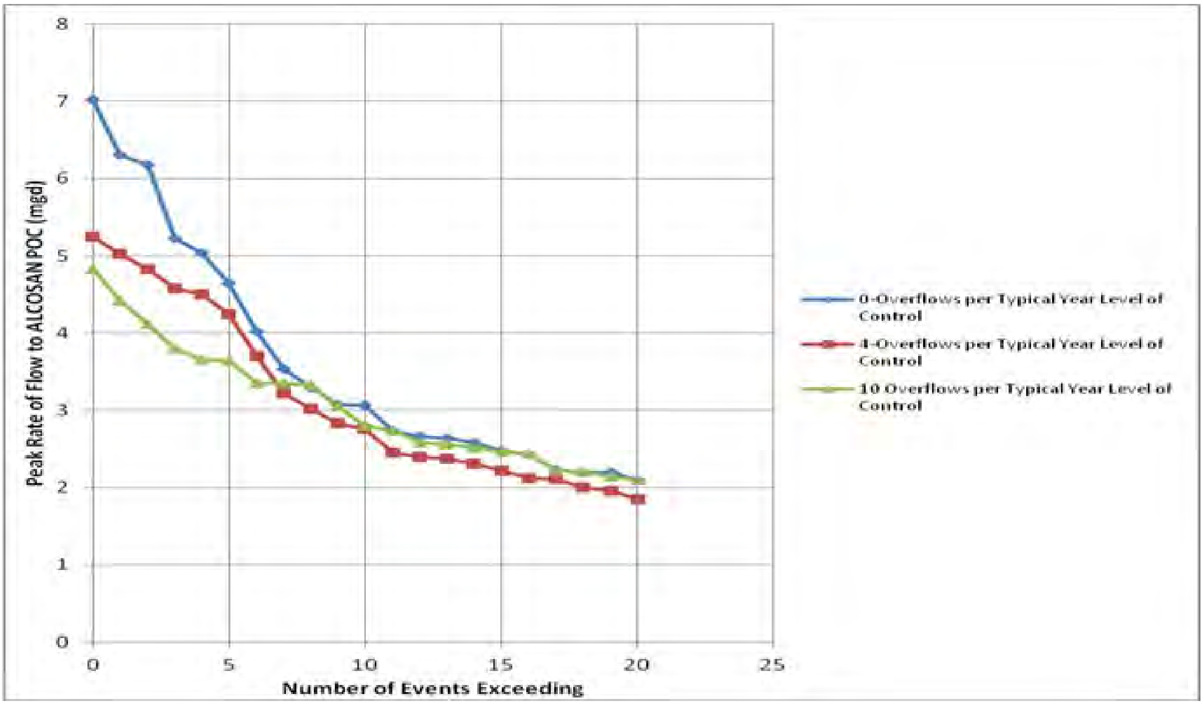


TABLE 5-5: MH-77 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-MH77-C-0	13.6	14.9	15.3	1.3	1.6	1.8
POC-MH77-C-4	7.9	9.0	9.8	1.1	1.3	1.4
POC-MH77-C-10	7.6	9.0	9.8	1.1	1.3	1.4

5.1.5 Recommended Control Alternative Integration

The MH-77 collection system and MH-77 POC does not contain/convey any upstream flow from surrounding municipalities. As a result, integration is limited to PWSA and its downstream sewage treatment provider ALCOSAN which is explained further in Section 5.7 of this POC report.

5.2 Hydraulic Capacity of the Recommended Alternative

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-MH77C-0 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through the construction of parallel relief sewers designed to convey flows associated with zero overflows per typical year, under 2-year design storm conditions (0 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the MH-77 sewershed, both before and after implementation of the recommended alternative:

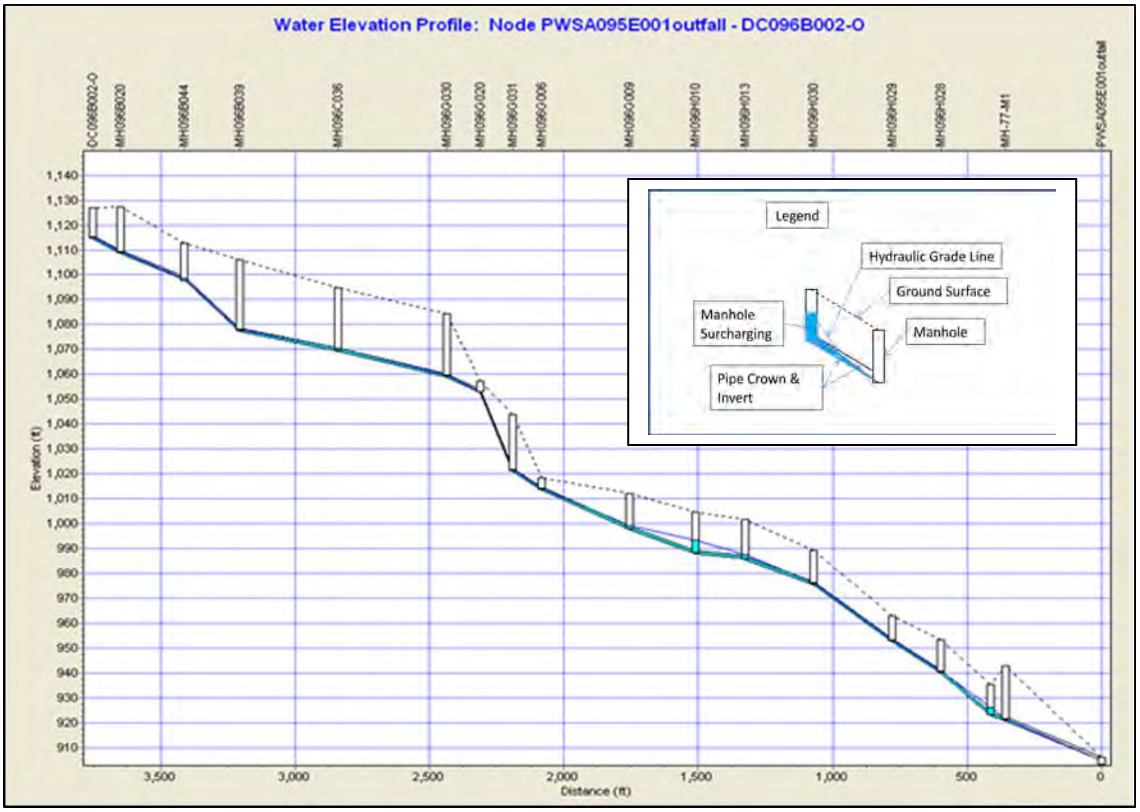
- Peak flow hydraulic grade line (HGL) of the trunk sewer
- 2046 peak flows and volumes to the MH-77 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figure 3 from that report presented profiles of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. These figures are reproduced below as Figure MH77-5-3.

The HGL along the main trunk sewer following implementation of alternative POC-MH77-C-0 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, modification of the diversion structures combined with additional conveyance capacity (0 OF/yr; 2-yr storm) will satisfactorily reduce manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE MH77-5-3: MH-77 UPPER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure 3, under the current system configuration, including existing CSO diversion chamber settings, minor surcharging occurs in the middle portion of the trunk sewer.

5.2.2 2046 Peak Flows and Volumes to MH-77 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known

municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the PWSA system. ALCOSAN made similar assumptions1, and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, as well as additional consolidation piping to convey increased flows to the MH-77 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the MH-77 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances From ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This contrasts with the PWSA's water quality based decision to recommend a zero OF/yr level of control within the Saw Mill Run planning basin.

However, the control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the MH-77 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

MH-77 is not a multi-municipal POC and therefore has no upstream tributary municipalities.

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, as well as increased conveyance piping to convey increased flows to the MH-77 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first five years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of regulator modifications and additional consolidation piping designed to control CSOs from the PWSA diversion structures to zero overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the MH-77 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts in Saw Mill Run due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-MH77-C-0 are consolidation piping, CSO screening facilities, and diversion structure modifications. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment MH77-5-1.

5.4.1 Consolidation Piping

In the MH-77 sewershed, additional conveyance capacity was provided through the use of parallel relief sewers to convey flows to the MH-77 POC. As detailed earlier, relief sewers were added to areas of the system that exhibited manhole flooding or surcharging at any time during the 24-hour design storm events. All improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewer.

Parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

Length – Measured from the improvements in the model

Diameter – Determined from the model runs to eliminate surcharging

- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft

- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street
- Other values included in the cost – Trench excavations and backfill, rock excavation, trench wall support, street opening, clearing and grubbing, street restoration, flow maintenance, traffic maintenance

5.4.2 CSO Screening Facilities

It was assumed that each outfall location will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

It was assumed that adjustments to existing regulator settings, including more effective and improved methods of flow control and monitoring, improved access, etc., would be sufficiently extensive as to make it more cost effective to simply replace each structure. The unit cost associated with the installation of each new diversion structure was assumed to be $200,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $360,000.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure MH77-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-

yr and 10-yr storm scenarios. No discernible "knee of the curve" is evident from this data.

These costs are also presented in a tabular format in Table MH77-5-7.

The selected level of CSO control - 0 OF/yr - was determined based upon water quality considerations. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-MH77-C-0 are summarized in Table MH77-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE MH77-5-4: MH-77 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

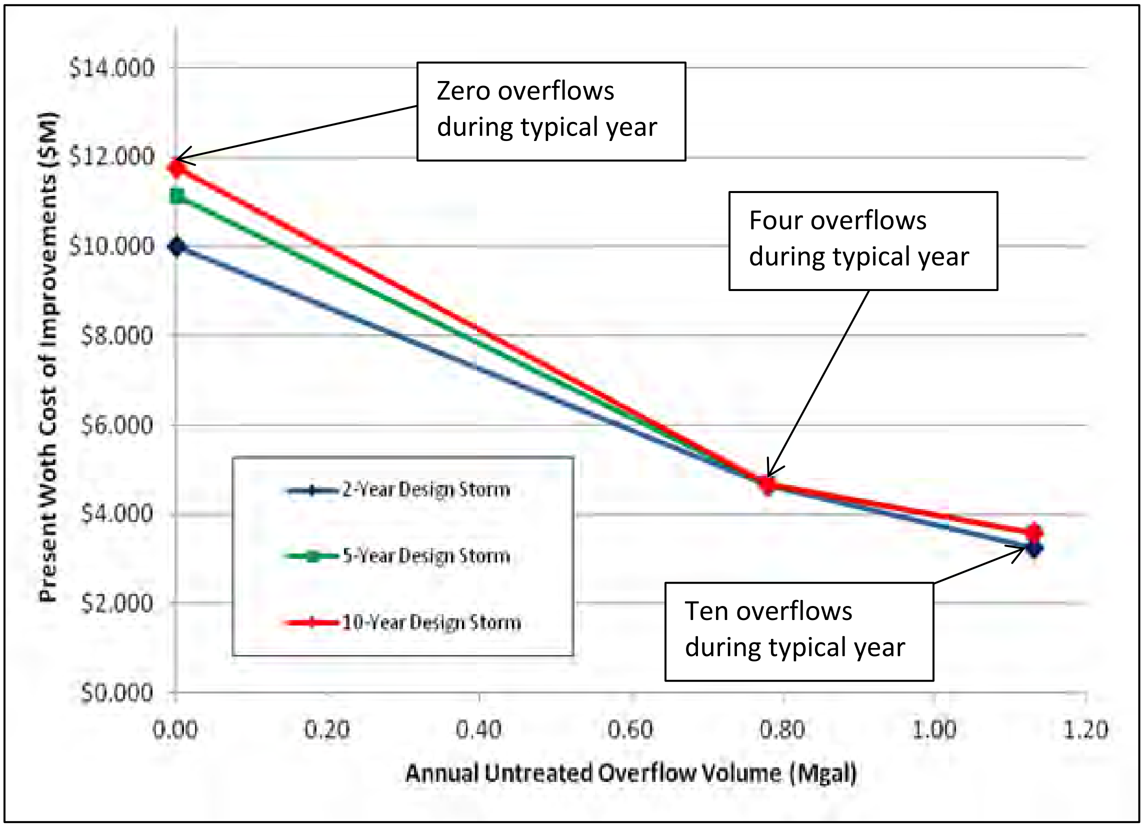


*Figure represents a combination of POCs S23, MH77, MH80 and MH55 curves.

TABLE MH77-5-7: MH-77 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control (DC096B001, DC096B002, DC096C001, DC096C002, & DC096H001)				
	Untreated CSO Volume (MG)	CSO Control Level (OF/yr)	PW Capital Cost ($MM)	PW O&M Cost* ($MM)	TPW CSO Control ($MM)
POC-MH77-C-0	0	0	$7.3	$0.10	$7.4
POC-MH77-C-4	0.1	4	$3.1	$0.04	$3.1
POC-MH77-C-10	0.3	10	$1.8	$0.02	$1.8
Alternative Name	SSO Control				
	Untreated SSO Volume (MG)	SSO Control Level	PW Capital Cost ($MM)	PW O&M Cost ($MM)	TPW SSO Control ($MM)
POC-MH77-C-0	0	2-year	$0	$0	$0
POC-MH77-C-4	0	2-year	$0	$0	$0
POC-MH77-C-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated

TABLE MH77-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-MH77-C-0

Capital Improvements	Size/Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)
Replace diversion structures: DC096B001 DC096B002 DC096C001 DC096C002 DC096H001	0 OF/yr Each	$1.80	$1.82
Add screening to diversion structures: DC096B001 DC096B002 DC096C001 DC096C002 DC096H001	0.7 to 6.8mgd overflow rates	$2.25	$2.27
Conveyance Piping	24-in diameter	$3.20	$3.28

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

MH-77 is not a multi-municipal POC and therefore has no upstream tributary municipalities. As a result, an Inter-Municipal O&M Agreement is not required.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the MH-77 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC MH-77 overflow is not intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the "Selected Plan" to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the "Recommended Plan". This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the "Selected Plan" is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

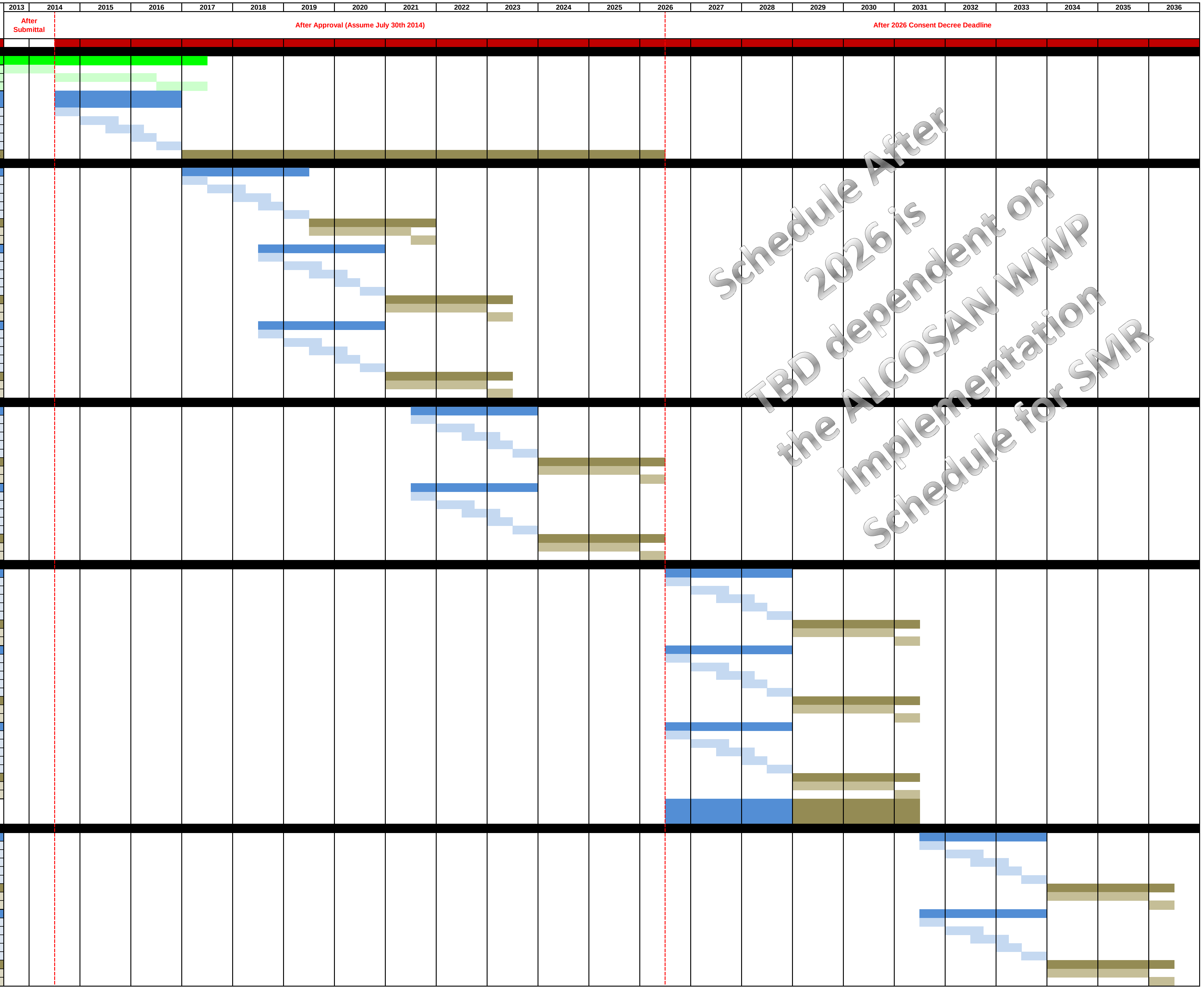
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it's important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements be up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the SMR portion of the regional plan is not being implemented by 2026, and an implementation date is not specified in the plan. Therefore, an implementation schedule for MH-77 improvements cannot be specified at this time as it depends on the ALCOSAN WWP' SMR implementation schedule. The deadline shown in the schedule for MH-77, which is shown in Figure MH77-5-5, is for reference purposes only.

ATTACHMENT B

FIGURE MH77-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the MH-77 sewershed. The PWSA is the only stakeholder municipality/ authority in this sewershed. Therefore Inter-Municipal Agreements are not applicable. The considerations regarding the MH-77 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

There are no cost allocation needs for the improvements in this sewershed.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

There are no inter-municipal agreements needed for the improvements in this sewershed.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this subsection, PWSA provides the plan and schedule for implementing the recommended MH-77 system improvements and the plan to meet regulatory reporting obligations during and after MH-77 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

- Phase I 2013 through 2017
- Phase II 2017 through 2023
- Phase III 2021 through 2026
- Phase IV TBD
- Phase V TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities

that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure MH77-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

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[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

6.3.2 Joint Municipal Planning and Implementation

There are no Joint Municipal Planning and Implementation needs for the improvements in this sewershed.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$6,444,000.
- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance
- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA collection systems that are not directly attributed to the recommended alternative.

For the purpose of submitting the Feasibility Study, inter-municipal agreements regarding O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative is not needed for the improvements in this sewershed.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table MH77-6-1. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE MH77-6-1: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure MH77-6-1.

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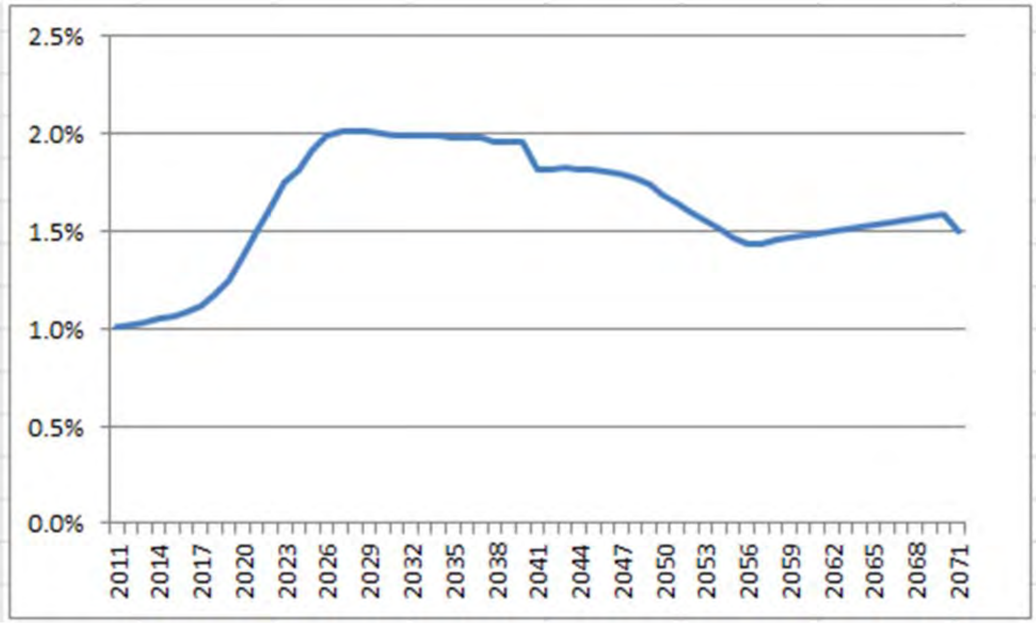
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

FIGURE MH77-6-1 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.

7.0 STAKEHOLDER INVOLVEMENT

For the purpose of developing the PWSA Feasibility Study and this POC-based feasibility study, the PWSA is the sole contributor of flow to the Brookline Boulevard sewershed. Due to the absence of flow from neighboring municipalities, the PWSA did not lead a Wet Weather Feasibility Study Coordination Meeting to facilitate stakeholder participation. Additionally, stakeholder meetings facilitated by 3RWW, titled POC Sewershed Coordination Meetings, were not held for POC MH-77. Other PWSA stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
S-15: MCNEILLY/MCDONOUGH’S RUN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PaDEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PaDEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PaDEP), and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study (of which this POC report is a part) and those of other municipalities will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh, Baldwin Township, Dormont Borough, and Mt. Lebanon. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1 provides the background for this POC FS Report and a description of the existing system.
- Section 2 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.
- Section 3 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.
- Section 4 presents the alternative development process for alternatives that would be implemented for the POC including the technology

screening and site screening processes, alternative development, alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

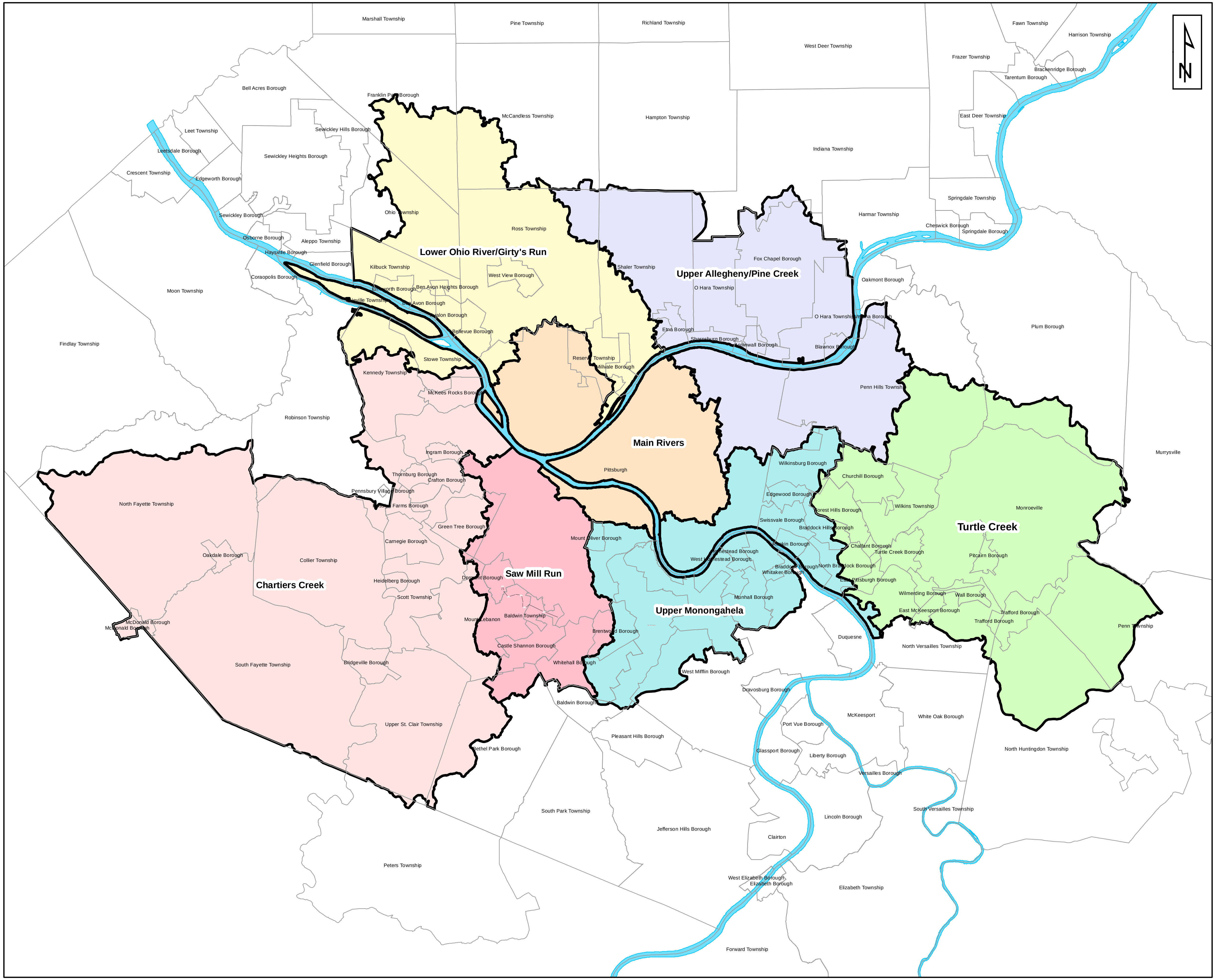
- Section 5 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.
- Section 6 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.
- Section 7 describes how stakeholders were included in the plan development.

1.2 EXISTING SYSTEM DESCRIPTION

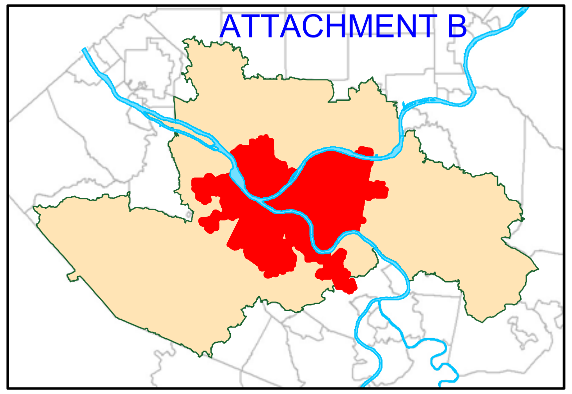
This POC FS Report addresses POC S-15, also known as McNeilly Run and McDonough's Run. The S-15 sewershed is located in the South Hills, within the Saw Mill Run Planning Basin. The Saw Mill Run basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in Figure 1-1.

The existing sewerage facilities in this sewershed are illustrated in Figure 1-2. The S-15 sewershed is served by five minor branch sewers and one main trunk sewer that directly connects to ALCOSAN's Saw Mill Run Interceptor at manhole MH 102. This connection point is commonly referred to as the S-15 POC. The main trunk sewer extends from MH 102 in a northwesterly direction along McNeilly Road to Dewalt Drive in Baldwin Borough. The VCP sewer varies in size from 15 inches to 20 inches in diameter.

There are seven PWSA CSO diversion chambers in the sewershed that overflow to McDonough's Run at six permitted CSOs. The S-15 sewershed encompasses approximately 1,068 acres. The sewershed is made up of 334 acres of the City of Pittsburgh, 175 acres of Baldwin Township, 222 acres of Dormont Borough, and 337 acres of Mt. Lebanon. Refer to Table 1-1 for specific information on this POC.



ATTACHMENT B



ALCOSAN Service Area Overview

Legend

- ☐ Municipal Boundary
- Chartiers Creek
- Lower Ohio River / Girty's Run
- Main Rivers
- Saw Mill Run
- Turtle Creek
- Upper Allegheny / Pine Creek
- Upper Monongahela
- River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

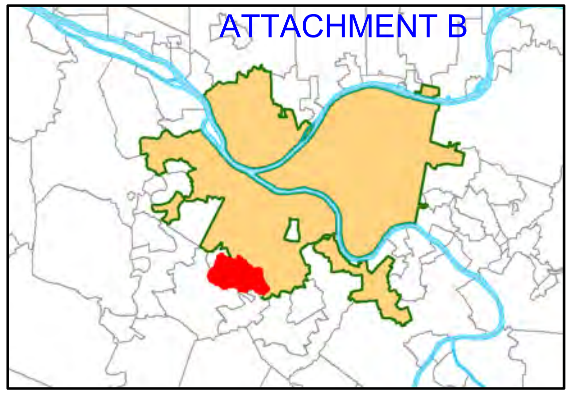
PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

- ● PWSA Diversion Structure
- — Trunk Sewer
- — Collector Sewer
- ☐ S-15 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- ■ River

Existing ALCOSAN Interceptor

- - - Deep Tunnel
- — Shallow Cut

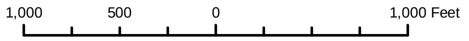


Figure 1-2: S-15 McNeilly/McDonoughs Run Existing Facilities

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Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\McDONOUGHS NUM (S-15)\FIGURE 1-2_S_15Existing Overflows.mxd

TABLE 1-1. SEWERSHED CHARACTERISTICS FOR MUNICIPALITIES TRIBUTARY TO S-15

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY			
	City of Pittsburgh	Baldwin Township	Dormont Borough	Mt. Lebanon[1]
Tributary Area (Acres)	334	175	222	315.04
Municipality Population	4,912	1,116	4,245	1,263
Combined				
Inch-Miles	175	16	0	0
Linear Feet	63,600	4,900	0	0
Inch-Miles/Acre	0.52	0.09	0	0
Separate				
Inch-Miles	22	43	92	79
Linear Feet	13,000	28,200	49,000	43,532
Inch-Miles/Acre	0.07	0.25	0.41	0.25

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows from the upstream PWSA diversion structures tie directly into the Saw Mill Run interceptor with no overflow structure. The Saw Mill Run interceptor conveys those flows to ALCOSAN diversion structure O-14.

A brief description of each permitted overflow is provided below in Table 1-2. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report* (August 2008).

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[1] Data provided by Municipality of Mt. Lebanon per municipal RFI.

TABLE 1-2. KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO S-15

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
139B002	DC096K001 DC139B001	CSO139B002	McNeilly Avenue	McDonough's Run
139A001	DC096N001	CSO139A001	McNeilly Avenue and Sussex Avenue	McDonough's Run
097L001	DC097L001	CSO097L001	Dorchester Avenue	McDonough's Run
139B001	DC139A001	CSO139B001	Rockford Avenue near McNeilly Avenue	McDonough's Run
139F001	DC139B002	CSO139F001	Seaton Street and Creedmore Place	McDonough's Run
139B003	DC139B003	CSO139B003	McNeilly Avenue and Creedmore Place	McDonough's Run

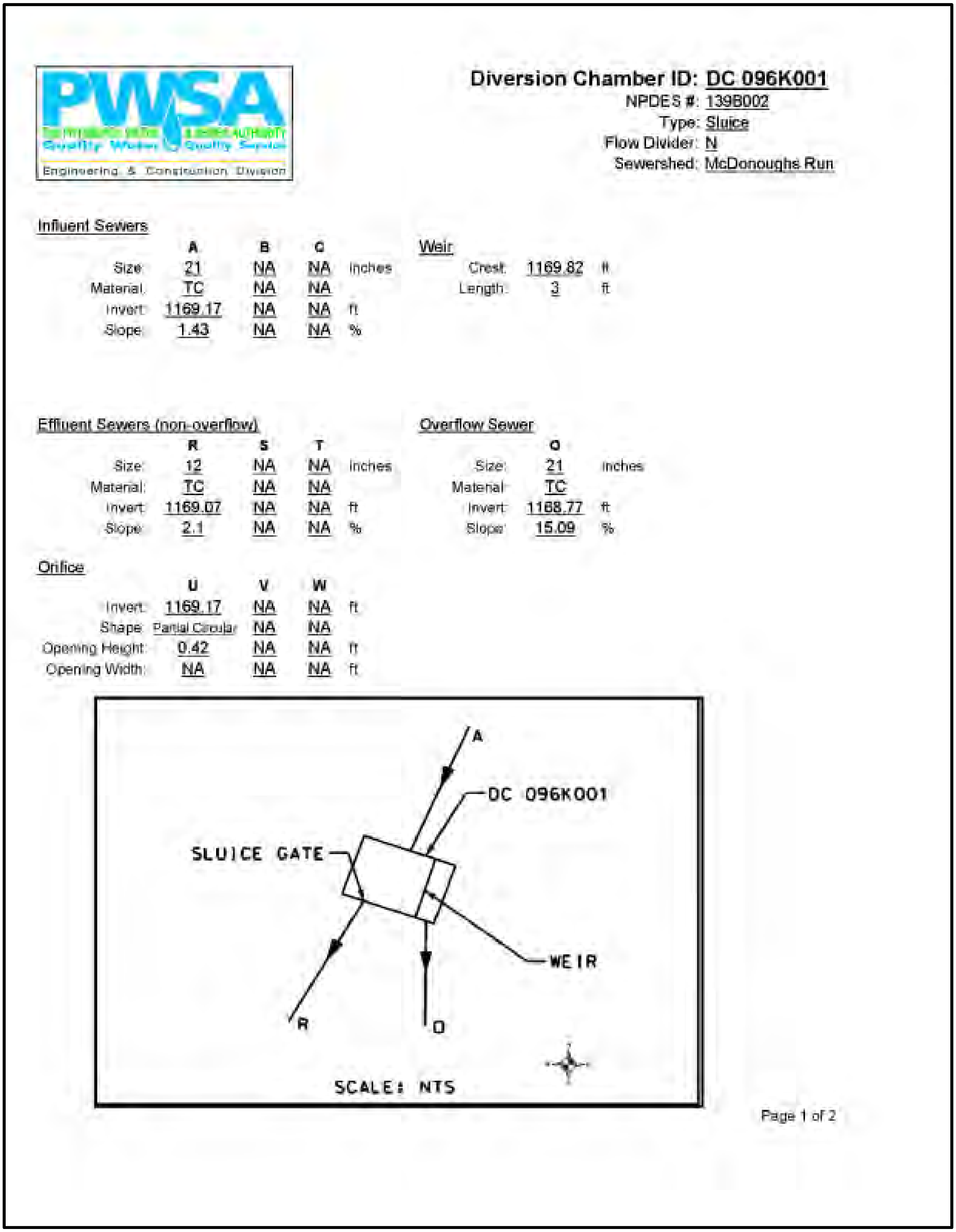
As shown in Table 1-3, during the typical year these seven structures overflow between 2 and 31 times. Overflow volumes range from 30,000 gallons to 1.2 million gallons per event, and from 40,000 gallons to 10.8 million gallons annually, on a structure by structure basis. Annual overflow flow volume for this sewershed is 11.96 million gallons.

TABLE 1-3. S-15 SEWERSHED TYPICAL OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (MG)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC096K001	4	2.31	N/A	N/A	0.04	N/A	N/A	0.06
DC096N001	31	39.53	23.24	11.84	1.2	0.72	0.38	10.78
DC097L001	8	4.31	0.81	N/A	0.22	0.01	N/A	0.37
DC139A001	2	2.06	N/A	N/A	0.03	N/A	N/A	0.04
DC139B001	16	3.66	0.80	0.31	0.11	0.016	0.01	0.30
DC139B002	10	3.03	0.47	N/A	0.07	0.01	0.01	0.146
DC139B003	18	3.44	0.50	0.18	0.07	0.02	0.01	0.26
							Total Annual Volume	**11.96**

1.2.1 Diversion Structure Sketches

The following sketches of the S-15 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.



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Diversion Chamber ID: DC 096K001

NPDES #: 139B002
Type: Sluice
Flow Divider: N
Sewershed: McDonoughs Run

Influent Sewers

	A	B	C	
Size:	21	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1169.17	NA	NA	ft
Slope:	1.43	NA	NA	%

Weir

Crest:	1169.82	ft
Length:	3	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1169.07	NA	NA	ft
Slope:	2.1	NA	NA	%

Overflow Sewer

	O	
Size:	21	inches
Material:	TC	
Invert:	1168.77	ft
Slope:	15.09	%

Orifice

	U	V	W	
Invert:	1169.17	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.42	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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Diversion Chamber ID: DC 096K001

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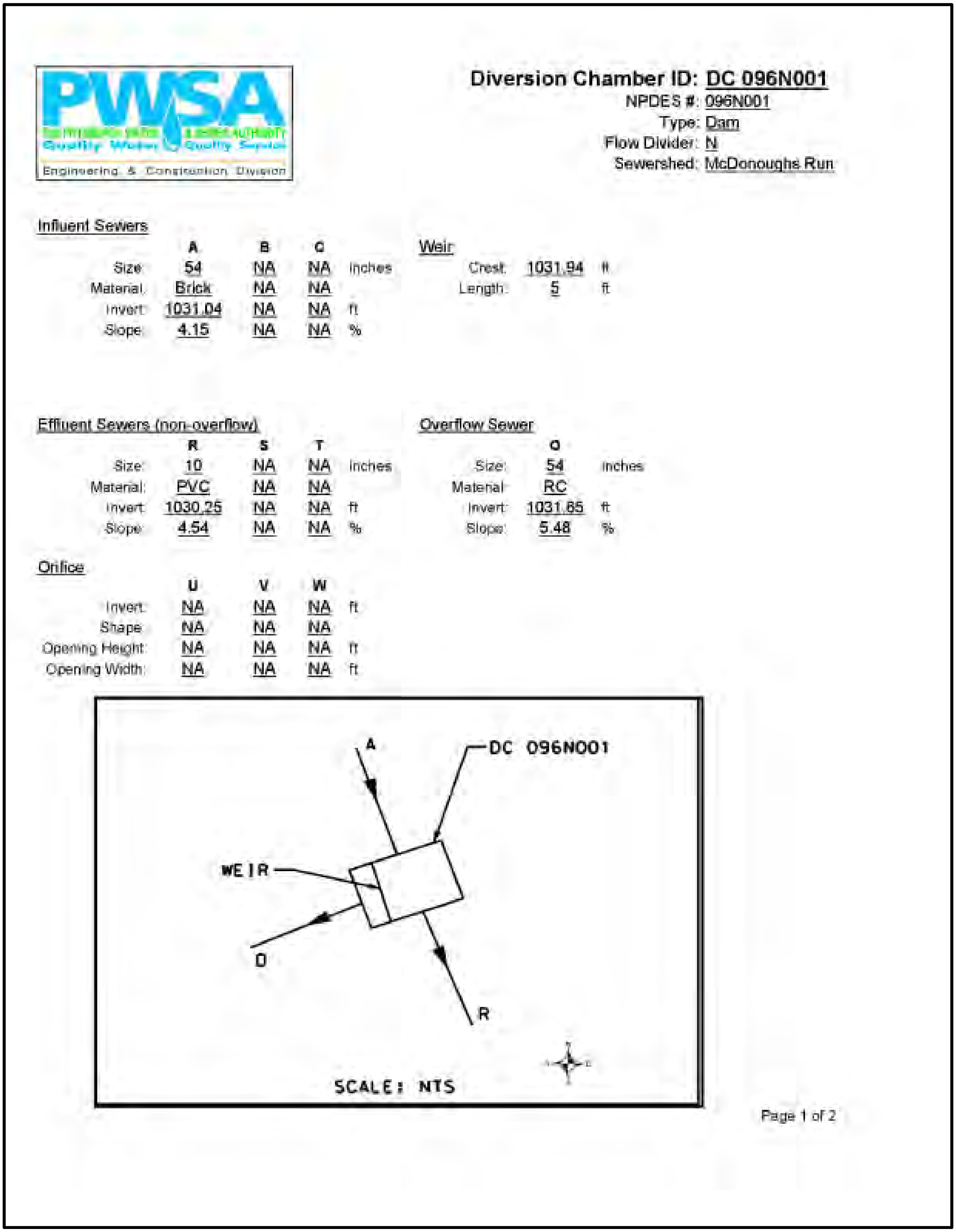

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Diversion Chamber ID: DC 096N001
NPDES #: 096N001
Type: Dam
Flow Divider: N
Sewershed: McDonoughs Run

Influent Sewers

	A	B	C	
Size:	54	NA	NA	inches
Material:	Brick	NA	NA	
Invert:	1031.04	NA	NA	ft
Slope:	4.15	NA	NA	%

Weir

Crest:	1031.94	ft
Length:	5	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	10	NA	NA	inches
Material:	PVC	NA	NA	
Invert:	1030.25	NA	NA	ft
Slope:	4.54	NA	NA	%

Overflow Sewer

	O	
Size:	54	inches
Material:	RC	
Invert:	1031.65	ft
Slope:	5.48	%

Orifice

	U	V	W	
Invert:	NA	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	NA	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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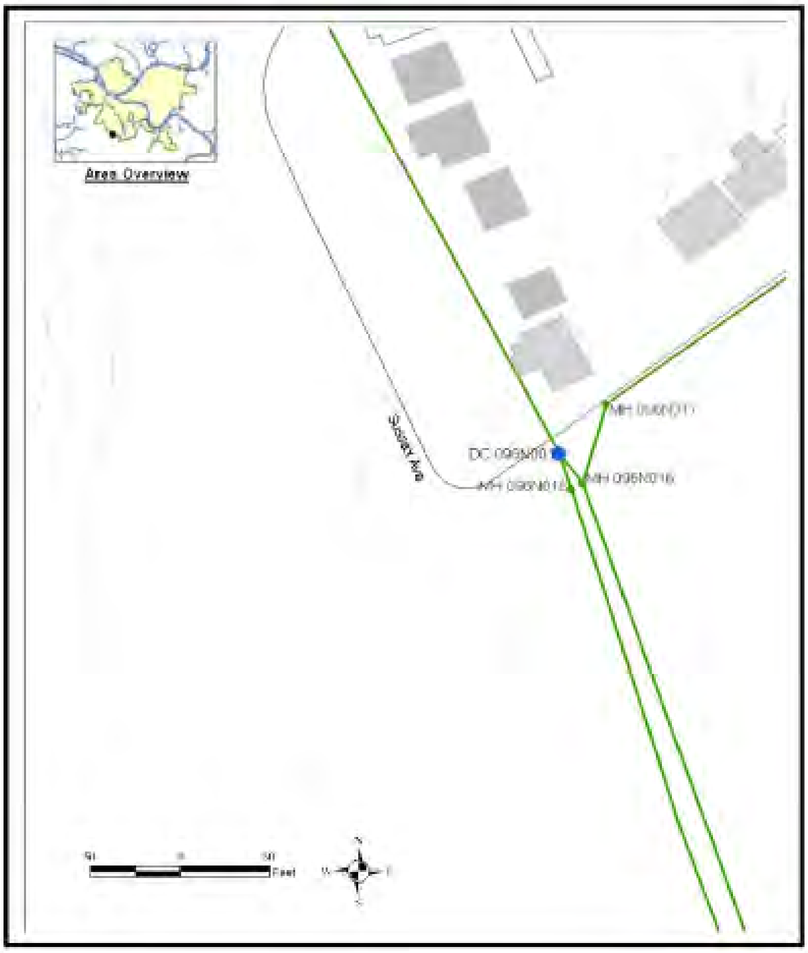
Diversion Chamber ID: DC 096N001



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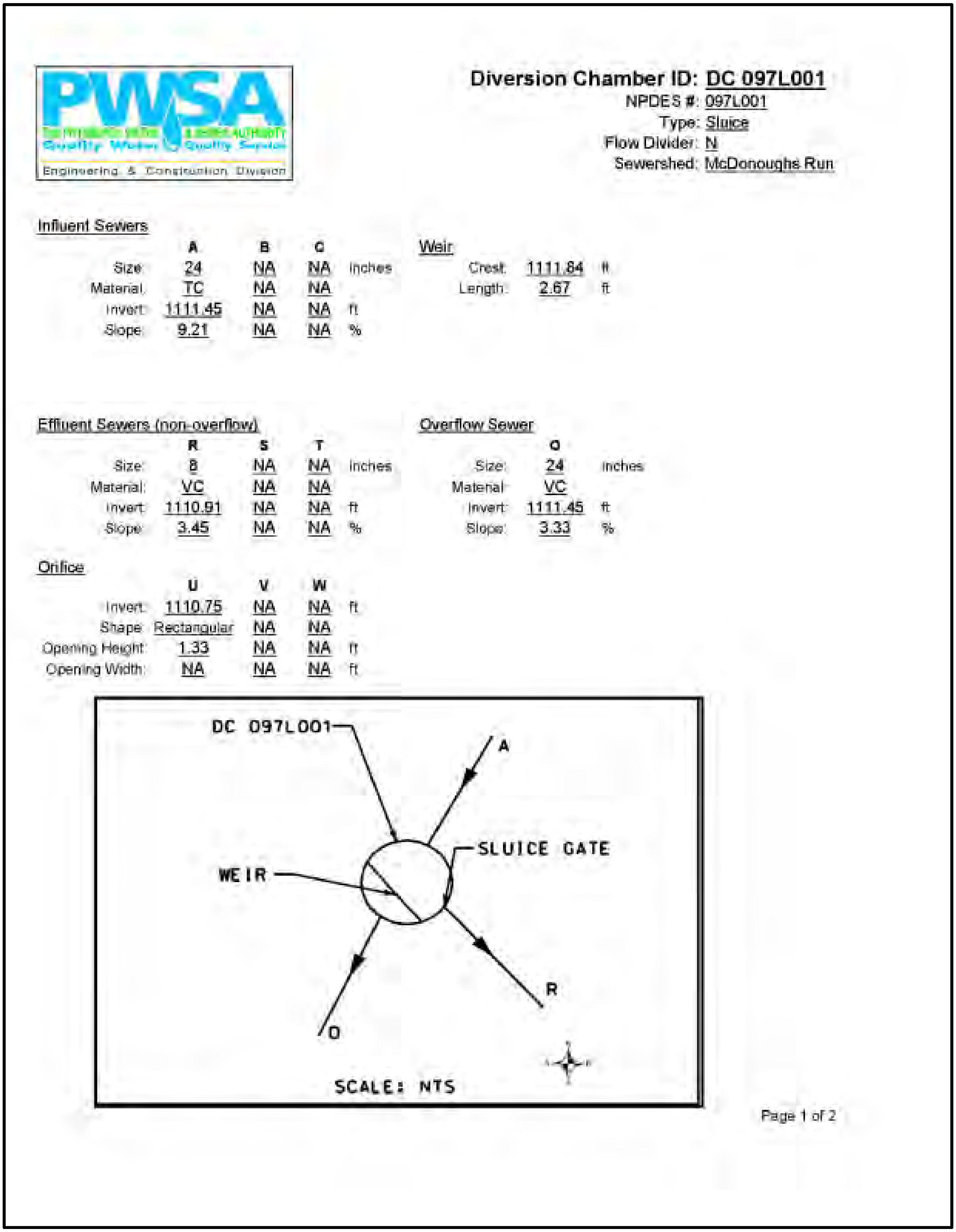

PWSA
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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 097L001

NPDES #: 097L001
Type: Sluice
Flow Divider: N
Sewershed: McDonoughs Run

Influent Sewers

	A	B	C	
Size:	24	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1111.45	NA	NA	ft
Slope:	9.21	NA	NA	%

Weir

Crest:	1111.84	ft
Length:	2.67	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	VC	NA	NA	
Invert:	1110.91	NA	NA	ft
Slope:	3.45	NA	NA	%

Overflow Sewer

	O	
Size:	24	inches
Material:	VC	
Invert:	1111.45	ft
Slope:	3.33	%

Orifice

	U	V	W	
Invert:	1110.75	NA	NA	ft
Shape:	Rectangular	NA	NA	
Opening Height:	1.33	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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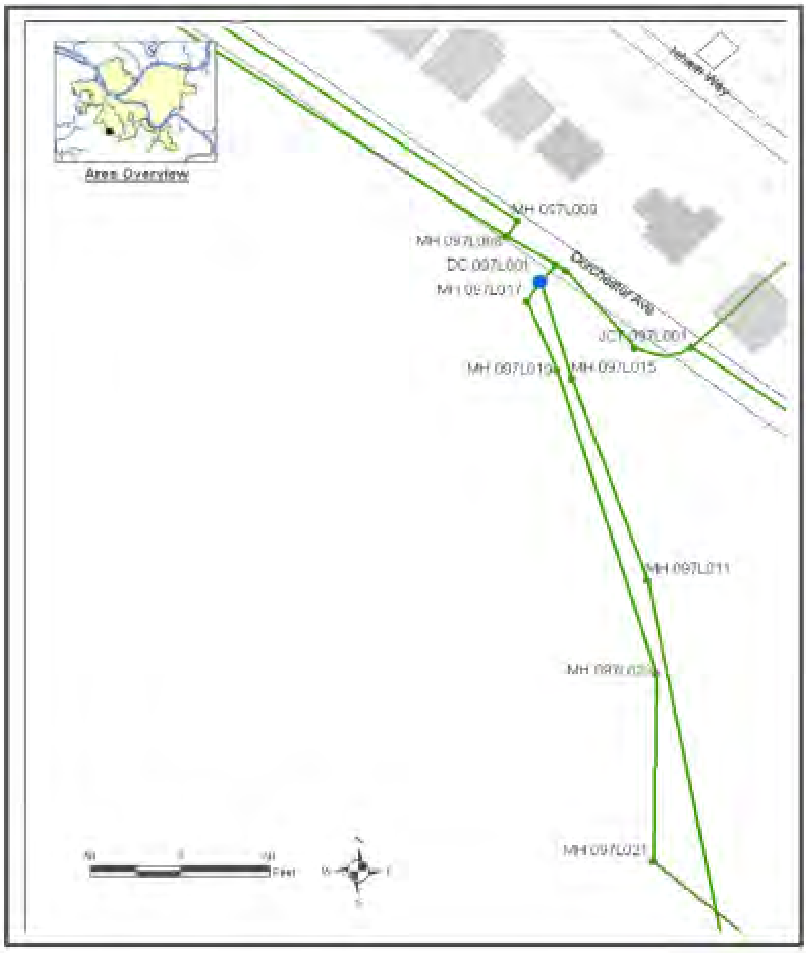
Diversion Chamber ID: DC 097L001



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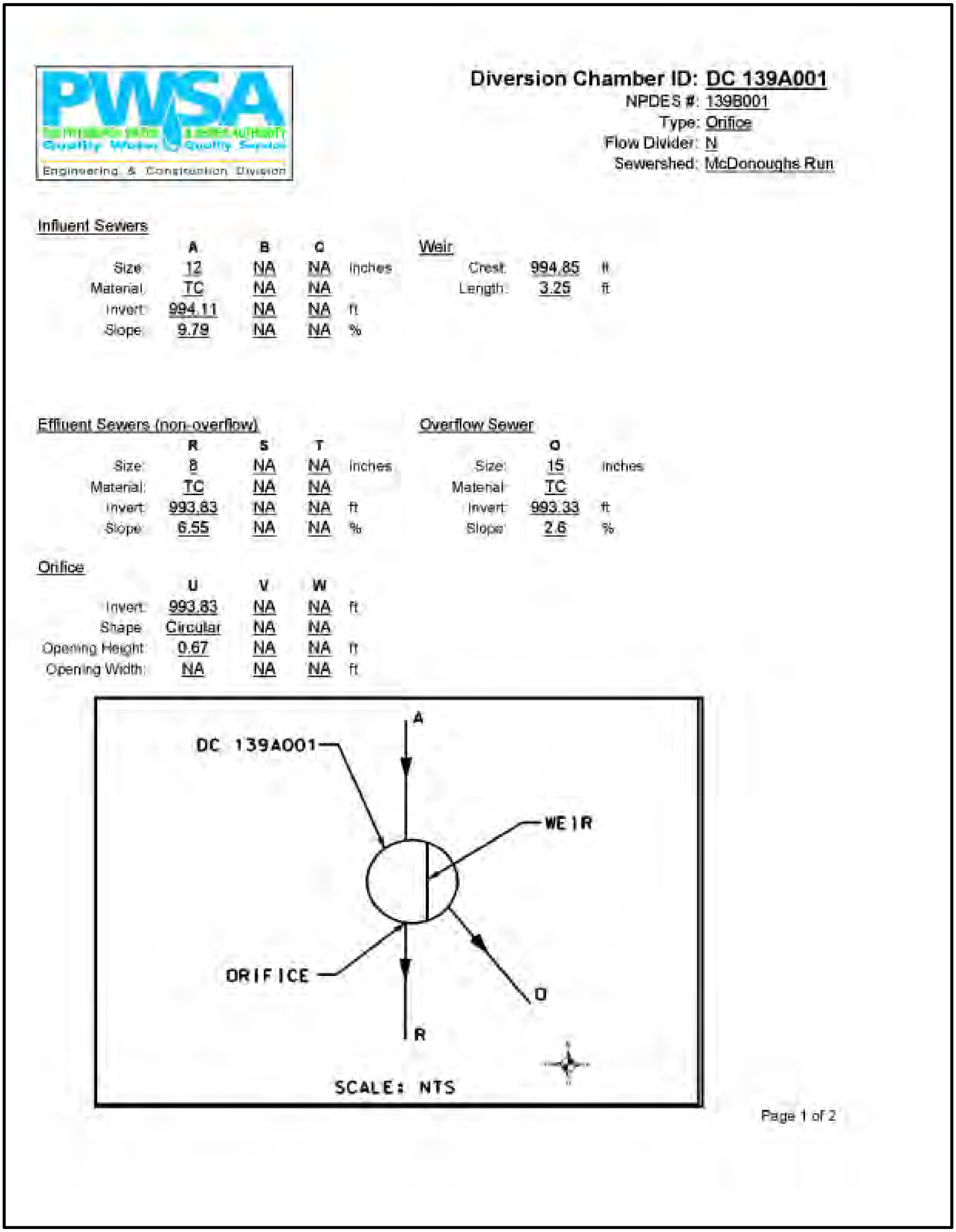

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Diversion Chamber ID: DC 139A001
NPDES #: 139B001
Type: Orifice
Flow Divider: N
Sewershed: McDonoughs Run

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	994.11	NA	NA	ft
Slope:	9.79	NA	NA	%

Weir

Crest:	994.85	ft
Length:	3.25	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	993.83	NA	NA	ft
Slope:	6.55	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	993.33	ft
Slope:	2.6	%

Orifice

	U	V	W	
Invert:	993.83	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	0.67	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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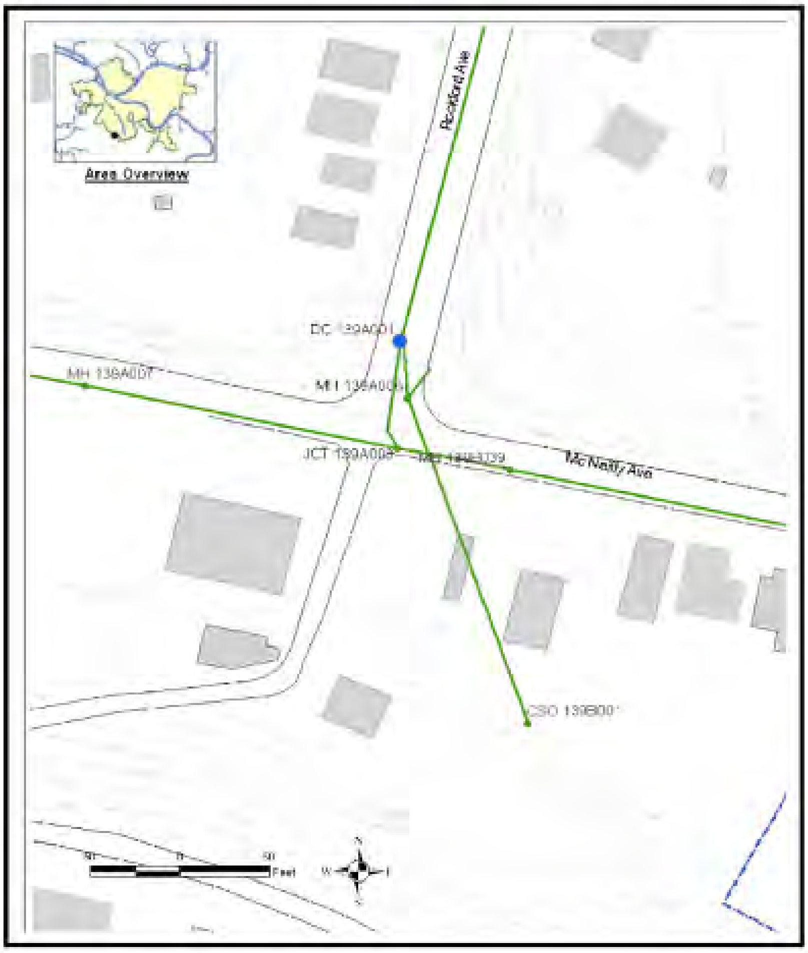
Diversion Chamber ID: DC 139A001



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Diversion Chamber ID: DC 139B001
NPDES #: 139B002
Type: Orifice
Flow Divider: N
Sewershed: McDonoughs Run

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	992.62	NA	NA	ft
Slope:	4.27	NA	NA	%

Weir

Crest:	993.12	ft
Length:	2.35	ft

Effluent Sewers (non-overflow)

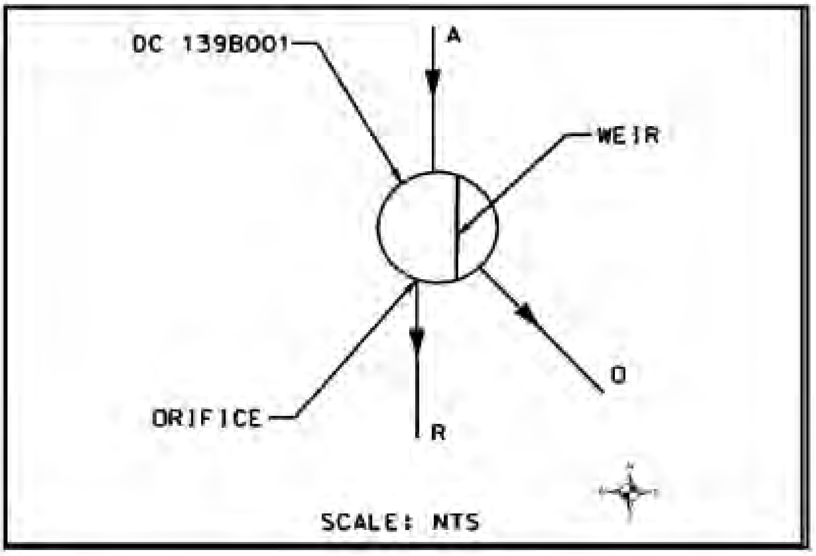
	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	992.52	NA	NA	ft
Slope:	14.6	NA	NA	%

Overflow Sewer

	O	
Size:	18	inches
Material:	TC	
Invert:	991.72	ft
Slope:	2.72	%

Orifice

	U	V	W	
Invert:	992.52	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	0.67	NA	NA	ft
Opening Width:	NA	NA	NA	ft



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Diversion Chamber ID: DC 139B001

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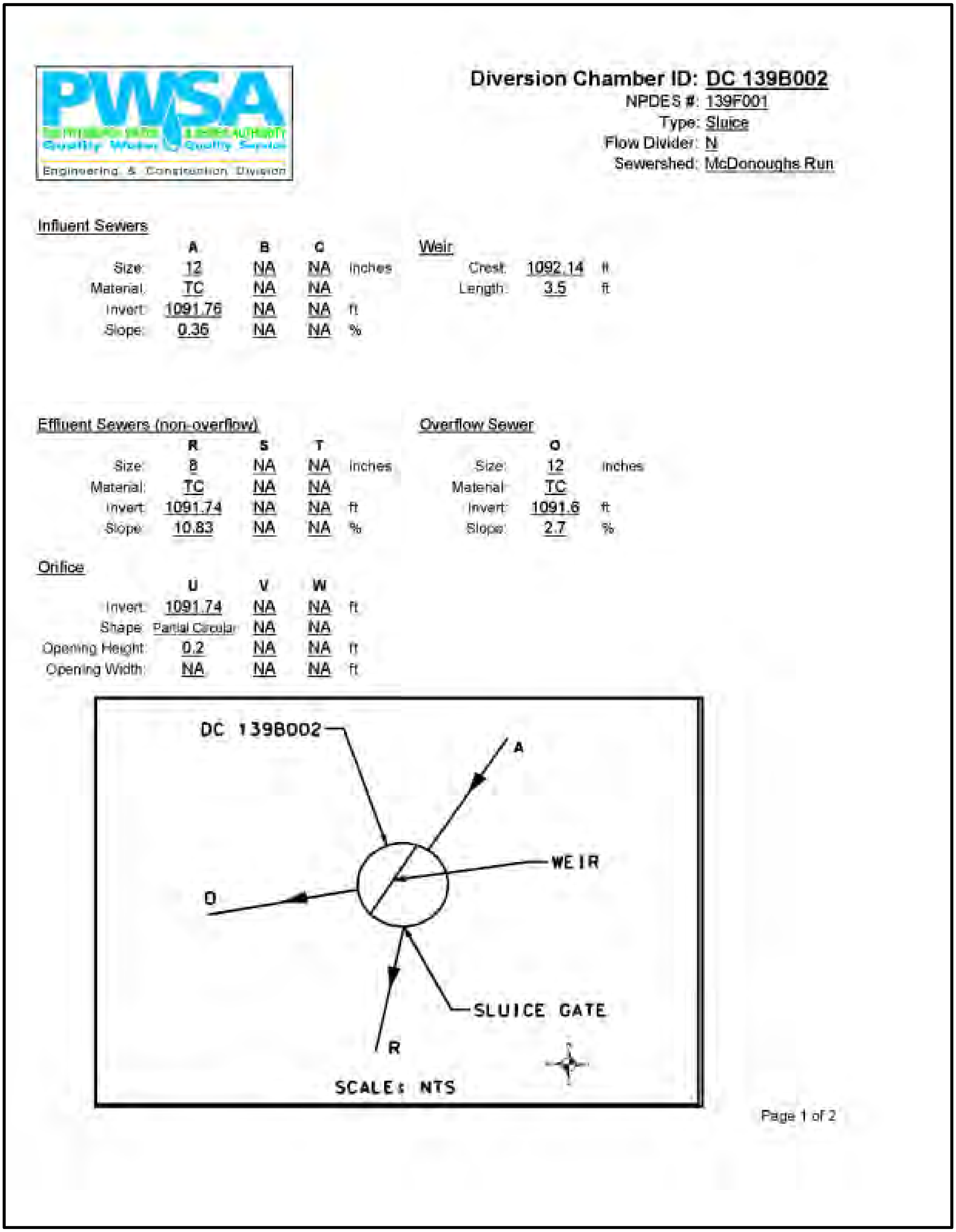

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Engineering & Construction Division

Diversion Chamber ID: DC 139B002
NPDES #: 139F001
Type: Sluice
Flow Divider: N
Sewershed: McDonoughs Run

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1091.76	NA	NA	ft
Slope:	0.36	NA	NA	%

Weir

Crest:	1092.14	ft
Length:	3.5	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1091.74	NA	NA	ft
Slope:	10.83	NA	NA	%

Overflow Sewer

	O	
Size:	12	inches
Material:	TC	
Invert:	1091.6	ft
Slope:	2.7	%

Orifice

	U	V	W	
Invert:	1091.74	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.2	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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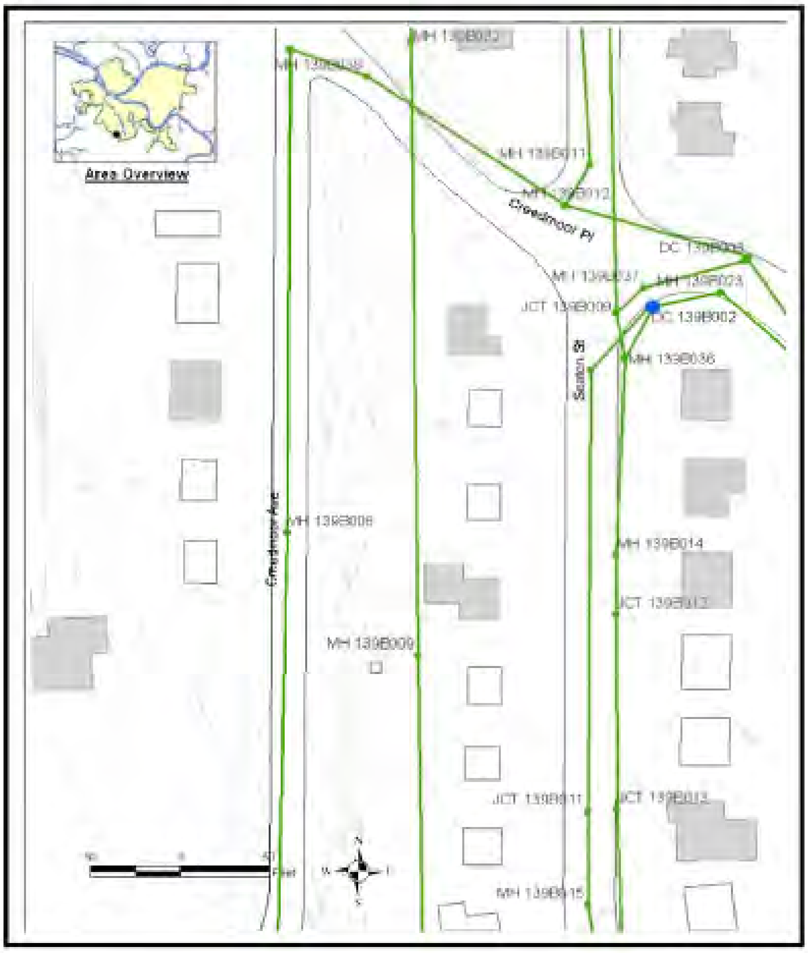
Diversion Chamber ID: DC 139B002



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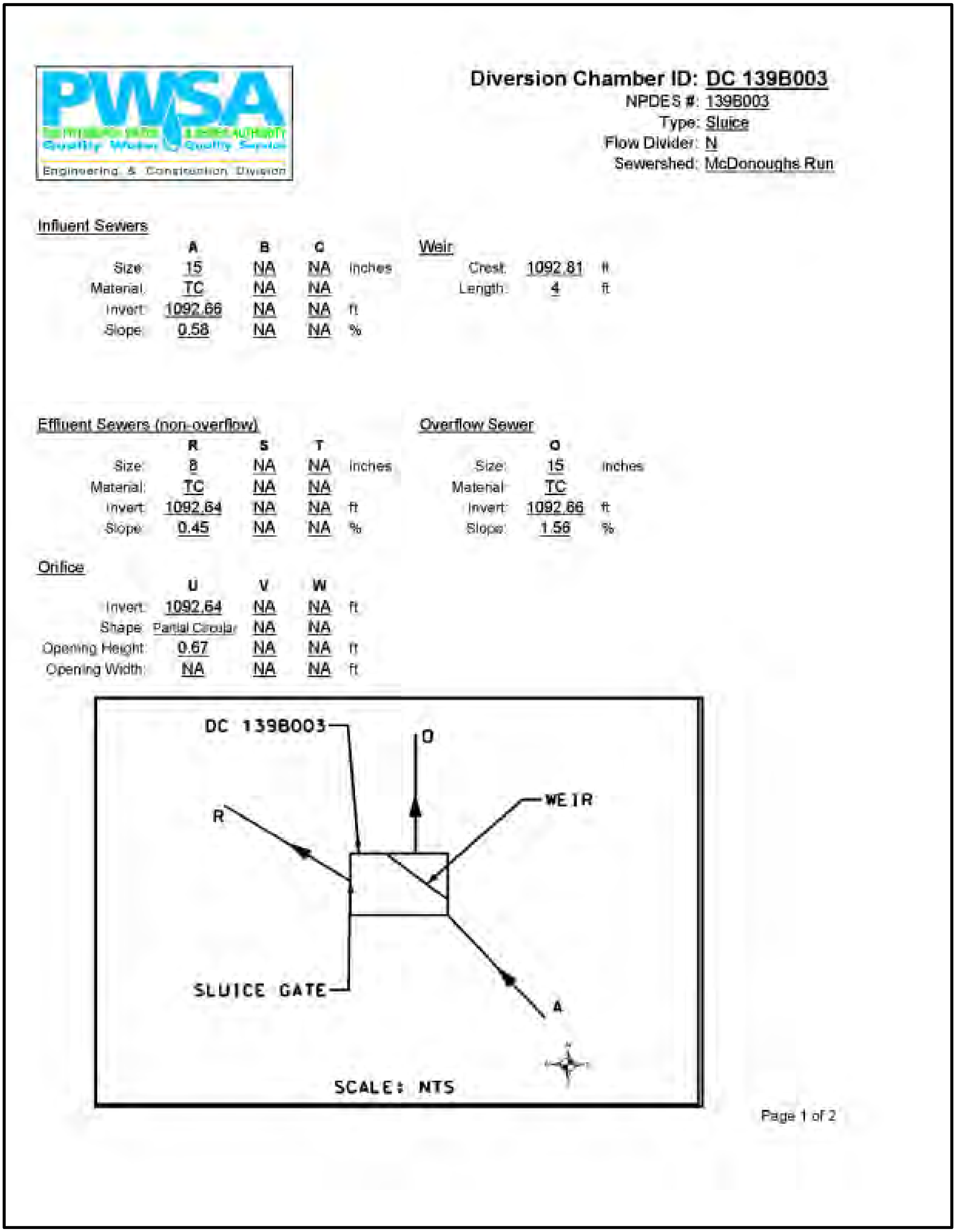

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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 139B003
NPDES #: 139B003
Type: Sluice
Flow Divider: N
Sewershed: McDonoughs Run

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1092.66	NA	NA	ft
Slope:	0.58	NA	NA	%

Weir

Crest:	1092.81	ft
Length:	4	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1092.64	NA	NA	ft
Slope:	0.45	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	1092.66	ft
Slope:	1.56	%

Orifice

	U	V	W	
Invert:	1092.64	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.67	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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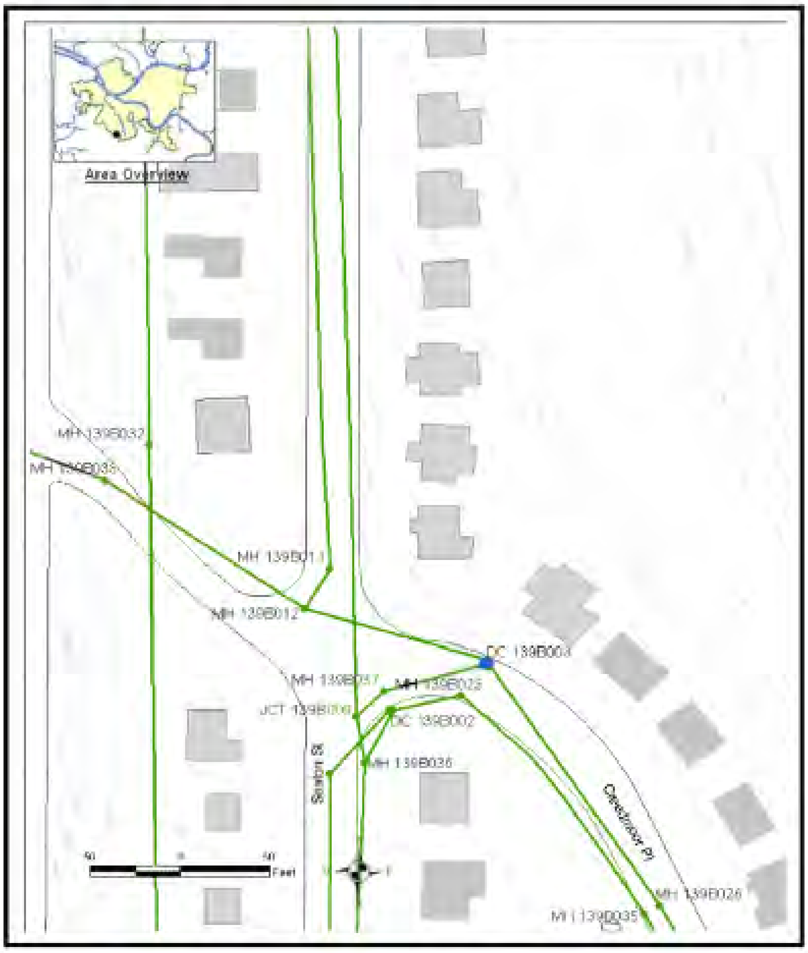
Diversion Chamber ID: DC 139B003



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2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC S-15: McNeilly/McDonough's Run through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Saw Mill Run Basin Planners (SMR_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system tributary to S-15, and the Future Baseline overflow frequency and volumes for S-15.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the PWSA Feasibility Study Report (October, 2008), PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. Nine (9) flow meters located within the S-15 sewershed were used in the RCS-FMP. Details on the nine (9) RCS-FMP flow monitors installed within the S-15 sewershed are found in *Table 2-1. S-15 Summary of RCS-FMP Flow Meters.*

TABLE 2-1. S-15 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Type	Monitor Term[1]
S1500__-IM_-S-08_	Baldwin Township	IM	S
S1500__-MB_-L-01_	Baldwin Township	MB	L
S1500__-MB_-L-02_	Baldwin Township	MB	L
S1500__-MB_-L-04_	Municipality of Mt. Lebanon	MB	L
S1500__-MB_-L-05_	Municipality of Mt. Lebanon	MB	L
S1500__-MB_-L-06_	Municipality of Mt. Lebanon	MB	L
S1500__-MB_-L-07_	Municipality of Mt. Lebanon	MB	L
S1500__-OSC-M-03_	Baldwin Township	OSC	M
S1500__-POC-L-01A	City of Pittsburgh	POC	L

[1]Short Term: 3-months to 6 months. Long Term: 1-year minimum to 21-month maximum.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).
- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.
- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.

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[1] The flow monitor information in this table is from a file titled "Summary of Program Monitors by Name, Type and Dates.xls". This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled "Summary and Report of Flow Monitoring June 2009".

- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the S-15 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the S-15 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.

- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The average daily flows, GWI ratio, and GWI per inch-mile of sewer for each flow monitor within the S-15 sewershed are listed in *Table 2-2. S-15 Dry Weather Flow Statistics During Baseline Conditions*. The GWI ratio is an estimated amount of the

DWF that can be associated with GWI compared to the DWF peaking factor (i.e. Average Daily Maximum Flow vs. Average Daily Minimum Flow). Relatively high GWI ratios, up to 0.8, can be seen at some of the meters.

TABLE 2-2. S-15 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

Flow Monitor[1]	Average Daily Flow (ADF) (mgd)	Average Daily Flow (ADF) (gpcpd)	DWF Peaking Factor (ADF Max/ ADF Min)	GWI Ratio (min/avg)
S1500_-POC-L-01A	2.6	213	1.5	0.8
S1500_-IM_-S-08_	<0.1	214	6.8	0.3
S1500_-MB_-L-01_	1.8	150	1.6	0.8
S1500_-MB_-L-04_	1.1	173	2.0	0.7
S1500_-MB_-L-05_	0.1	111	2.4	0.6
S1500_-MB_-L-06_	0.4	196	2.0	0.6
S1500_-MB_-L-07_	0.3	98	4.0	0.4
S1500_-OSC-M-03_	0.6	306	1.6	0.8

[1] Flow for S1500-MB-L-02_ was not included in the source document for this table. No explanation was given.

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in *Table 2-3*: S-15 *Existing and Future Baseline Conditions for Dry Weather Flows.*

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[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Saw Mill Run Planning Basin – Table 2.3.

TABLE 2-3. S-15 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
S-15	2.36	2.38	0.8%

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event. RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWF for existing and future Baseline Conditions for S-15 are presented in *Table 2-4: S-15 Existing and Future Baseline Conditions for Wet Weather Flows*.

TABLE 2-4. S-15 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
S-15	10.6	10.6	0.0%

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[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.4
[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.5

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure 2-2A. S-15 Sewershed Main Trunk Sewer Profile-1 and *Figure 2-2B. S-15 Sewershed Main Trunk Sewer Profile-2* present the computed hydraulic profiles of the existing S-15 main trunk sewer system under projected 2-year design storm peak flow conditions.

As is indicated in the figures, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding, occurs along the length of the trunk sewer.

Figure 2-3A. S-15 Sewershed Main Trunk Sewer Profile-3 and *Figure 2-3B. S-15 Sewershed Main Trunk Sewer Profile-4* present the computed hydraulic profiles of the existing McDonough's Run main trunk sewer system under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along the length of the trunk sewer.

Figure 2-4A. S-15 Sewershed Main Trunk Sewer Profile-5 and *Figure 2-4B. S-15 Sewershed Main Trunk Sewer Profile-6* present the computed hydraulic profiles of the existing McDonough's Run main trunk sewer system under projected 10-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along the length of the trunk sewer.

Computed flow hydrographs for each of the design storms at the ALCOSAN point of connection (S-15) are presented in *Figure 2-5: S-15 Sewershed Peak Flow Rates to ALCOSAN POC.* It is noted that the peak flows reaching the POC are truncated due to extensive manhole surcharging and manhole flooding.

FIGURE 2-1A. S-15 SEWERSHED MAIN TRUNK SEWER PROFILE-1

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

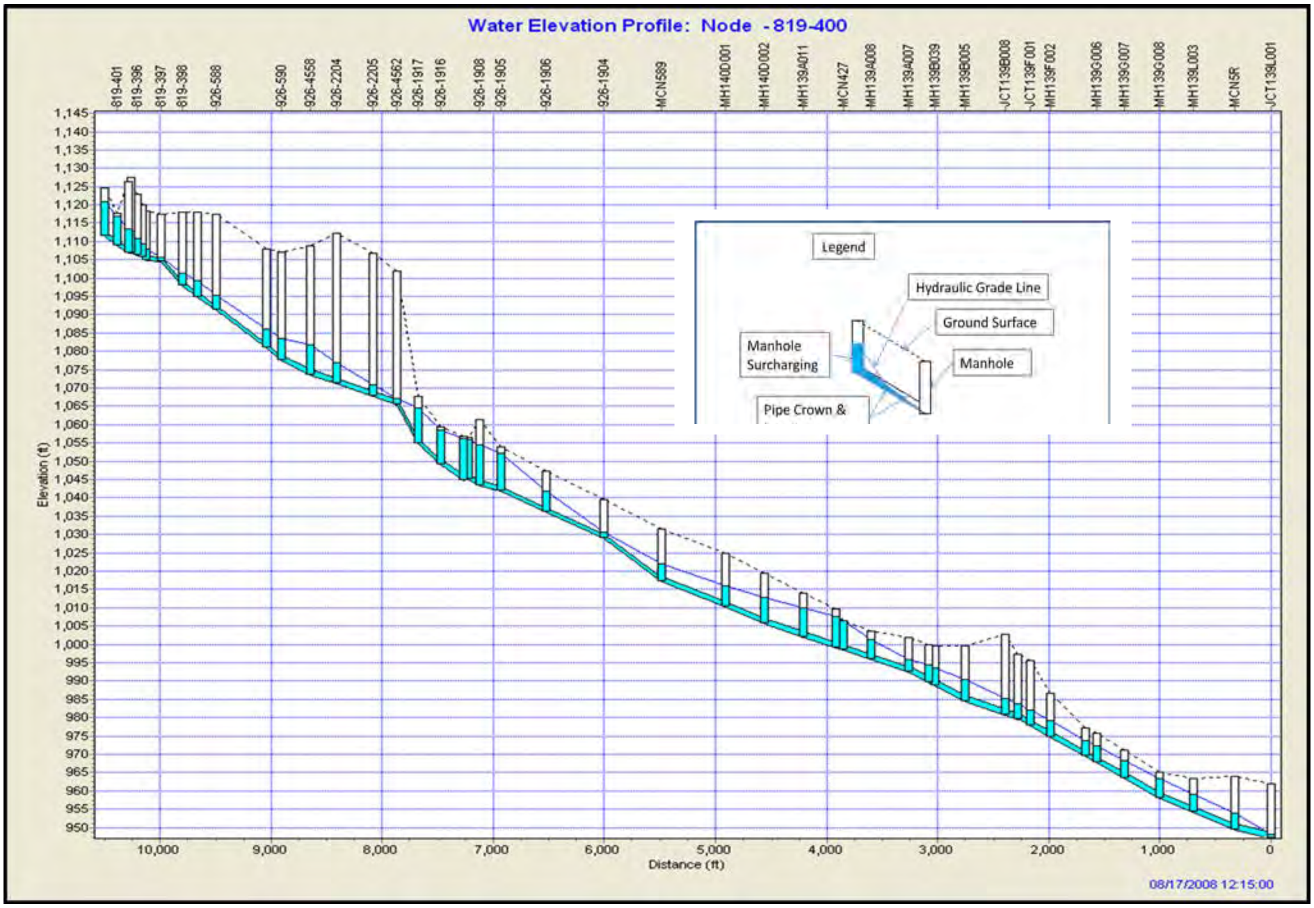


FIGURE 2-1B. S-15 SEWERSHED MAIN TRUNK SEWER PROFILE-2

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

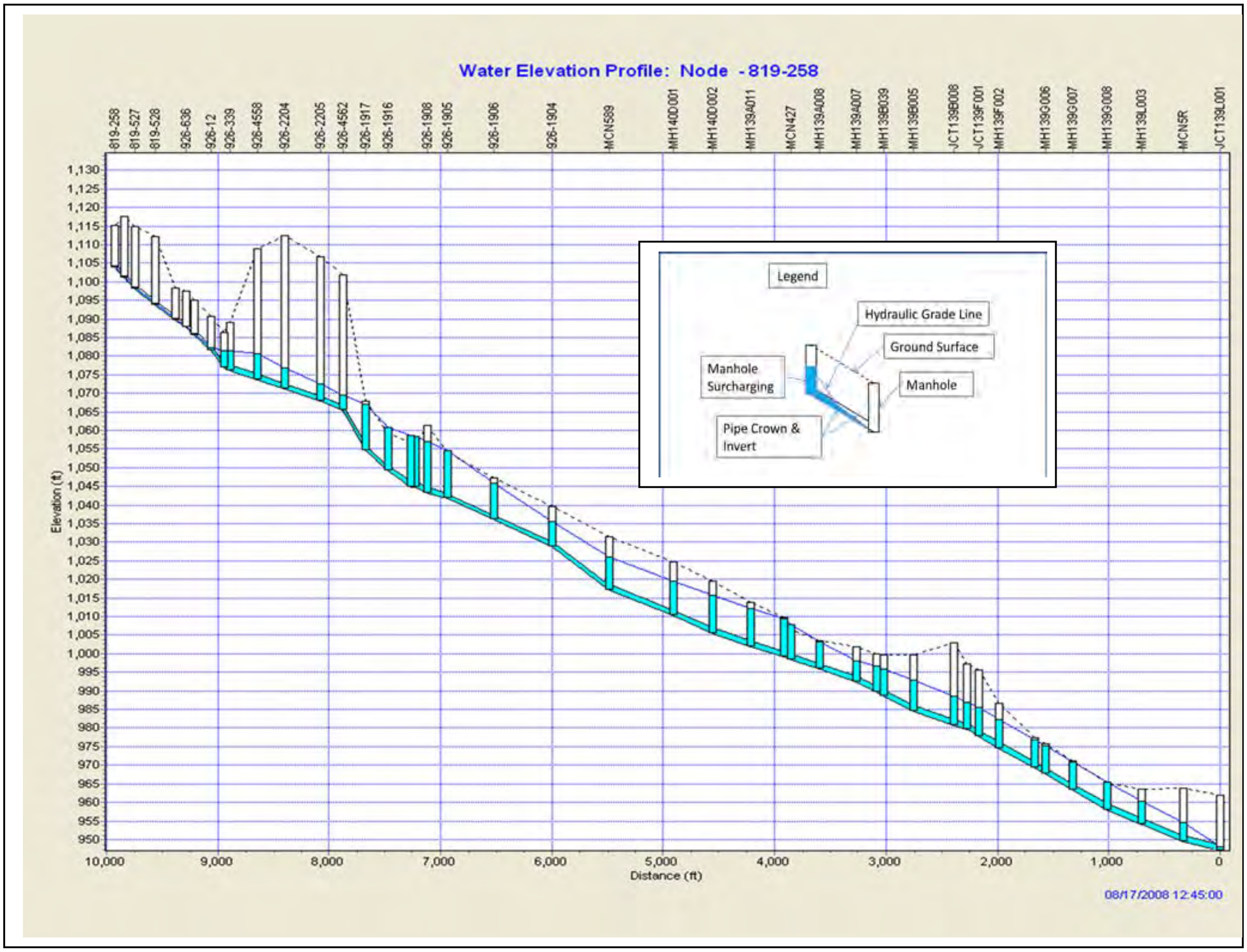


FIGURE 2-2A. S-15 SEWERSHED MAIN TRUNK SEWER PROFILE-3

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

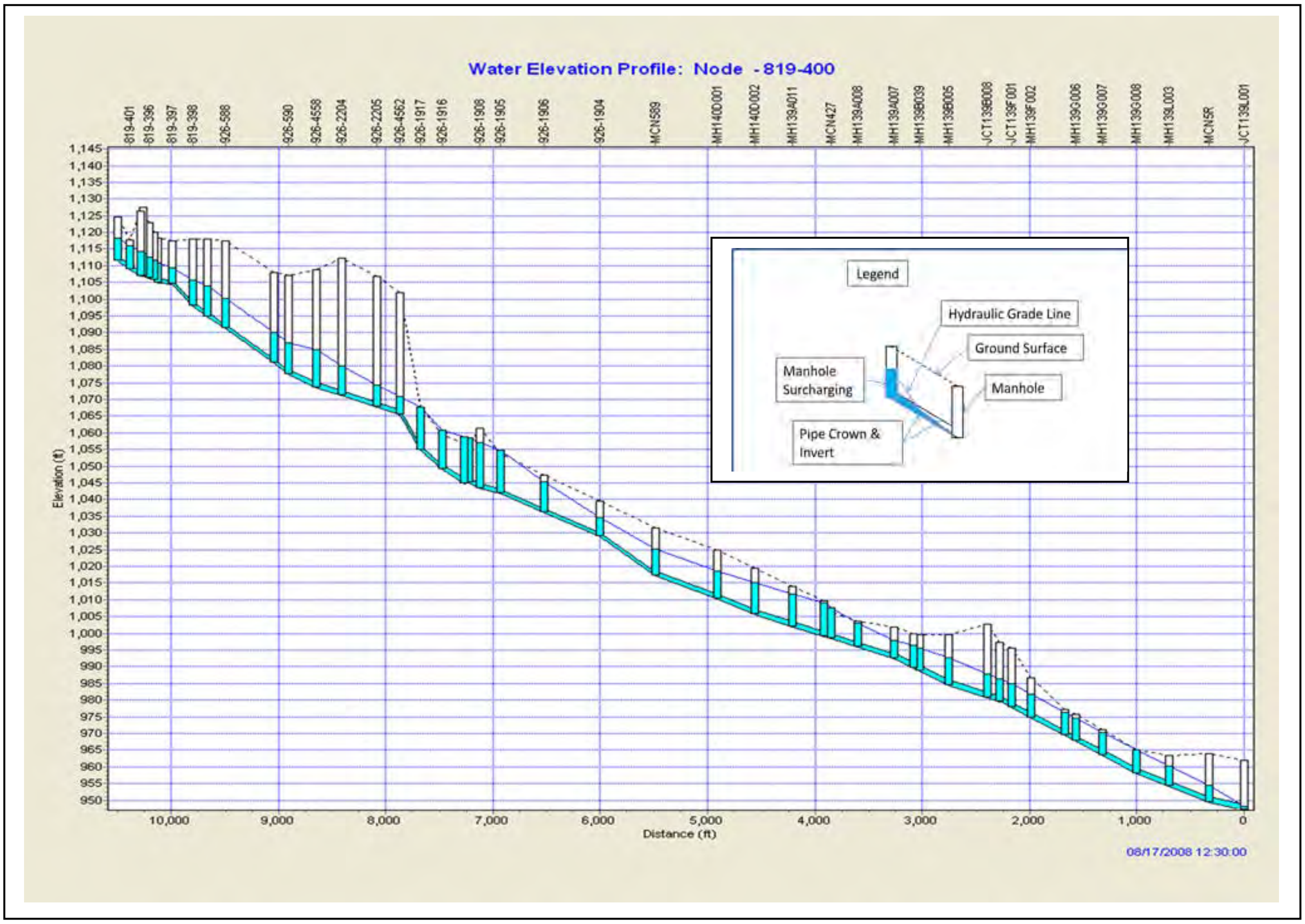


FIGURE 2-2B. S-15 SEWERSHED MAIN TRUNK SEWER PROFILE-4

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

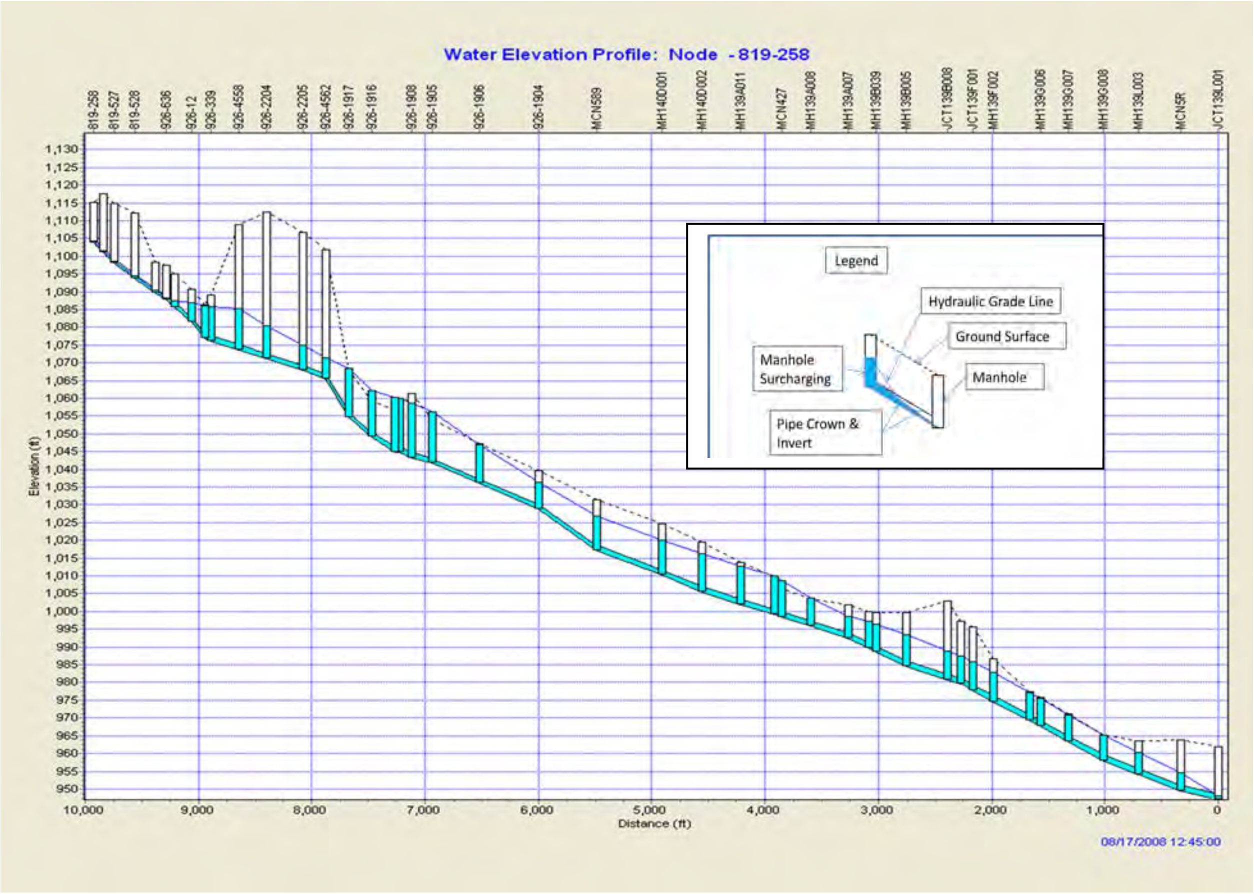


FIGURE 2-3A. S-15 SEWERSHED MAIN TRUNK SEWER PROFILE-5

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

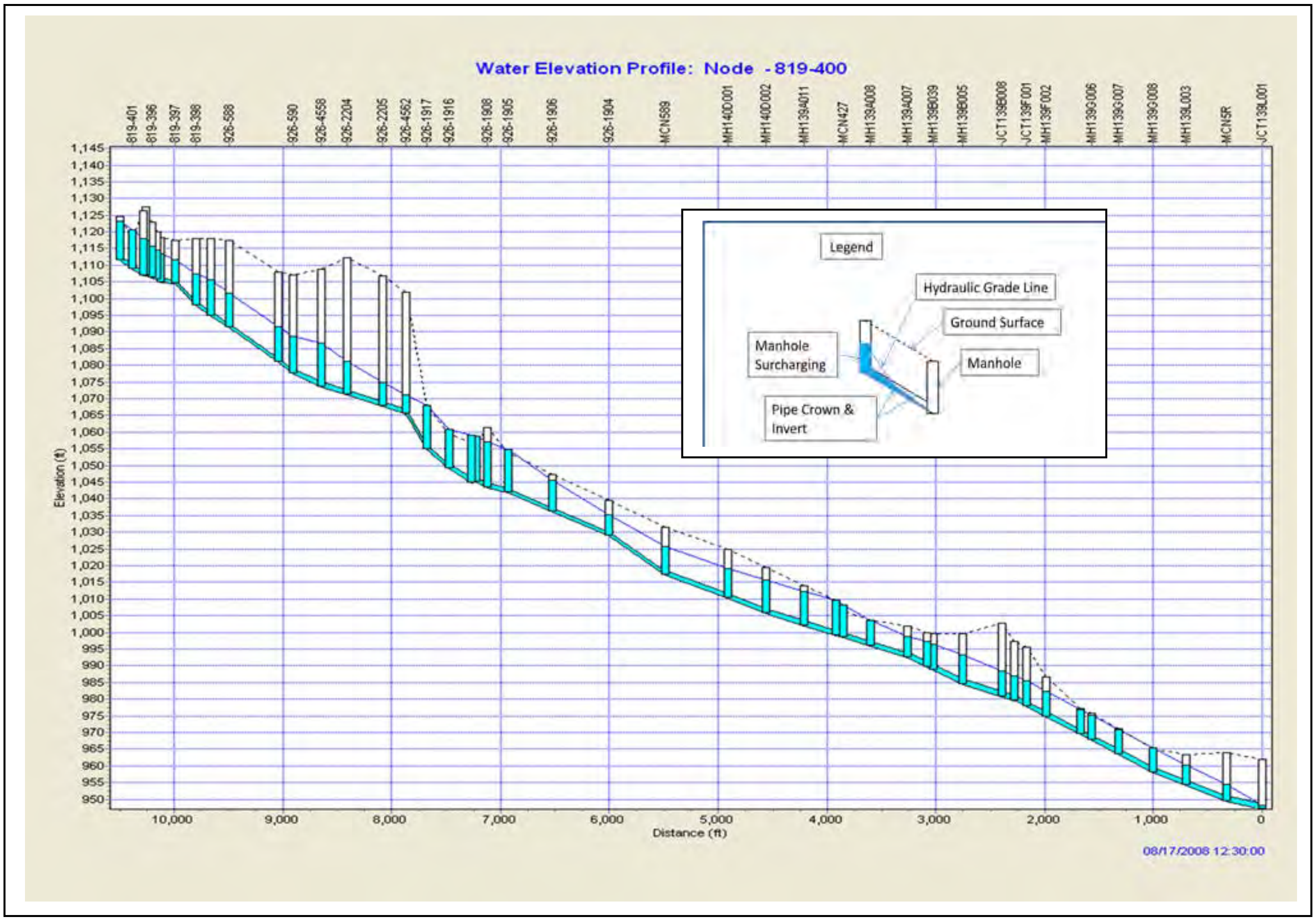


FIGURE 2-3B. S-15 SEWERSHED MAIN TRUNK SEWER PROFILE-6

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

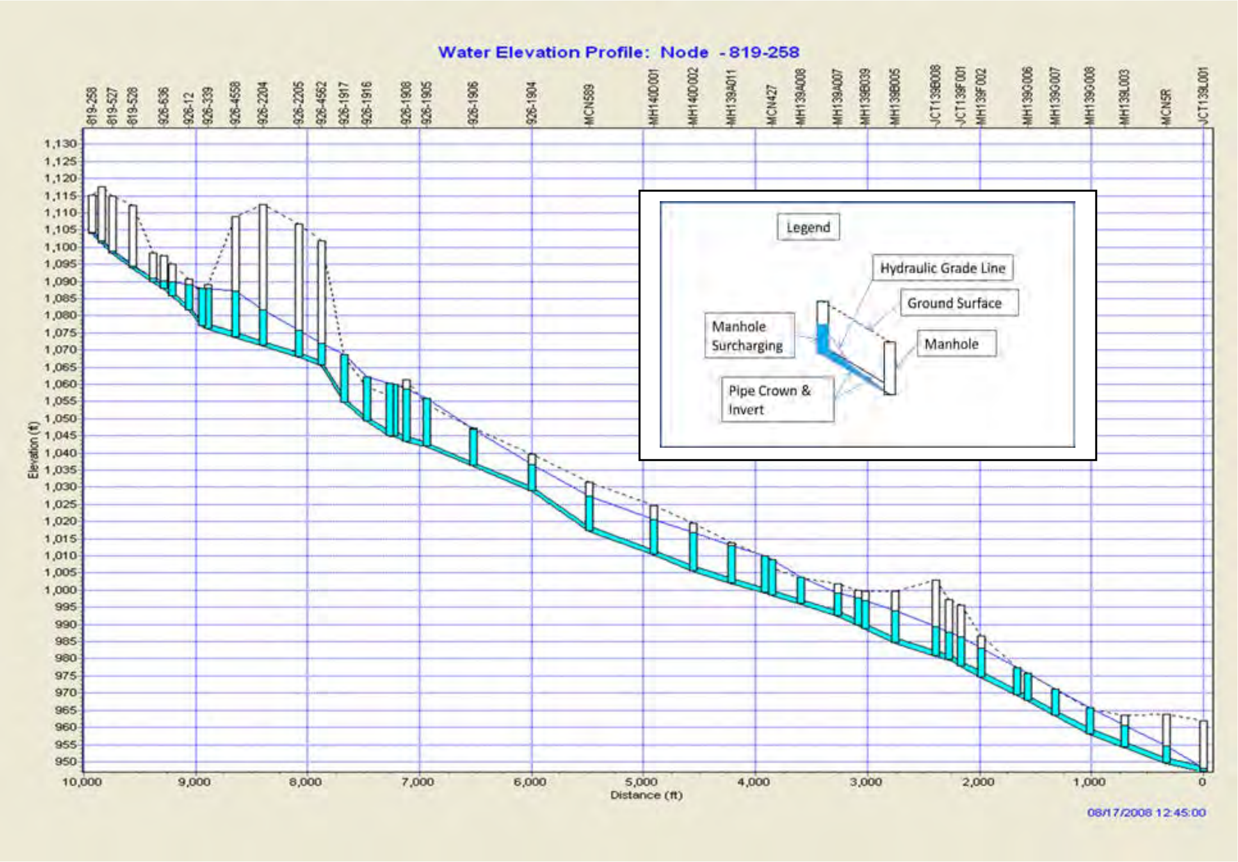
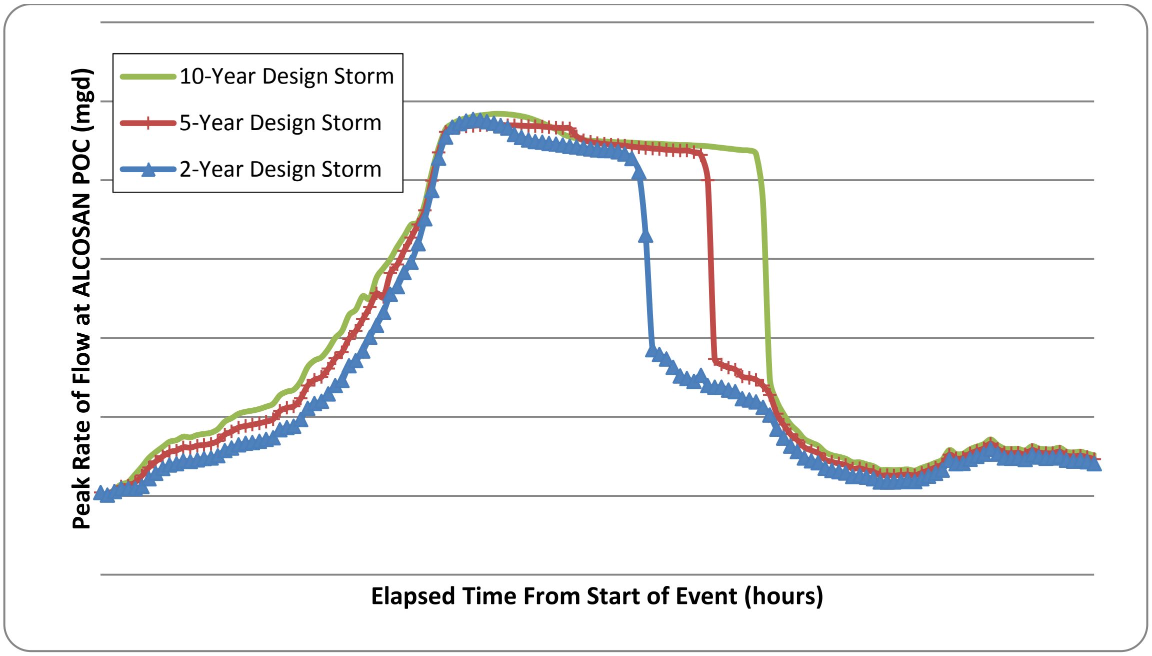


FIGURE 2-4. S-15 SEWERSHED PEAK FLOW RATES TO ALCOSAN POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

Table 2-5 presents a summary of the identified chronic basement flooding locations within the PWSA portion of this sewershed. The neighboring municipalities, with the exception of Mt. Lebanon, that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. Mt. Lebanon has indicated via response to a request for information letter that their municipality has no basement backups within S-15.

The data presented in Table 2-5 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE 2-5. S-15 CHRONIC BASEMENT BACKUP LOCATIONS (PWSA SYSTEM)[5]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
826 Berkshire Avenue	3	2010
1508 Berkshire Avenue	2	2008

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the S-15 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in *Figure 2-6. S-15 Sewershed Main Trunk Sewer Profile-7* and *Figure 2-6. S-15 Sewershed Main Trunk Sewer*

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[5] Information from analysis of PWSA SAP system

Profile-8. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per year, 2-year design storm level of control conditions. This is the least stringent level of control and it produces the smallest peak flows that require conveyance to the point of connection.

The figure shows that even at the smallest peak flow condition, the existing trunk sewer system does not have sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding. These results validate the findings and recommendations of the Draft Feasibility Study that anticipated the need to construct a consolidation/relief sewer to supplement the capacity of the existing trunk sewer system.

FIGURE 2-5A. S-15 SEWERSHED MAIN TRUNK SEWER PROFILE-7

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF per Typical Year

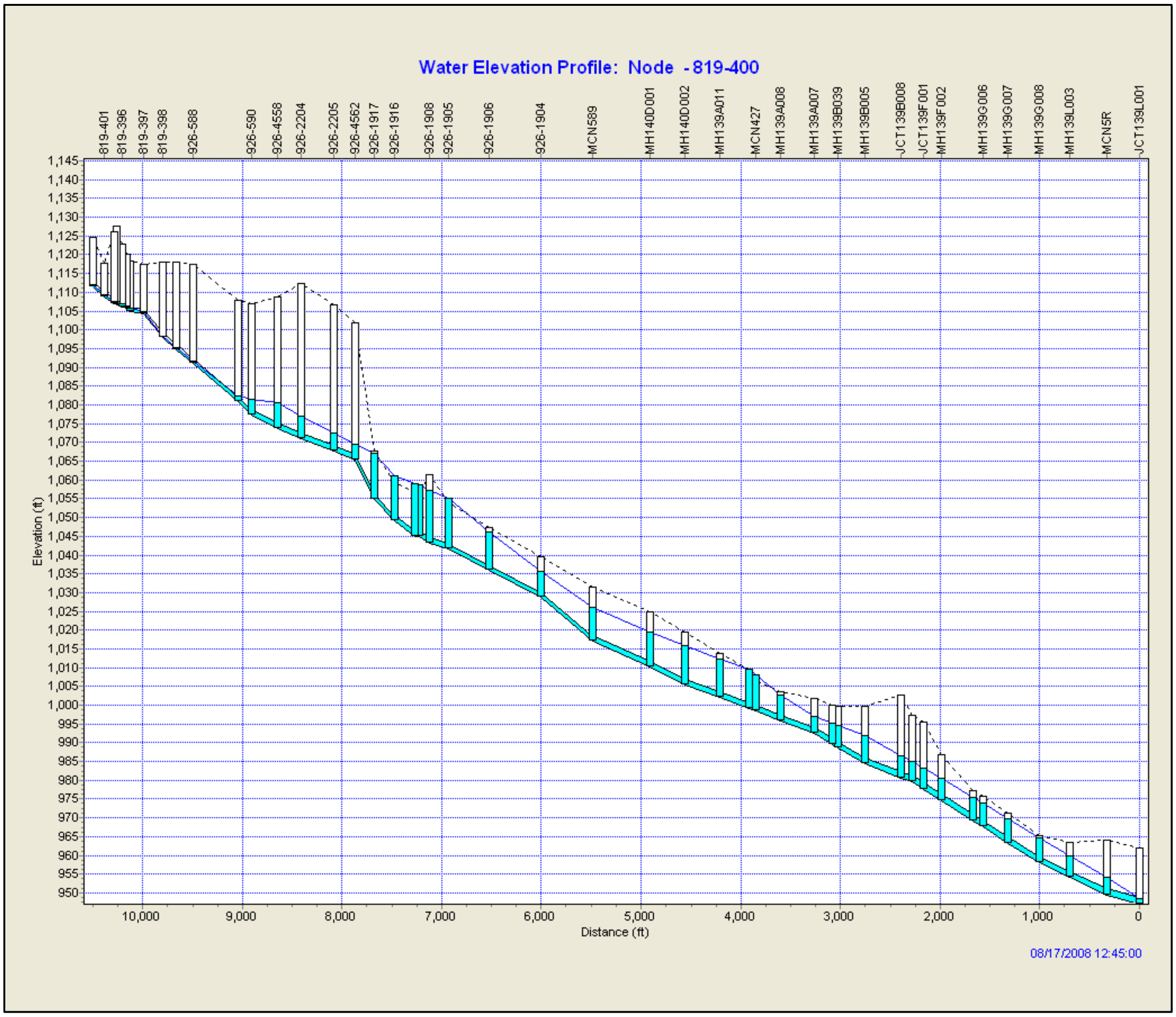
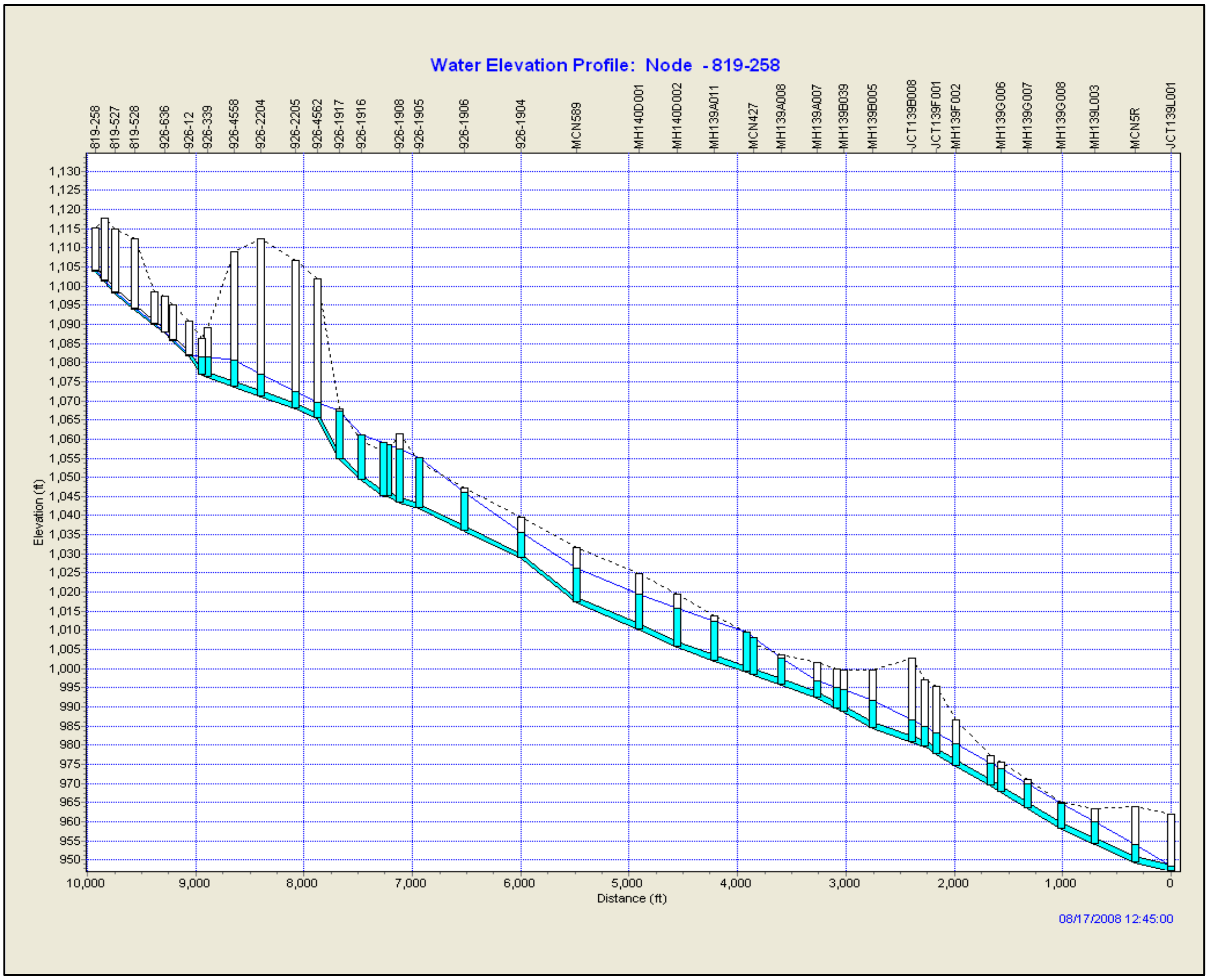


FIGURE 2-5B. S-15 SEWERSHED MAIN TRUNK SEWER PROFILE-8

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF per Typical Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the S-15 sewer system performed by PWSA produced the following computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in *Table 1-3. S-15 Sewershed Typical Year Overflow Statistics.*

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the S-15: McNeilly/McDonough's Run sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.

- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."

- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."

- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA) which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated "high quality" and "exceptional quality" waters.

Other. Navigation.

Wherever a "designated use" is not being met due to water quality issues, the stream is said to be impaired. "Use impairments" are normally documented in the USEPA's 303(d) list. The USEPA website states: "The term, '303(d) list', is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. Seven (7) of these outfalls are found within the S-15 or McNeilly/ McDonough's Run Sewershed, as shown in Table S15-3-1.

TABLE S15-3-1. WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE S-15: McNEILLY/ McDONOUGH'S RUN SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF097L001	SMR	S-15	McDonough's Run	WWF[1]	N	Y
CSO139A001	SMR	S-15	McDonough's Run	WWF	N	Y
S1500POCL01AOF	SMR	S-15	Saw Mill Run	WWF	N	Y
OF139B001	SMR	S-15	McDonough's Run	WWF	N	Y
OF139B002	SMR	S-15	McDonough's Run	WWF	N	Y
OF139B003	SMR	S-15	McDonough's Run	WWF	N	Y
OF139F001	SMR	S-15	Saw Mill Run	WWF	N	Y

As shown in the table, these seven (7) PWSA owned outfalls discharge into either McDonough's Run or Saw Mill Run. Both receiving waters are classified as warm water fisheries (WWF) and currently do not meet their assigned water quality standards.

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[1] Warm Water Fisheries

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.
- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream, including Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

The receiving water characterization field program resulted in certain findings within Saw Mill Run. In general, the DO concentrations for Saw Mill Run did not meet regulatory limits during wet weather which is likely related to CSO discharges during the storm events and/or wet weather discharges from upstream municipalities. Saw Mill Run also showed DO concentrations not meeting standards during dry weather indicating that CSO discharges are not likely causing the condition.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters, including Saw Mill Run and its tributaries within the PWSA limits, with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL. For Saw Mill Run, the concentration during the recreational season exceeded the 200 cfu/100mL limit in 100% of the samples and exceeded the 400 cfu/100mL limit in 80% of the samples.

Saw Mill Run has an in-stream target concentration of 0.035 mg/L for total phosphorus (TP) which was exceeded by 75% of the samples. TP appears to be a concern throughout Saw Mill Run, with CSO discharges being a potentially significant source in wet weather.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan*, *January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS. However for Saw Mill Run, it is judged that a higher level of control is needed due to the need to reduce phosphorus levels (see next section).

3.2.2 Saw Mill Run TMDL Report

A TMDL report was completed for Saw Mill Run and its tributaries which showed phosphorus TMDL results are shown below in Table S15-3-2.

TABLE S15-3-2. SAW MILL RUN PHOSPHORUS TMDL RESULTS

Total Phosphorus Load	CSO Load	SSO Load
Existing Load (Ib/Growing Season)	7,161.9	1,950.4
Allocated Load (Ib/ Growing Season)	177.5	0.0
Percent Reduction (%)	98%	100%

The implication of this is that substantial reductions of CSOs and complete elimination of SSOs is necessary for compliance. For CSOs, it is judged that a control level of 0 overflows per year will be required.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the S-15 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the S-15 sewershed, Table S15-3-3 lists the untreated CSO statistics that were computed for each control level.

TABLE S15-3-3. CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE S-15: MCNEILLY/MCDONOUGH'S RUN SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC097L001	0	0	3	0.08	10	0.45
DC096N001	0	0	5	0.44	10	1.66
DC139A001	0	0	2	0.04	2	0.04
DC096K001	0	0	4	0.06	4	0.06
DC139B001	0	0	4	0.16	10	0.24
DC139B002	0	0	3	0.09	8	0.16
DC139B003	0	0	4	0.06	8	0.10
Total Volume		**0**		**0.93**		**2.71**

As will be described later in this report, the S-15 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year and 10-year return frequency events).

Since Saw Mill Run has a TMDL which requires a high level of Phosphorous removal (98%), a higher CSO control level will be required. While 10, 4 and 0 OF/yr are analyzed, it is judged that 0 OF/yr will be necessary for compliance.

A range of design storms (2-yr, 5-yr, and 10-yr) were evaluated for transport of flows. PWSA plans to use the 2-yr storm which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

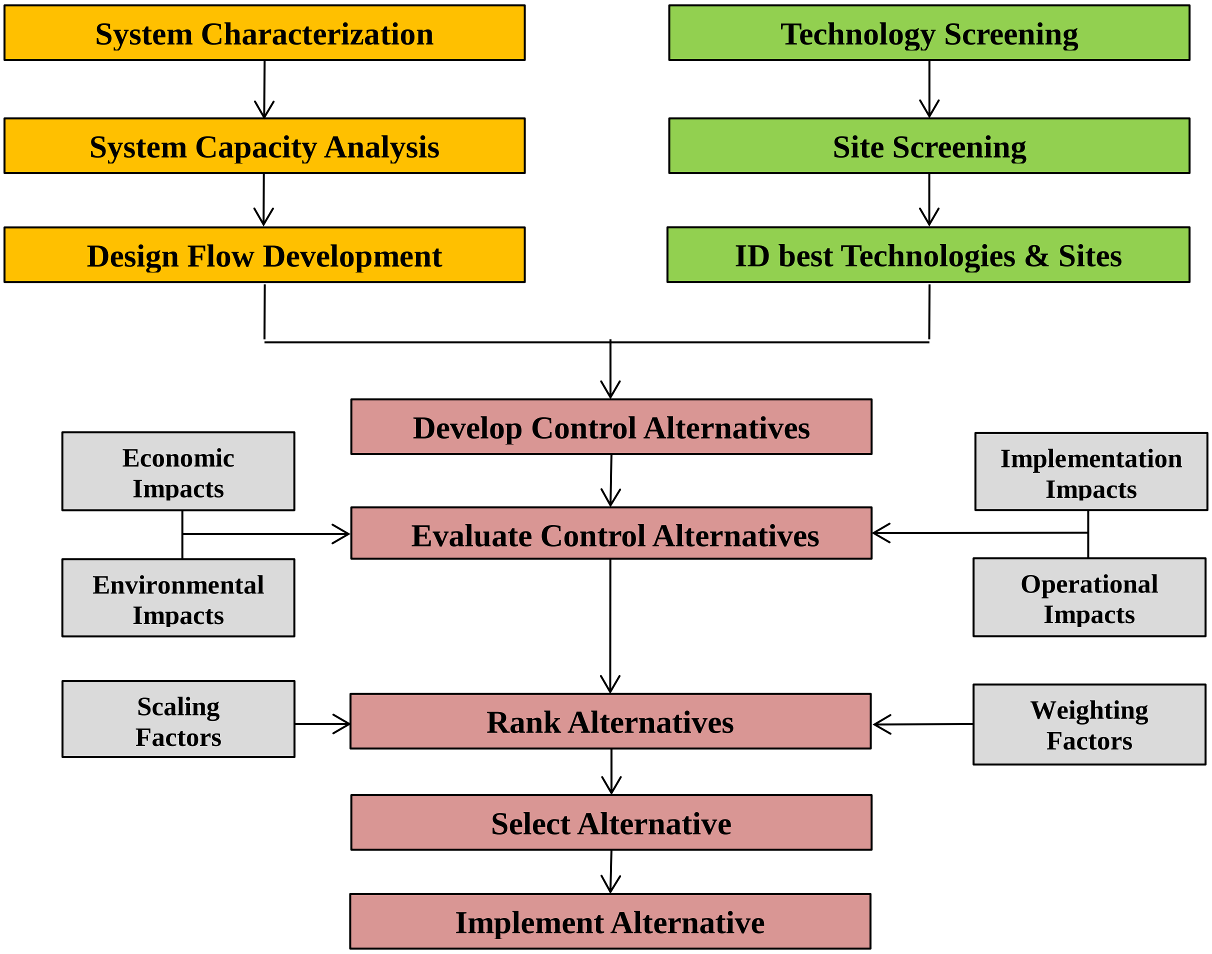
The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. *Figure 4-1: Control Alternative Development and Evaluation Process* shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE 4-1. CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered "feasible" for use in the S-15 sewershed are shown below in *Table 4-1. S-15 Technology Screening Results*.

TABLE 4-1. S-15 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house

the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies was identified for the S-15 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in *Table 4-2. S-15 Potential Control Alternatives*.

Contributing flows from the municipalities that are tributary to the S-15 sewershed, which include Baldwin Township, Dormont Borough and the Municipality of Mt. Lebanon, were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as waterways.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning "Objective Scores" to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

TABLE 4-2. S-15 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 097L001	CS4 097L001: Sewer separation	Complete sewer separation of tributary area.
	S2-097L001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-097L001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-097L001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-097L001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-097L001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-097L001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfalls 139A001, 139B001, and 139B002	CS4-139A001 to 139B002: Sewer Separation	Complete sewer separation of tributary area.
	S2-139A001 to 139B002: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-139A001 to 139B002: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-139A001 to 139B002: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-139A001 to 139B002: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-139A001 to 139B002: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-139A001 to 139B002: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 139B003	No activations during the typical year.	No control required.
Outfall 139F001		
Regional Controls – S-15: McNeilly / McDonough's Run Controls		
Outfalls 097L001, 139A001, 139B001, and 139B002	CS4-139A001 to 097L001: Sewer Separation	Complete sewer separation of tributary areas.
	S2-139A001 to 097L001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-139A001 to 097L001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-139A001 to 097L001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.

CSO(s)	Control Alternative(s)	Description
	T2-139A001 to 097L001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-139A001 to 097L001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-139A001 to 097L001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 139B003	No activations during the typical year.	No control required.
Outfall 139F001		
Sub-system Controls - Saw Mill Run Controls		
Outfalls 097L001, 139A001, 139B001 and 139B002	SMR-1a: Tunnel Storage[2]	A 2.8 mile long tunnel O-14 to the S-30 POC. The S-15 CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • 097L001 - Sub-Surface Storage • 139A001, 139B001 and 139B002 - Sub-Surface Storage • 139B003 and 139F001 - No control required.
	SMR-1b: Tunnel Storage[2]	
	SMR-2a: Tunnel Storage[2]	A 5.7 mile long tunnel from O-14 to the S-15 POC. The S-15 CSOs will be controlled via 7,100-ft of consolidation sewer to a drop shaft near the S-15 POC. • 139B003 and 139F001 - No control required.
	SMR-2b: Tunnel Storage[2]	

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

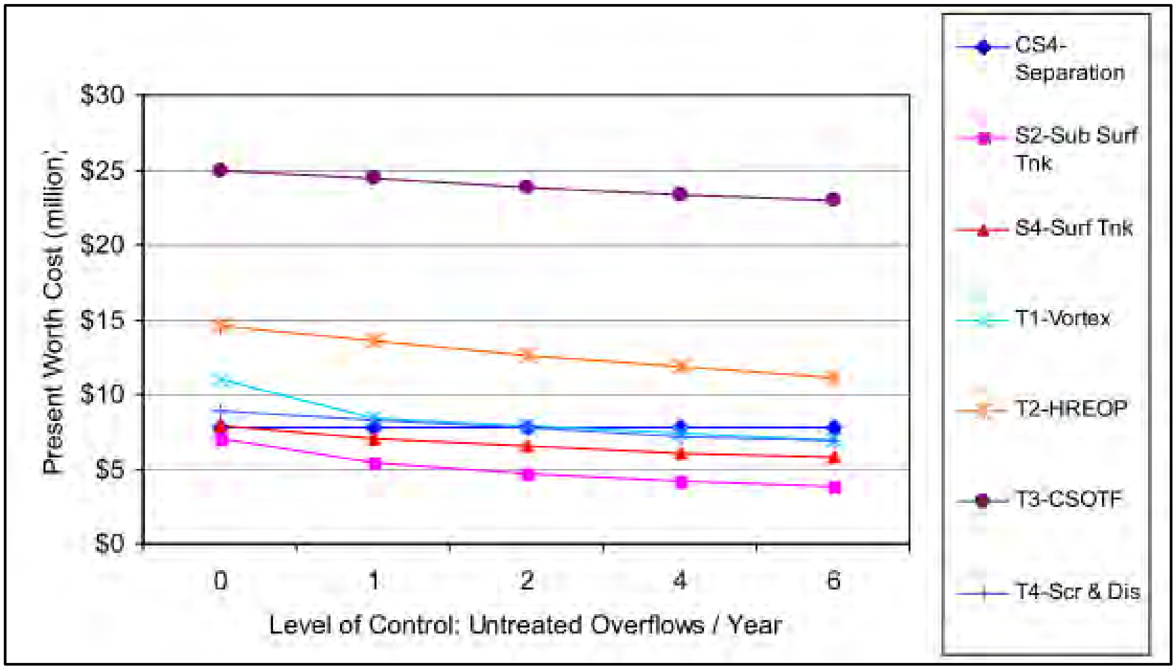
PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

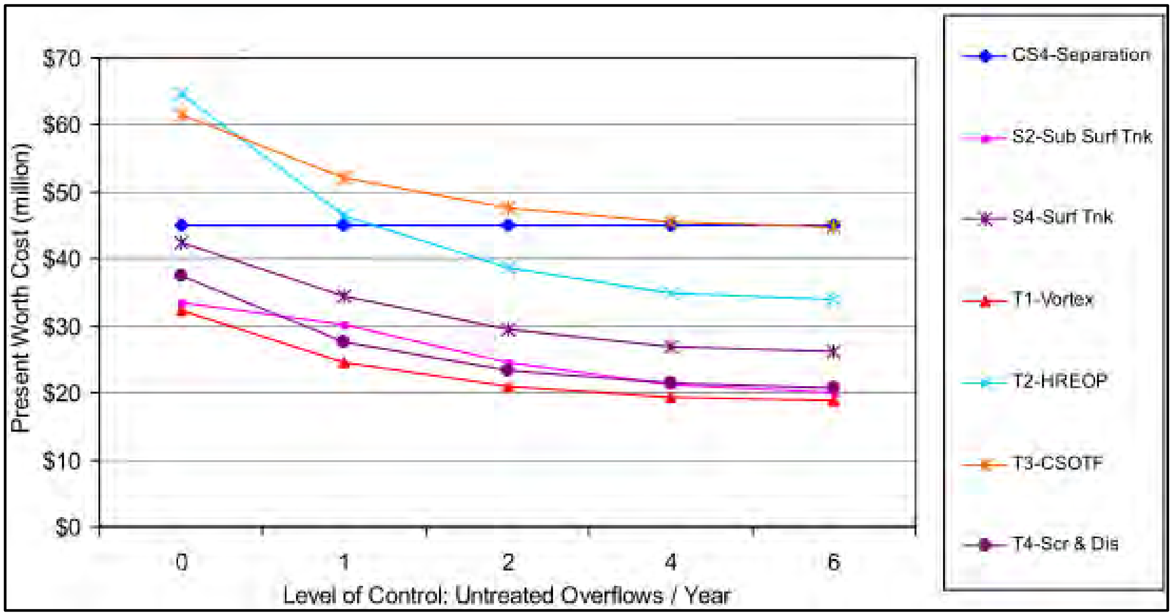
Outfall 097L001: Cost estimates were produced for outfall-specific control alternatives CS4 097L001: Sewer separation, S2-097L001: Sub-Surface Storage, S4-097L001: Surface Storage, T1-097L001: Suspended Solids Control, T2-097L001: High Rate End of Pipe Treatment, T3-097L001: CSO Treatment Facility, and T4-097L001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. *Figure 4-2. Outfall 097L001 Alternative Costs* illustrate the ranges of estimated present worth costs for these alternatives.

FIGURE 4-2. OUTFALL 097L001 ALTERNATIVE COSTS



Outfalls 139A001, 139B001 and 139B002: Cost estimates were produced for outfall-specific control alternatives CS4-139A001 to 139B002: Sewer separation, S2-139A001 to 139B002: Sub-Surface Storage, S4-139A001 to 139B002: Surface Storage, T1-139A001 to 139B002: Suspended Solids Control, T2-139A001 to 139B002: High Rate End of Pipe Treatment, T3-139A001 to 139B002: CSO Treatment Facility, and T4-139A001 to 139B002: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. *Figure 4-3. Outfalls 139A001 to 139B002 Alternative Costs* illustrate the ranges of estimated present worth costs for these alternatives.

FIGURE 4-3. OUTFALLS 139A001 TO 139B002 ALTERNATIVE COSTS



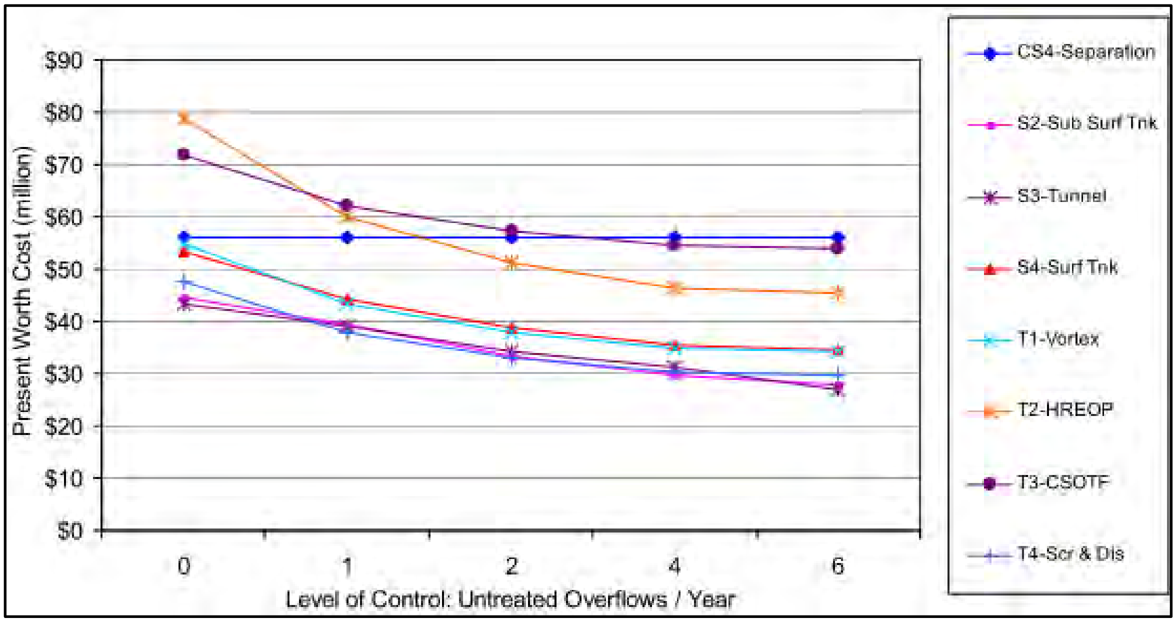
Outfall 139B003: Outfall 139B003 did not activate the typical year, and no control alternatives were required.

Outfall 139F001: Outfall 139F001 did not activate the typical year, and no control alternatives were required.

4.2.2 Regional Control Alternatives

Cost estimates were produced for regional control alternatives developed for the S-15: McNeilly / McDonough's Run region. *Figure 4-4. S-15: McNeilly / McDonough's Run Alternative Costs* illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-4. S-15: MCNEILLY / MCDONOUGH'S RUN ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Saw Mill Run sub-system. *Table 4-3. Saw Mill Run Sub-system Alternative Costs* illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Saw Mill Run subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE 4-3. SAW MILL RUN SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
SMR-1a	249.3	2.1	272.1
SMR-1b	253.3	1.9	274.0
SMR-2a	246.2	1.6	265.1
SMR-2b	251.8	1.5	269.0

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the "highest ranked alternative" for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining "Objective Scores" relative to each evaluation criteria.
- Applying "scaling" and "weighting" factors.
- Determining "Weighted Objective Scores" relative to each evaluation criteria.
- Ranking each alternative based on the sum of its "Weighted Objective Scores".

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in the following Table, taken from Section 7 of the Wet Weather Feasibility Study.

TABLE 4-4. OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13

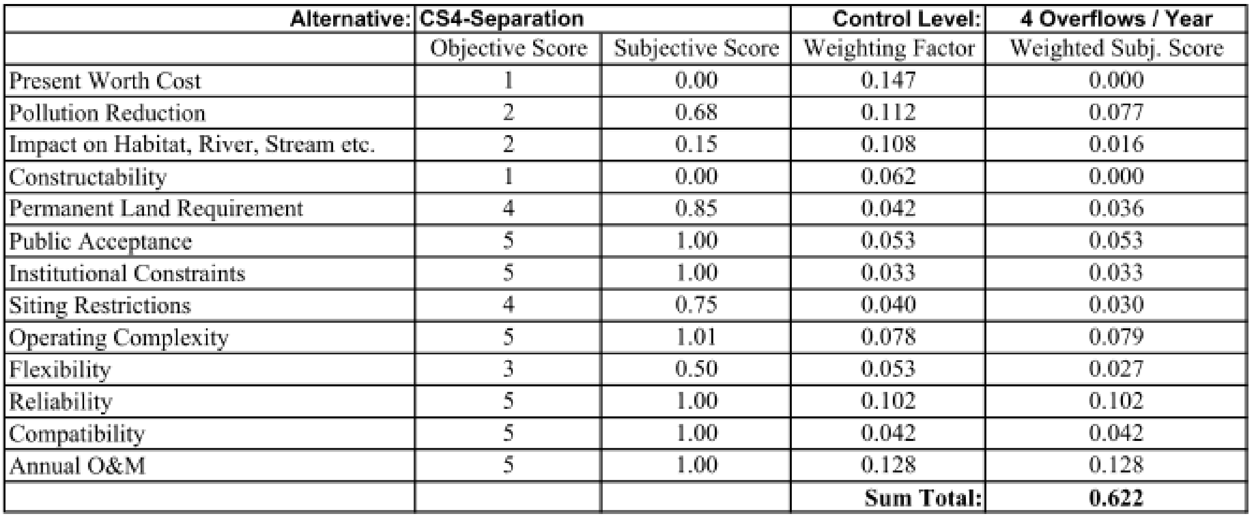
criteria were determined. The results of the workshop are presented in the following Table, taken from Section 7 of the Wet Weather Feasibility Study.

TABLE 4-5. PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 139A001 to 139B002: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in *Table 4-6. Weighted Subjective Scoring - CS4 139A001 to 139B002: Sewer Separation*.

TABLE 4-6. WEIGHTED SUBJECTIVE SCORING - CS4 139A001 TO 139B002: SEWER SEPARATION



Alternative:	**CS4-Separation**		**Control Level:**	**4 Overflows / Year**
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	1	0.00	0.147	0.000
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.108	0.016
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	5	1.00	0.033	0.033
Siting Restrictions	4	0.75	0.040	0.030
Operating Complexity	5	1.01	0.078	0.079
Flexibility	3	0.50	0.053	0.027
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.622**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008)*. Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 097L001: The results of the control alternative evaluation process are shown in *Figure 4-5. Alternative Scoring - Outfall 097L001*. It was recommended that, for all levels of control, *Alternative S2-097L001: Sub-Surface Storage* be carried forward and re-evaluated during the regional and sub-system alternatives analyses.

Outfalls 139A001, 139B001 and 139B002: The results of the control alternative evaluation process are shown in *Figure 4-6. Alternative Scoring - Outfalls 139A001 to 139B002*. It was recommended that, for all levels of control, *Alternative S2-139A001 to 139B002: Sub-Surface Storage* be carried forward and re-evaluated during the regional and sub-system alternatives analyses.

Outfall 139B003: According to the results of the H&H model, this outfall had no activations throughout the typical year. This “no activation” outfall was not considered further in the alternatives analysis process.

Outfall 139F001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This “no activation” outfall was not considered further in the alternatives analysis process.

FIGURE 4-5. ALTERNATIVE SCORING - OUTFALL 097L001

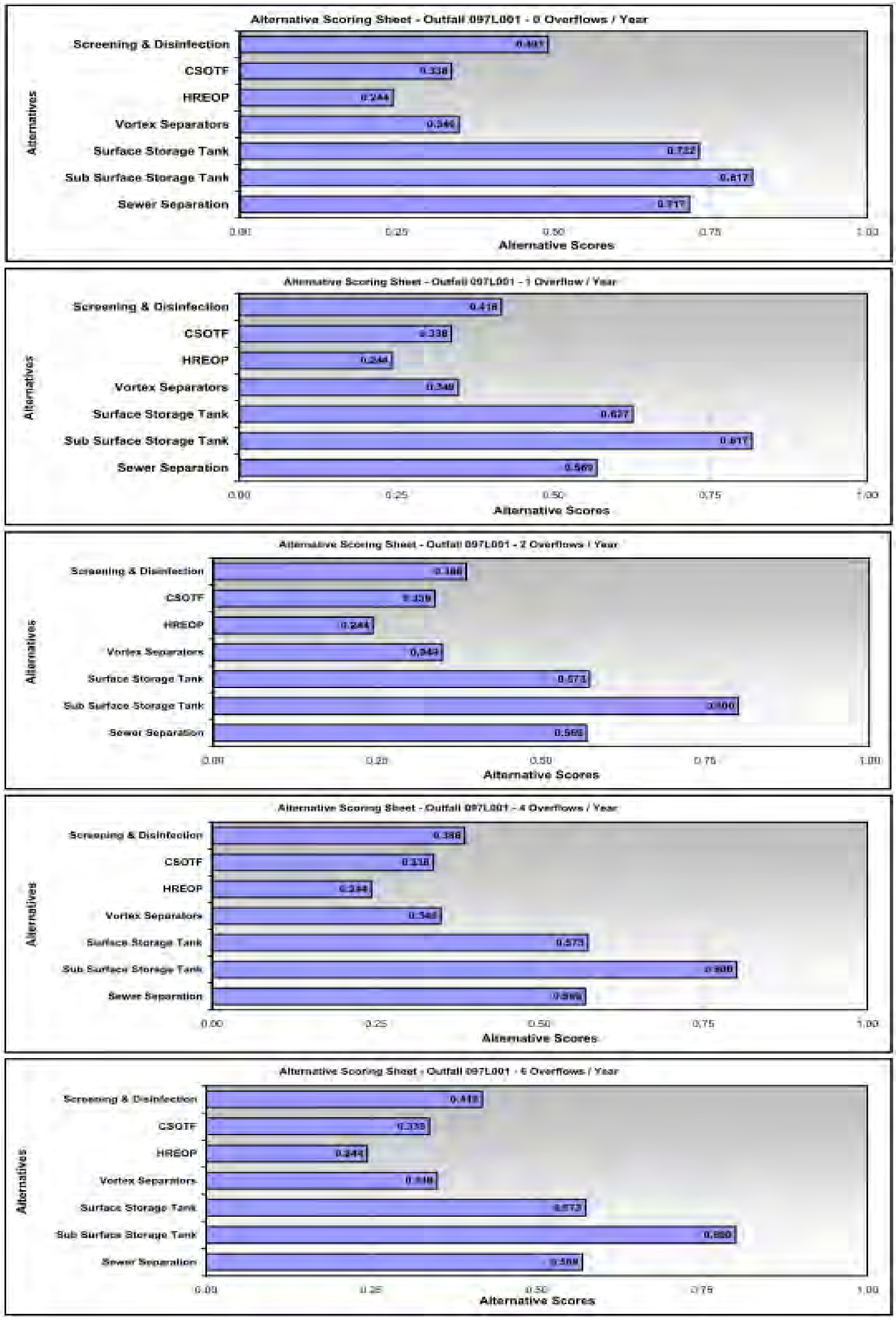
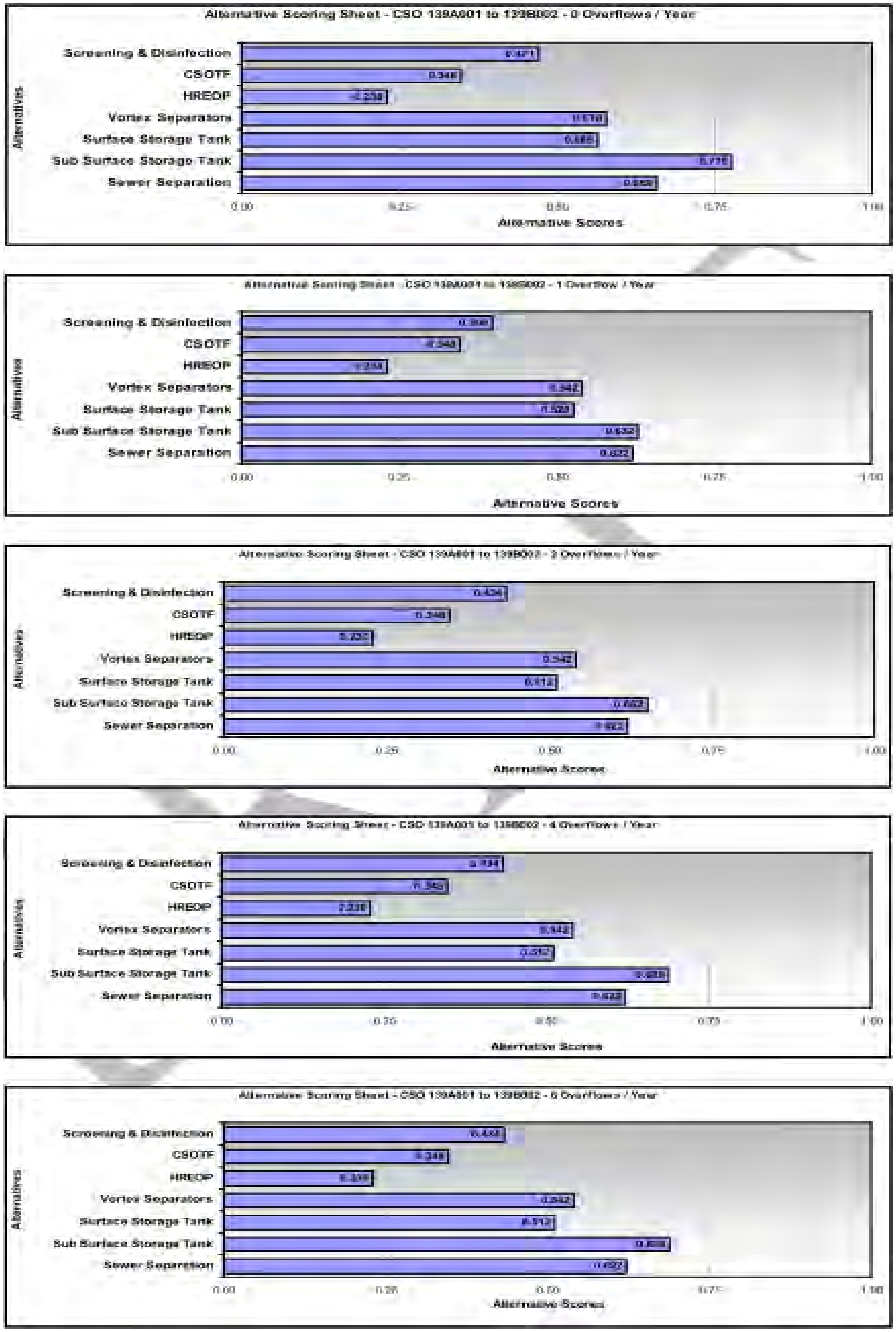


FIGURE 4-6. ALTERNATIVE SCORING - OUTFALLS 139A001 TO 139B002



4.4.2 Regional Control Alternatives

S-15: McNeilly / McDonough's Run. The results of the regional control alternative evaluation process are shown below in *Figure 4-7. Alternative Scoring* – S-15: *McNeilly / McDonoughs Run Region.* It was recommended, for a control level of zero overflows per year, that *Alternative S3-139A001 to 097L001: Tunnel Storage* be carried forward and re-evaluated during the system-wide alternatives analyses. For control levels of 1, 2, 4, and 6 overflows per year, it was recommended that *Alternative S2-139A001 to 097L001: Sub-Surface Storage* be carried forward and re-evaluated during the system-wide alternatives analyses.

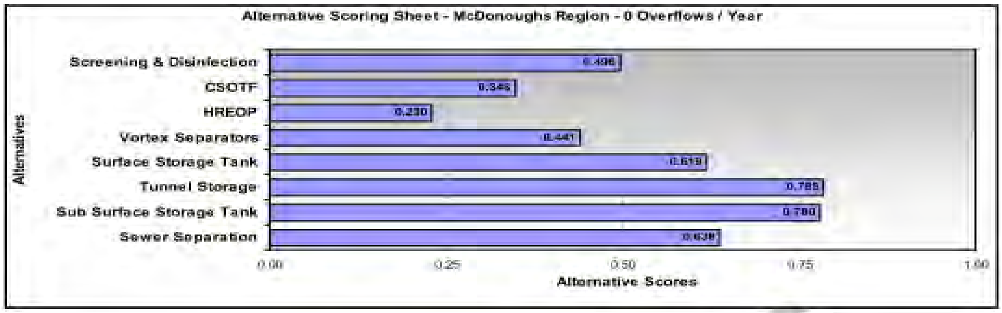
4.4.3 Sub-System Control Alternatives

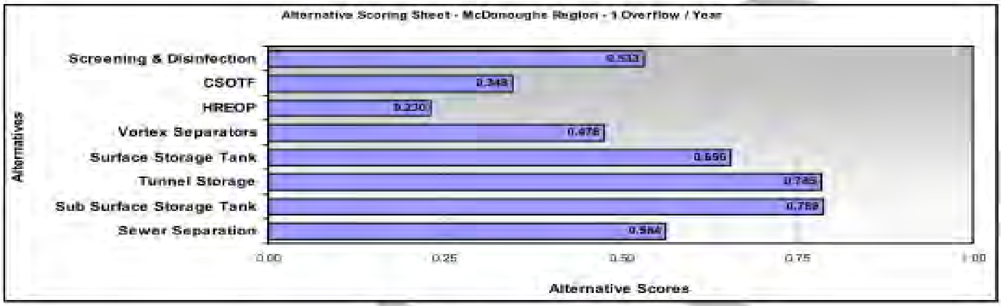
Saw Mill Run. The results of the sub-system control alternative evaluation process are shown below in *Figure 4-8. S-15: Alternative Scoring– Saw Mill Run Sub-System*. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

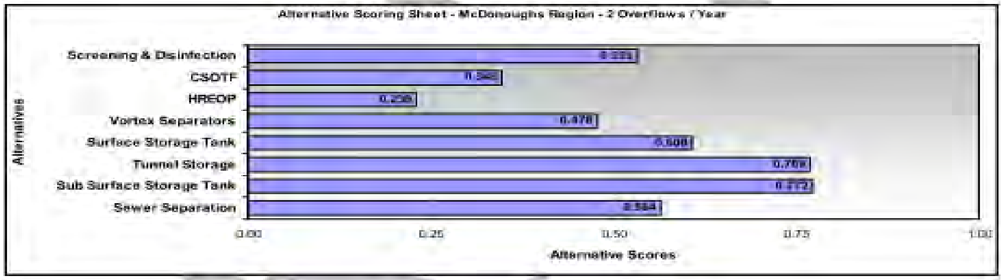
It was recommended that *Alternative SMR-2b: Tunnel Storage* be carried forward as the Saw Mill Run component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative SMR-2b: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative SMR-2b* included only those components required to deliver flows to the S-15 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the S-15 POC would become the responsibility of ALCOSAN.

FIGURE 4-7. ALTERNATIVE SCORING - S-15: MCNEILLY / MCDONOUGH'S RUN REGION







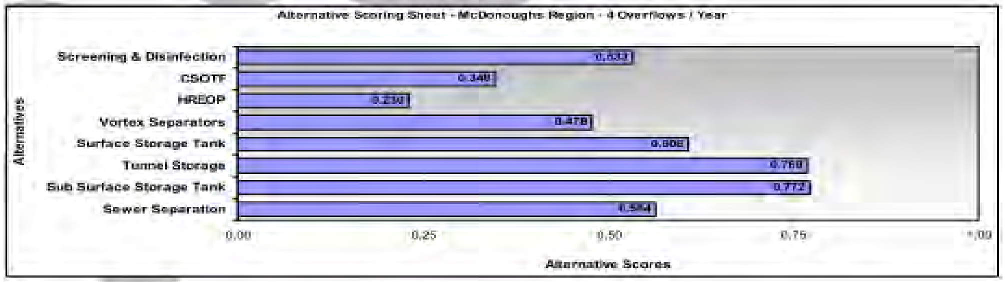
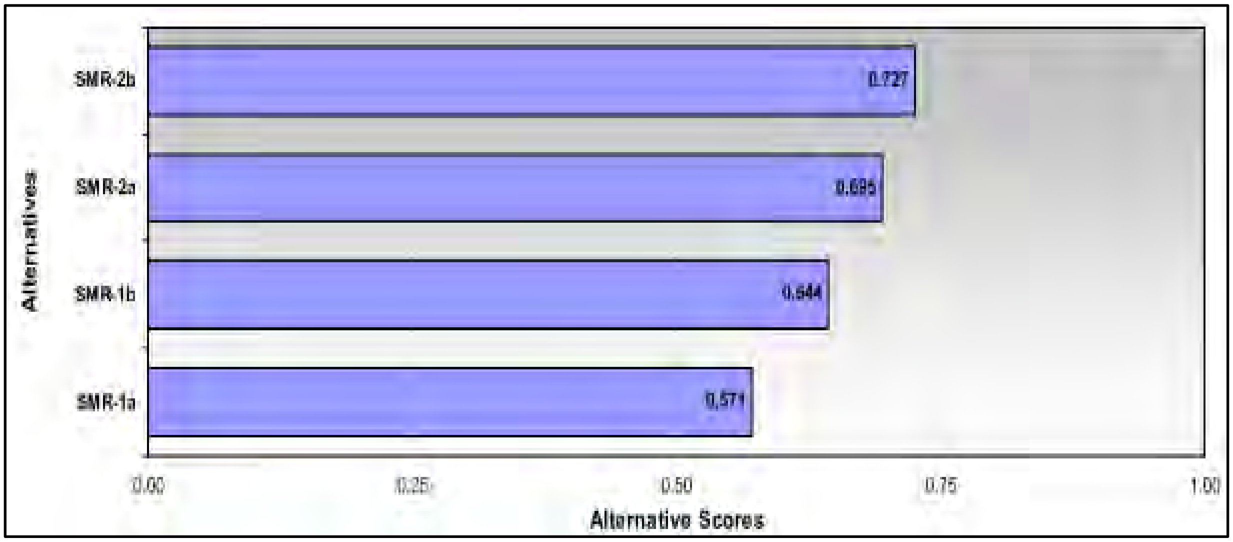


FIGURE 4-8. S-15: ALTERNATIVE SCORING – SAW MILL RUN SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the S-15: McNeilly / McDonough's Run sewershed would best be accomplished by implementing *Alternative SMR-2b: Tunnel Storage*. Within the S-15 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the six PWSA permitted CSOs to the targeted level of control. Wastewater flows not diverted from the system would be conveyed through approximately 7,100 feet of consolidation piping to the S-15 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative SMR-2b* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-S15-C-0*, *POC-S15-C-4* and *POC-S15-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **S15 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.

- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the S-15 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities, with the exception of Mt. Lebanon, did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows. The Municipality of Mt. Lebanon indicated that no wet weather projects would result in reductions of projected flows. All flows will be conveyed through the S-15 trunk line.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the S-15 sewershed is zero untreated overflows per year. The recommended control alternative for the S-15 McNeilly / McDonough's Run sewershed has been designated as POC-S15-C-0. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **S15** The S-15 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **0** The selected level of control is zero untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of zero (0) untreated overflows per year, the required consolidation / conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-S15-C-0 are summarized in Table S15-5-1.

TABLE S15-5-1: ALTERNATIVE POC-S15-C-0 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
S-15	DC096K001	139B002	C*	0
	DC139B001			
	DC096N001	139A001		
	DC097L001	097L001		
	DC139A001	139B001		
	DC139B002	139F001		
	DC139B003	139B003		

*To be achieved via additional conveyance piping and regulator modifications.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, any anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, any stream removal projects that may be included, its integration with ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-S15-C-4 and/or POC-S15-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. Both analyses determined that the optimal method of increasing the level of control of CSO overflows in the S-15 sewershed would be to reduce the number of overflows by conveying the additional wastewater to the ALCOSAN point of connection. To accomplish this, the PWSA and/or their tributary municipalities must:

- Modify existing diversion structures to achieve desired level(s) of control.
- Construct additional consolidation piping to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

For each of the seven diversion structures in the S-15 sewershed, the H&H model was employed to identify the type and extent of modifications required to achieve zero overflows during the typical year.

The required modifications to the flow diversion settings were determined by the current typical year overflow statistics. Table S15-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control. The upstream municipalities of Mt. Lebanon, Baldwin Township and the Borough of Dormont are not tributary to the PWSA CSO diversion structures, and their tributary flows do not have an impact on the planned diversion structure modifications.

TABLE S15-5-2: POC-S15-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC096K001	Diversion structure replacement*	3.4	No Change	No Change
DC096N001	Diversion structure replacement*	45.0	27.0	15.0
DC097L001	Diversion structure replacement*	6.2	2.2	No Change
DC139A001	Diversion structure replacement*	3.5	No Change	No Change
DC139B001	Diversion structure replacement*	5.2	2.0	0.9
DC139B002	Diversion structure replacement*	3.6	0.7	No Change
DC139B003	Diversion structure replacement*	4.4	0.8	0.3

*The installation of screening is planned for all PWSA diversion structures.

As can be seen from the table, new consolidation piping to convey flows at the zero OF/yr level of control must be designed to carry flows ranging from 3.4 to 45 mgd.

5.1.2 Consolidation Piping

The H&H model was employed to identify the capacity improvements necessary to consolidate and convey increased flows from the seven existing diversion structures to the S-15 POC. The modeling was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the S-15 POC without significant manhole surcharging and flooding. These results validated the findings and recommendations of the *PWSA*

Feasibility Study Report (October 2008) that anticipated the construction of consolidation / relief sewers to supplement the capacity of the existing trunk sewer system.

It was anticipated that the required increase in conveyance capacity would be achieved by constructing parallel relief sewers designed to convey flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Note that the upstream municipalities of Mt. Lebanon, Baldwin Township and the Borough of Dormont have not reported any plans to modify their systems to reduce their tributary flows.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table S15-5-3 and in Figure S15-5-1.

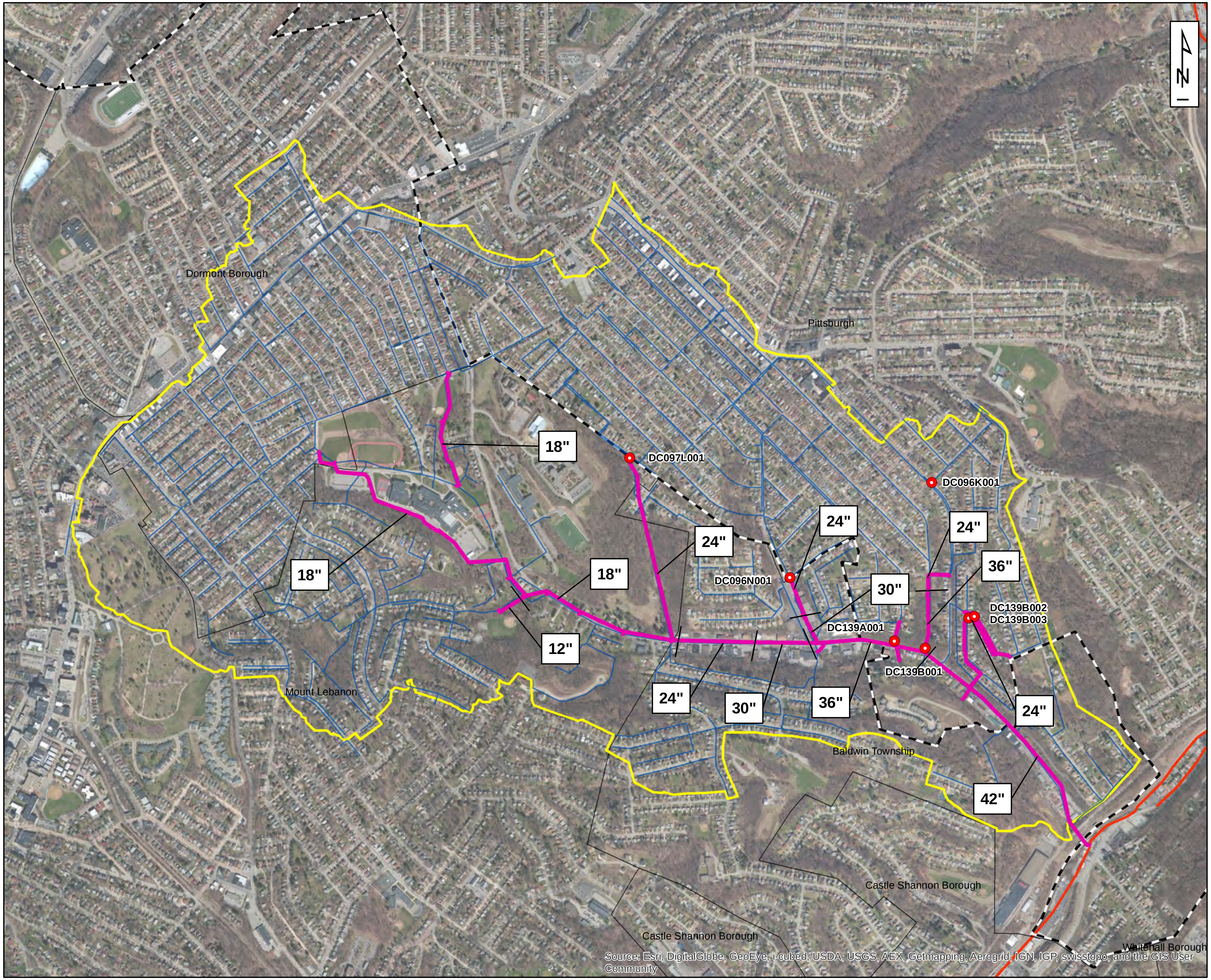
TABLE S15-5-3: POC-S15-C-0 CONSOLIDATION PIPING

Diameter (in)	Length (ft)
12	1,191
18	4,131
24	3,140
30	1,105
42	4,825

*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

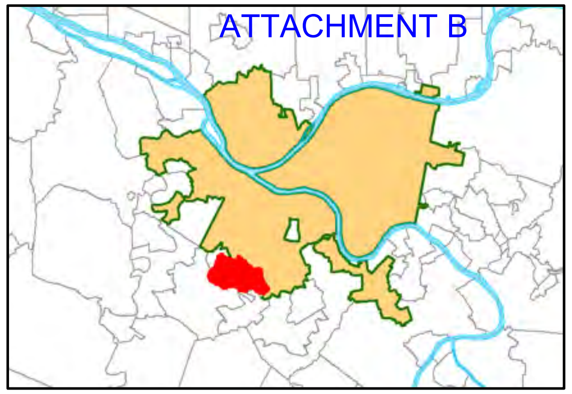
5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table S15-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 12 MG in the typical year.



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

●	PWSA Diversion Structures Modification
▬	Relief/Consolidaion Sewers
—	Collector Sewer
☐	S-15 Sewershed Boundary
☐	PWSA Service Area Boundary
☐	Municipal Boundary
▬	River
Existing ALCOSAN Interceptor	
▬	Deep Tunnel
—	Shallow Cut

1,000 500 0 1,000 Feet

Figure S15-5-1: POC-S15-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\McDONOUGHS NUM (S-15)\FIGURE 5-1_S_15.mxd

TABLE S15-5-4: S-15 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name					
	POC-S15-C-0		POC-S15-C-4		POC-S15-C-10	
	No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)	No. of OFs	Annual Volume (Mgal)
DC096K001	0	0	4	0.1	4	0.1
DC096N001	0	0	5	0.4	10	1.7
DC097L001	0	0	3	0.1	10	0.5
DC139A001	0	0	2	0.04	2	0.04
DC139B001	0	0	4	0.2	10	0.2
DC139B002	0	0	3	0.1	8	0.2
DC139B003	0	0	4	0.1	8	0.1
Total Volume		**0**		**1.0**		**2.8**

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The combination of regulator modifications and additional consolidation piping will result in increased flow rates and volumes to the S-15 POC. Peak flow rates to the S-15 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-S15-C-0, POC-S15-C-4 and POC-S15-C-10 are presented in Figure S15-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the S-15 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table S15-5-5.

FIGURE S15-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE S-15 POC

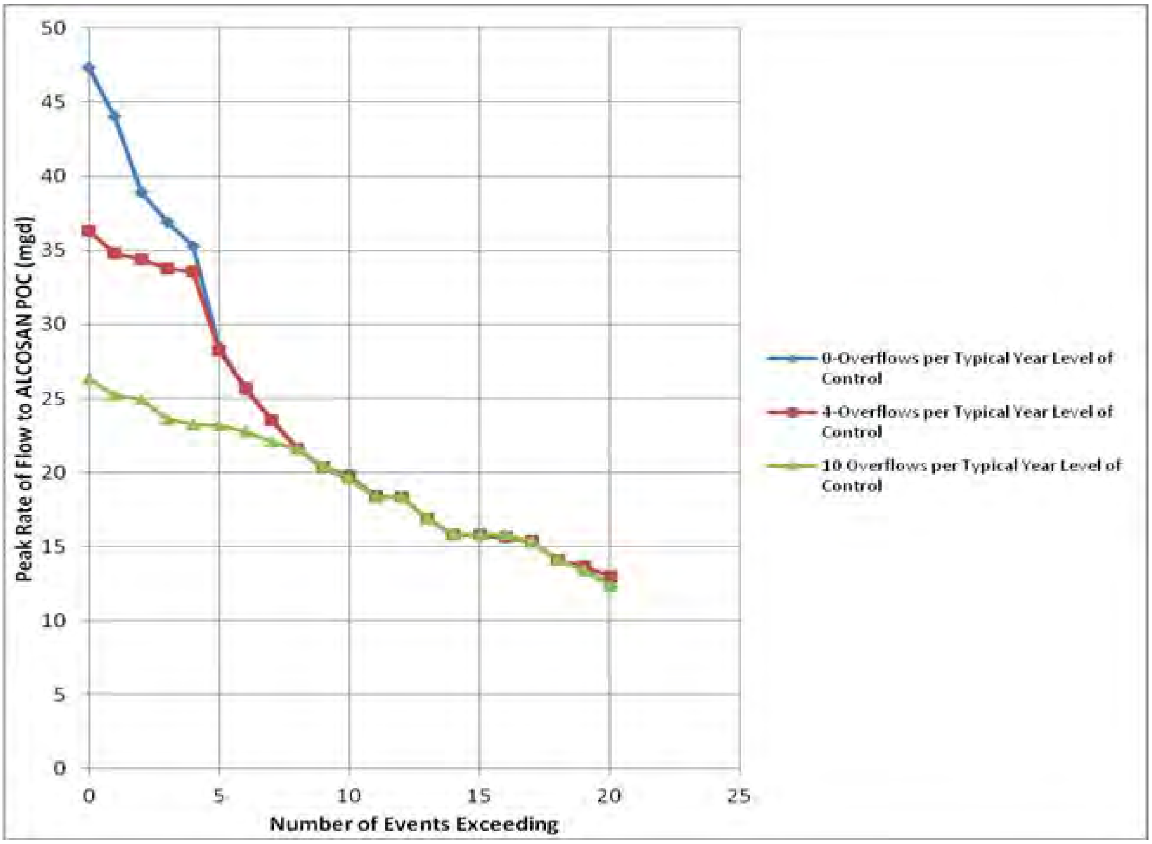


TABLE 5-5: S-15 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-S15-C-0	76.5	79.4	82.0	9.5	11.2	12.4
POC-S15-C-4	50.0	53.4	55.7	8.5	9.8	10.9
POC-S15-C-10	41.2	44.2	46.5	8.4	9.6	10.5

5.1.5 Recommended Control Alternative Integration

In the spring of 2013, 3 Rivers Wet Weather facilitated a series of meetings between the PWSA and the municipalities tributary to this sewershed. All associated parties in the POC sewershed have participated in these planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements.

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. MOU updates can be found in Addendum S15-6-1.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

5.2 Hydraulic Capacity of the Recommended Alternative

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-S15C-0 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through the construction of parallel relief sewers designed to convey flows associated with zero overflows per typical year, under 2-year design storm conditions (0 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the S-15 sewershed, both before and after implementation of the recommended alternative:

- Peak flow hydraulic grade line (HGL) of the trunk sewer
- 2046 peak flows and volumes to the S-15 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figures 3a and 3b from that report presented profiles of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. These figures are reproduced below as Figure S15-5-3a and Figure S15-5-3b. Under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging and manhole flooding occurs along the length of the trunk sewer.

The HGL along the main trunk sewer following implementation of alternative POC-S15-C-0 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, modification of the diversion structures combined with additional conveyance capacity (0 OF/yr; 2-yr storm) will satisfactorily reduce manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE S15-5-3A: S-15 UPPER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)

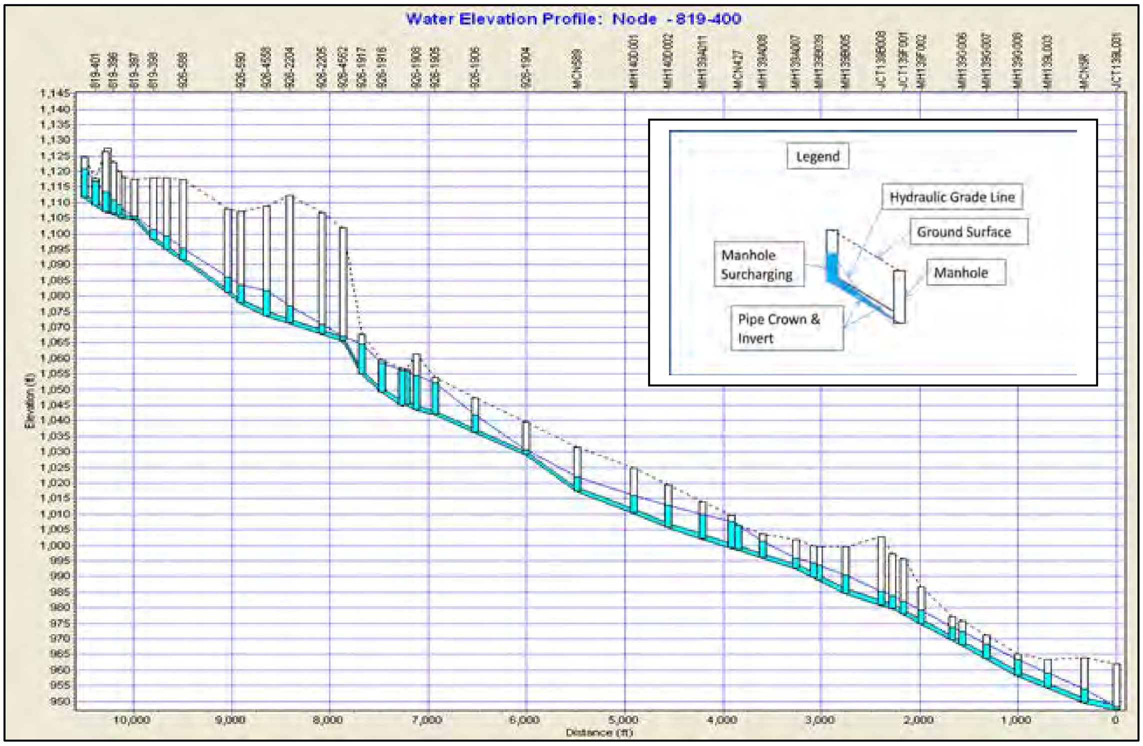
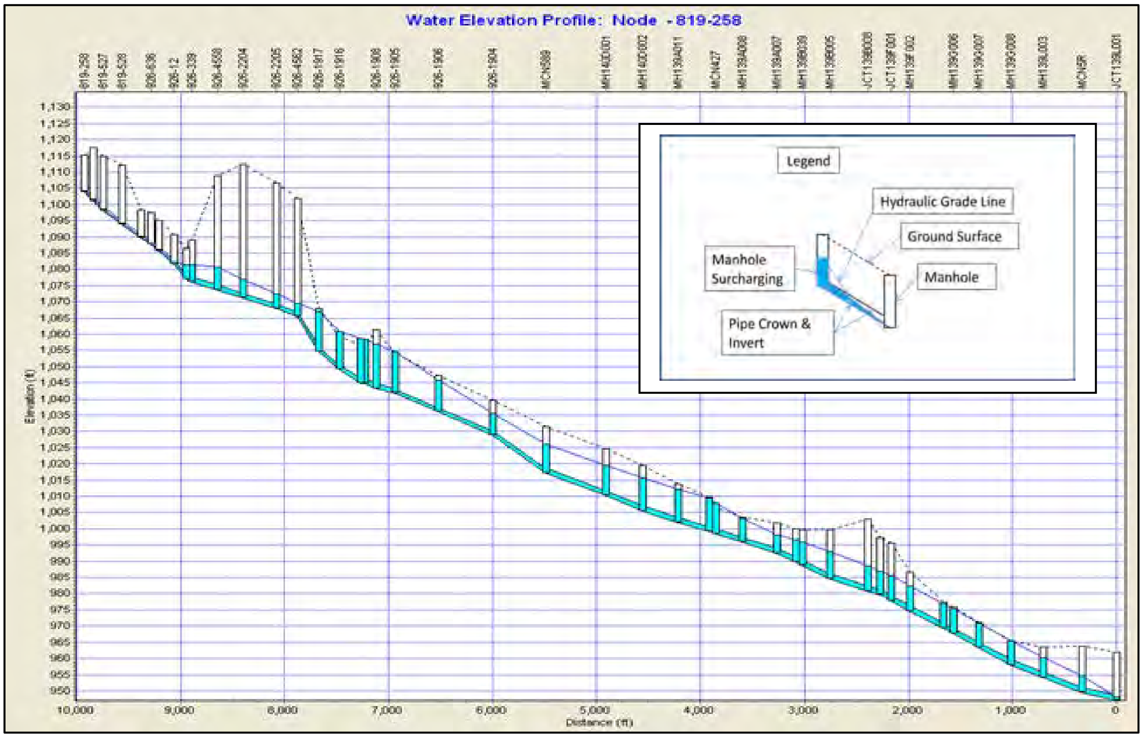


FIGURE S15-5-3B: S-15 LOWER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



5.2.2 2046 Peak Flows and Volumes to S-15 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the PWSA system. ALCOSAN made similar assumptions[1], and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, as well as additional consolidation piping to convey increased flows to the S-15 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the S-15 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances From ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This contrasts with the PWSA's water quality based decision to recommend a zero OF/yr level of control within the Saw Mill Run planning basin.

However, the control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the S-15 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from the Borough of Dormont, Mt. Lebanon and Baldwin Township indicate that each of them plan to convey all their flows to the S-15 trunk sewer for the duration of the planning period. They have no plans to implement controls that would alter the modeled flows upon which the recommended alternative was based. This information is summarized in Table S15-5-6.

TABLE S15-5-6: S-15 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

Tributary Municipality	Volume*		
	Captured	Treated	Conveyed
Borough of Dormont	N/A	N/A	All modeled flows
Mt. Lebanon	N/A	N/A	All modeled flows
Baldwin Township	N/A	N/A	All modeled flows

*Following implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, as well as increased conveyance piping to convey increased flows to the S-15 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first five years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

McNeilly Run was fortunate to have been one of the sewersheds selected by 3 Rivers Wet Weather where an initial assessment of the potential for incorporation of GI methods and projects specifically for the reduction of flows from combined sewered areas in McNeilly was performed. A brief write-up of the assessment along with accompanying exhibits/figures has been provided for reference as Attachment S15-5-2. The analysis concluded that there is great potential for the implementation of GI within the combined portion of the McNeilly sewershed. It is intended that the analysis be built upon within the next several years to determine the feasibility of implementation of GI within the McNeilly sewershed.

As the primary flow contributor within this sewershed, the PWSA intends to extend the incorporation of IWP to the entire sewershed. The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of regulator modifications and additional consolidation piping designed to control CSOs from the PWSA diversion structures to zero overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the S-15 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts in Saw Mill Run and McNeilly/McDonough's Run due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-S15-C-0 are consolidation piping, CSO screening facilities, and diversion structure modifications. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment S15-5-1.

5.4.1 Consolidation Piping

In the S-15 sewershed, additional conveyance capacity was provided through the use of parallel relief sewers to convey flows to the S-15 POC. As detailed earlier, relief sewers were added to areas of the system that exhibited manhole flooding or surcharging at any time during the 24-hour design storm events. All improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewer.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street

5.4.2 CSO Screening Facilities

It was assumed that each outfall location will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

It was assumed that adjustments to existing regulator settings, including more effective and improved methods of flow control and monitoring, improved access, etc., would be sufficiently extensive as to make it more cost effective to simply replace each structure. The unit cost associated with the installation of each new diversion structure was assumed to be $200,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $360,000.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure S15-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible “knee of the curve” is evident from this data.

These costs are also presented in a tabular format in Table S15-5-7.

The selected level of CSO control - 0 OF/yr - was determined based upon water quality considerations. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-S15-C-0 are summarized in Table S15-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE S15-5-4: S-15 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

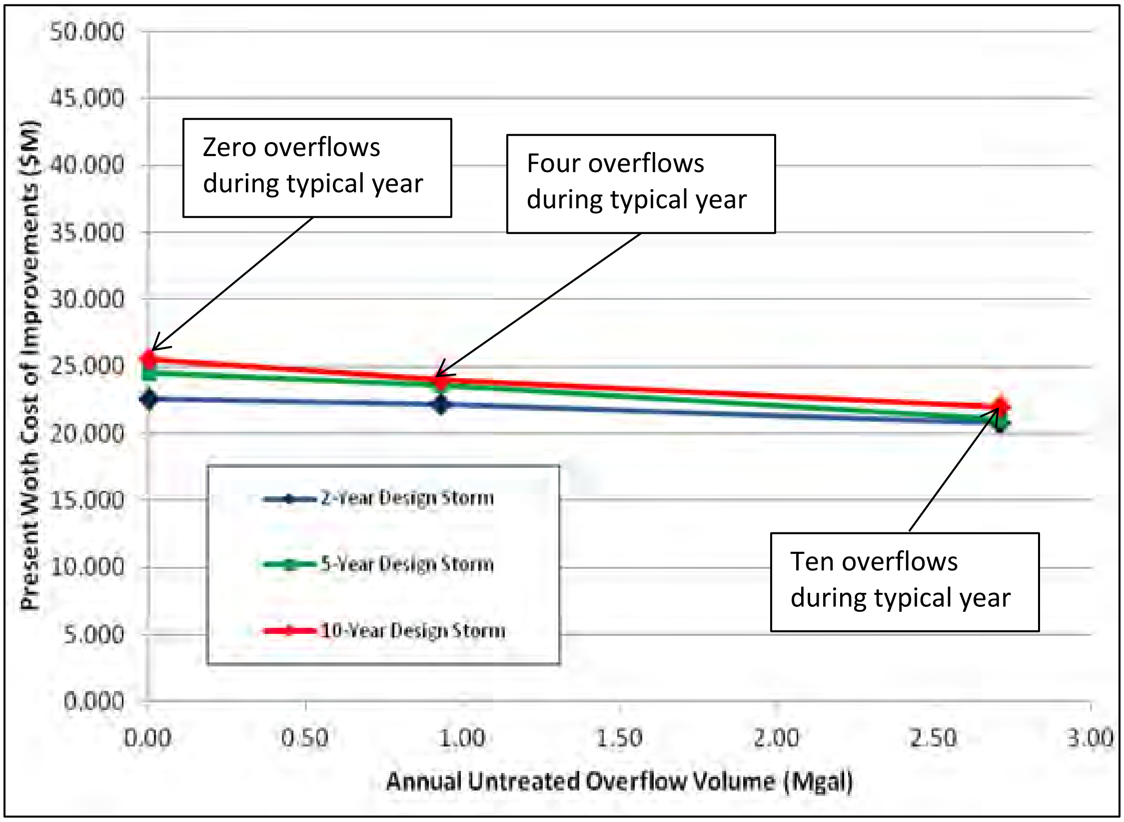


TABLE S15-5-7: S-15 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	**CSO Control**				
	Untreated CSO Volume (MG)	**CSO Control Level (OF/yr)**	**PW Capital Cost ($MM)**	**PW O&M Cost* ($MM)**	**TPW CSO Control ($MM)**
POC-S15-C-0	0	0	$22	$0.3	$22.3
POC-S15-C-4	0.9	4	$22	$0.2	$22.2
POC-S15-C-10	2.7	10	$20	$0.8	$20.8
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-S15-C-0	0	2-year	$0	$0	$0
POC-S15-C-4	0	2-year	$0	$0	$0
POC-S15-C-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE S15-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-S15-C-0

Capital Improvements	Size/ Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Replace diversion structures: DC096K001 DC096N001 DC097L001 DC139A001 DC139B001 DC139B002 DC139B003	Zero OF/yr each	$2.52	$2.52	$2.55
Add screening to diversion structures: DC096K001 DC096N001 DC097L001 DC139A001 DC139B001 DC139B002 DC139B003	3.4 to 45 mgd overflow rates	$3.15	$3.15	$3.18
Conveyance piping	12-in dia.	$1.02	$1.02	$1.04
Conveyance piping	18-in dia.	$3.71	$3.71	$3.80
Conveyance piping	24-in dia.	$3.88	$3.88	$3.99
Conveyance piping	30-in dia.	$1.21	$1.21	$1.24
Conveyance piping	42-in dia.	$6.34	$6.34	$6.46

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA and their tributary municipalities have agreed that the basis of allocation for future operation and maintenance costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the S-15 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC S-15 overflow is not intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the "Selected Plan" to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the "Recommended Plan". This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the "Selected Plan" is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

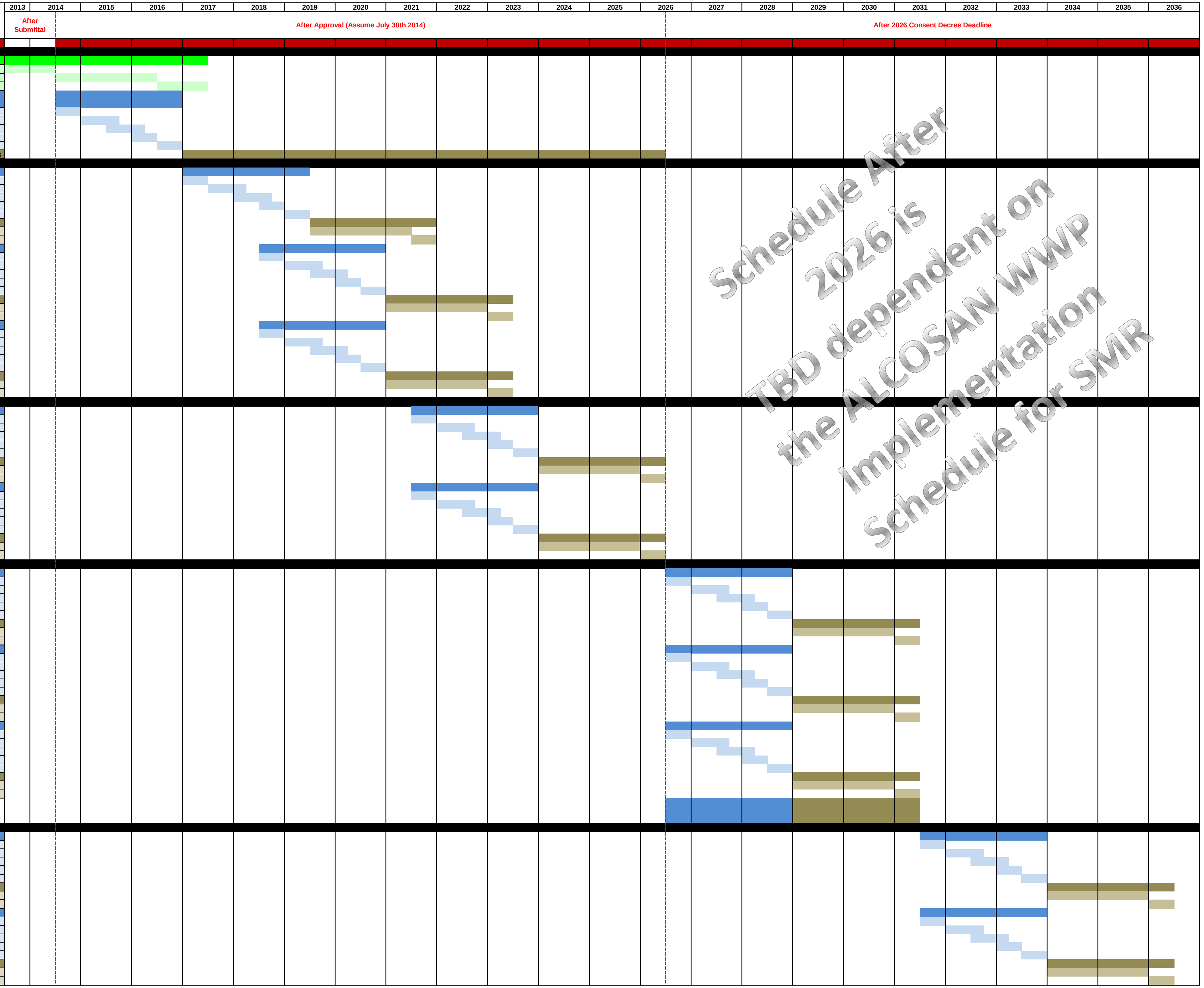
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it's important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements be up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the SMR portion of the regional plan is not being implemented by 2026, and an implementation date is not specified in the plan. Therefore, an implementation schedule for S-15 improvements cannot be specified at this time as it depends on the ALCOSAN WWP' SMR implementation schedule. The deadline shown in the schedule for S-15, which is shown in Figure S15-5-5, is for reference purposes only.

ATTACHMENT B

FIGURE S15-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the S-15 sewershed. These considerations include Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Baldwin Township, Dormont Borough, Municipality of Mt. Lebanon, and the Pittsburgh Water and Sewer Authority. Other considerations regarding the S-15 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the “2-year design storm” for the municipal separate sanitary system portions and “4 OF/ typical year” for the PWSA’s combined system outside of Saw Mill Run where “0 OF/ typical year” is proposed.

A set of guiding principles were produced for use in developing cost allocation procedures. These principles form the basis of a DRAFT Memorandum of Understanding by and between Baldwin Township, Dormont Borough, Municipality of Mt. Lebanon, and The Pittsburgh Water and Sewer Authority, and include:

- The major goal is to develop a fair and equitable cost allocation process.

- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.
- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.
- Cost allocations should be simple and easy to calculate in the future.
- The final cost allocation methodology should encourage efficiencies between municipalities.
- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.
- Unless agreed to by all parties, existing contracts should not form the only basis for cost allocations.

6.1.1 Cost Sharing Concept and Method

Two distinctive categories of cost allocations will need to be addressed by the PWSA and their tributary municipalities: capital cost allocations and O&M cost allocations. A number of methods for capital cost allocation were considered, based on the following:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution
- Proportion of internal municipal costs

All of these approaches could be modified by the addition of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc. The following discussion describes each of these methodologies.

"Agreed Upon" Basis: This approach could be as simple as each party agreeing to a fixed share of each element of cost or all costs across the board. Negotiation of the

basis of the percent share is left to the discretion of the involved parties. Shares could be fixed for the term of the agreement, or they could be adjustable on a scheduled or otherwise agreed to basis. This approach is usually successful where there are existing agreements or a long history of collaboration between the affected parties.

Capacity Basis: Capacity based cost sharing is predicated on the design capacity of the shared facilities and the portion that is allocable to the various parties to the Agreement. For the types of facilities being evaluated, wet weather flow rate and volume would be the primary capacity parameters. A Design Engineer's Report, normally submitted as part of the construction permitting process, should clearly specify and set forth the flow rate and volumetric design basis, as well as the capacity needs associated with all municipal entities. This information can serve as the basis for pro rata distribution of cost elements such as Debt Service and initial costs. One issue that should be addressed is how and whether unused and/or excess capacity utilized by "others" will be subject to cost reimbursement.

Expected Annual Flow Contribution: This method would utilize estimated flow rates for a predetermined average year as the basis for the evaluation of cost allocations. This may work well for systems where a hybrid approach of wet weather flow rate and volume is desired.

Proportion of Internal Municipal Cost: This approach requires municipalities to evaluate their own internal projects. This evaluation would include outlining control alternatives and selecting the highest ranked alternative for their internal solution. The municipalities' share of the combined project becomes a "not-to-exceed" or proportional value of its internal cost to the total regional cost.

6.1.2 Evaluation and Selection of Capital Cost Allocation Methodology

Four sewersheds, including the S-15 POC sewershed, were selected by 3RWW and their PM Team as pilot sewersheds for cost allocation evaluations. Monthly meetings were held at which the meeting attendees selected the methodologies that they thought were appropriate, and the 3RWW/PM Team provided the necessary statistics for use in evaluating and selecting the best methodology.

Statistics intended to support the various allocation methodologies were developed and discussed with each POC participant. Over the course of several meetings, the major point of discussion was the identification of ways to ensure the allocation was

fair and equitable by assigning the costs proportionally to the cost-causative items. In addition, participants agreed with the idea that it would not be fair for downstream municipalities pay for upstream sections of the project, given that they did not contribute flows directly into that sewer.

Following these discussions, the first decision regarded the need to use peak wet weather flows as the basis for the cost allocation. The PM Team evaluated three main types of peak flow based analysis:

Percentage of Flow at POC: In this approach, the total flows at the POC and at each connection point tributary to the POC are obtained from the H&H Model. The flow rate for each connection point is then divided by the total POC flow to obtain its ratio. This represents the connection point's portion of the total cost of the regional project. It should be noted that portions of the project dedicated to a single municipality would be subtracted from the total cost of the regional project.

Percentage by Length of Use: In this approach, the distance from the POC is used as a "weighing factor" in the cost allocation calculation.

Segmental: In this approach, areas that are tributary to a project or a portion of a project would divide the cost based on peak wet weather flow rates from each tributary area.

In all of the cost allocation procedures, the calibrated ALCOSAN H&H Model was the accepted tool for determining peak flow rates. In some cases where two or more municipalities were combined into one loading point, the agreement was to use the model to affect the required split through RTK and area adjustments (if separate) and area adjustment (if combined).

6.1.3 Operation & Maintenance Cost Allocation

In the development of O&M cost allocation methods, it is important to define what constitutes O&M. The following is a general list of those items considered for each POC sewershed:

- Sewer Inspection
- CCTV and cleaning
- Utilities and power requirements for pump stations and storage basins

- Chemical costs for CSO facilities
- Minor repair and rehabilitation
- Staff salaries, wages and fringe benefits
- Replacement costs (sewers and structures - 100 years; mechanical equipment – 25 years)
- SSO Response Plan

The next step was to categorize these expenses into at least groups – those items impacted by peak flow (such as CCTV and sewer cleaning) and those items impacted by volume of wastewater (such as storage basins). Once categorized, various methodologies for O&M cost allocation could be investigated. A number of approaches to O&M cost allocation were considered, and three of those chosen for capital cost allocation were also chosen for O&M cost allocations:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution

As was the case for the capital cost allocation methods, each of these approaches can be modified by the application of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc.

6.1.4 Selected Capital Cost Allocation Method

The selected method of capital cost allocation between the PWSA and their tributary municipalities is based upon the use of peak wet weather flows, as determined using the segmental approach.

Using this approach, areas of each municipality tributary to a section of new consolidation / conveyance piping would divide the cost based on peak wet weather flow rates from each municipal tributary area. The calibrated ALCOSAN H&H Model was the accepted tool for use in determining those peak flow rates.

For the purposes of this Feasibility Study, alternative POC-S15-C-0 has been divided into 11 (eleven) segments. Eight of these segments receive flows from one or more tributary municipalities, and are subject to the allocation of capital costs. The remaining three segments convey flows generated solely by the City of Pittsburgh. General locations of the eight inter-municipal segments of the recommended alternative are illustrated in Figure S15-6-1.

It is anticipated that the conceptual capital cost allocation estimates for each segment will be based on the municipal peak wet weather flow percentages shown in Table S15-6-1.

TABLE S15-6-1: MUNICIPAL PEAK WET WEATHER FLOW PERCENTAGES

Segment	Percentage (%)			
	PWSA	Mt. Lebanon	Borough of Dormont	Baldwin Township
1	0	14.9	85.1	0
2	30.4	5.0	64.6	0
3	12.3	29.0	58.7	0
4	32.7	23.0	36.5	7.7
5	76.8	7.6	12.0	3.6
6	78.9	6.9	10.9	3.3
7	80.5	6.1	9.8	3.6
8	89.1	0	0	10.9
9	100	0	0	0
10	100	0	0	0
11	100	0	0	0

If work is done by a municipality to reduce flow below the flows currently predicted and the municipality wants to revise these percentages, that municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties prior to the commencement of design.

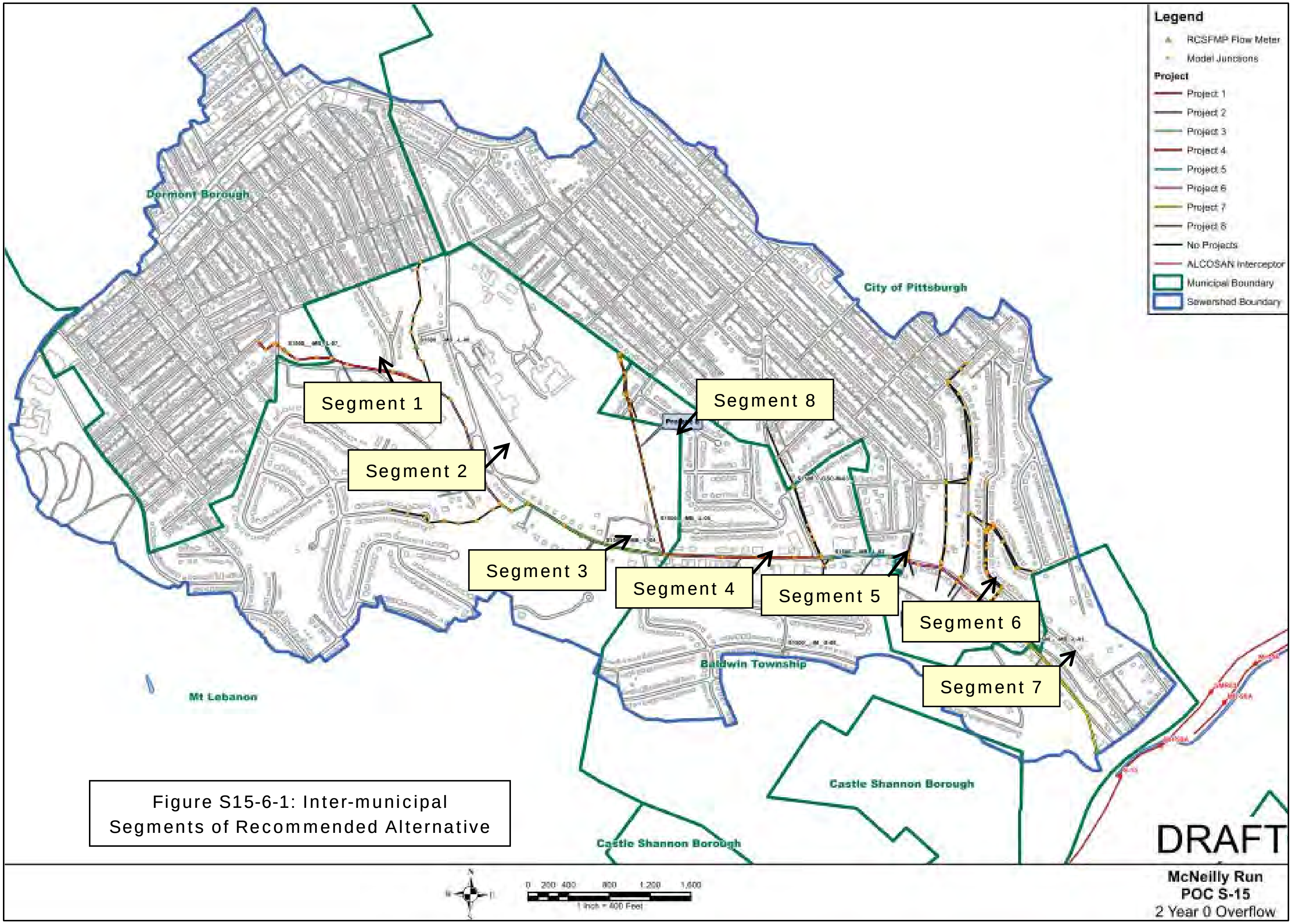


Figure S15-6-1: Inter-municipal Segments of Recommended Alternative

6.1.5 Selected O&M Cost Allocation Method

For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

One of the early steps taken to facilitate the development of up-to-date and relevant MOUs and/or inter-municipal agreements was to determine whether or not there were any existing, applicable MOUs or service agreements. 3RWW, working with the University of Pittsburgh, collected many of the existing agreements. The FSWG also formed an inter-municipal agreements subcommittee to review those existing agreements, develop an agreement outline for use by the municipalities, and prepare draft agendas for use in multi-municipal meetings.

The various inter-municipal agreements that have been compiled by 3RWW were reviewed for the purpose of summarizing the provisions that are relevant to allowable flow contributions. The results of this review are presented below. All specific references to “sanitary sewers”, “sanitary sewage” or other characterizations of the tributary sewer systems were extracted and presented below. In addition, specific information regarding cost sharing arrangements was also extracted from the agreements and is presented below.

McNeilly / McDonough’s Run. In an agreement dated July 22, 1927, the City of Pittsburgh, the Borough of Dormont, the Municipality of Mt. Lebanon & Baldwin Township reached an agreement. Relevant terms of that agreement are:

- Agreement for the construction of a branch trunk separate sewer along a line at or near McDonough’s Run, by the City of Pittsburgh.

- Costs to construct and repair trunk sewer to be shared as follows:

1.	Pittsburgh	32.35%
2.	Dormont	46.39%

3.	Mt. Lebanon	11.30%
4.	Baldwin Township	9.96%

Each party to the Agreement shall have the right to make connections of separate sewers to the main sewer without cost for the privilege of making said connections…. **"providing further that said lateral sewers shall be of the separate type from which ground water and storm water shall be excluded."**

It should be emphasized that this 1927 agreement is not anticipated to be used as the inter-municipal agreement for this project. The draft MOU developed per the following subsections would serve as an initial understanding of what would form a new future agreement between the municipalities.

6.2.1 Development of MOU and Inter-Municipal Agreements

When more than one municipality is involved in the design, construction and operation of wet weather control facilities, it is intended that they will develop inter-municipal agreements to outline their mutual understanding of the project as well as their municipal, customer and legal responsibilities. These responsibilities include, but are not limited to, joint permitting, joint ownership, joint cost sharing, and who will operate and maintain the facility on a long term basis.

In addition, it is the PWSA's position that any agreements or MOUs should contain provisions for periodic review and amendment as necessary by the respective parties and their solicitors.

6.2.2 MOU and Inter-Municipal Agreements

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. It is currently being reviewed by each of the parties.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and the schedule of the overall project is better understood.

In summary, the draft MOU states that, for the purpose of submitting the feasibility study, the municipalities agree that the preliminary estimated total cost to be expended on the inter-municipal segments of the recommended alternative, as shown in Figure S15-6-1, is $17,070,000. This cost represents the cost associated with the elements of the required improvements in the sewershed that provide multi-municipal service (i.e. convey or otherwise handle flows generated by more than one municipality). Each municipality shall have the right to void the MOU if the total cost exceeds $20,000,000. The draft MOU also states that the municipalities agree that the basis of allocation for costs of each segment is based on percentage of peak flow contributed to each segment at the time of the MOU, multiplied by the preliminary estimated total cost of each segment agreed to by the municipalities that will share in such costs.

It is intended that an agreement will be entered into by all parties after an implementation order has been issued by the PADEP and/or the ACHD. Such an order would indicate that the cost to each party would be based on the cost of each segment, to be adjusted for changes in costs made during construction.

The draft MOU further states that, for the purpose of submitting the Feasibility Study, the municipalities agree that the preliminary estimate of the percentage and amount of the total cost of implementation of the recommended alternative for each municipality will be as indicated below:

- Baldwin Township 2.7% ($460,000)
- Borough of Dormont 28.1% ($4,800,000)
- Municipality of Mt. Lebanon 10.2% ($1,740,000)

- The Pittsburgh Water and Sewer Authority 59.0% ($10,070,000)

It is noted that these costs represent the allocated costs for joint conveyance facilities. These costs do not include additional costs that may be associated with other recommended improvements in the sewershed within individual municipalities. The draft MOU is provided in Attachment S15-6-1. Also, signed copies of the MOU, if provided by the municipality, would be provided in Addendum S15-6-1. Mt. Lebanon has submitted a signed Addendum on behalf of POC S-15. While they are in agreement with the preparation of a report on a POC basis that required upstream inter-municipal co-ordination, they are not in agreement and not able to sign the MOU. PWSA received a signed MOU on behalf of Dormont Borough and POC S-15. A copy of Mt. Lebanon's signed Addendum and Dormont's signed MOU is presented in Addendum S15-6-1.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended S-15 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after S-15 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)

- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

Phase I	2013 through 2017
Phase II	2017 through 2023
Phase III	2021 through 2026
Phase IV	TBD
Phase V	TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements, including S-15, are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all

PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure S15-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the S-15 shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

6.3.2 Joint Municipal Planning and Implementation

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[1] Text is derived from "A Guide for Preparing Act 537 Update Revisions, 2003".

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. The draft MOU contains provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

The specific municipal tasks and efforts necessary to effect implementation of the Feasibility Study involve the completion of the 11 project segments listed above in Table S15-6-1.

All associated parties in the POC sewershed have participated in planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. Signature pages of executed MOUs or other expressions of agreement as provided by the municipalities are attached as Addendum S15-6-1 to this POC report.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$22,740,000; $17,070,000 of which would be part of the inter-municipal agreement.

- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance

- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table S15-6-2. The projected costs per household includes the “normal” current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE S15-6-2: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638
Borough of Dormont	Not Available	Not Available	Not Available
Municipality of Mt. Lebanon	$492	$1,243	Not Available
Baldwin Township[4]	$69	$639	Not Available

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure S15-6-2.

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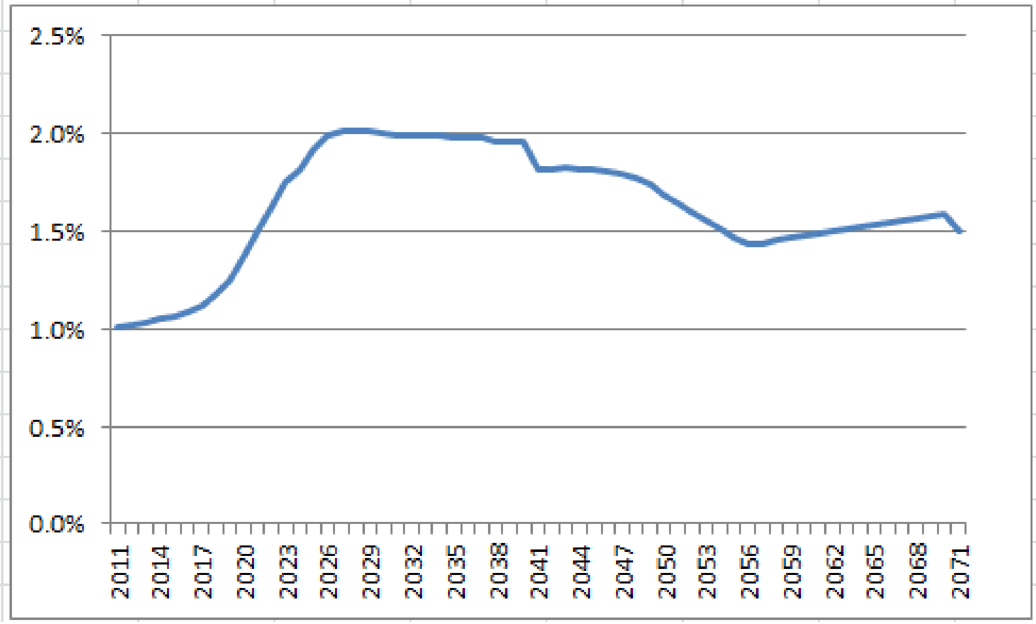
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.

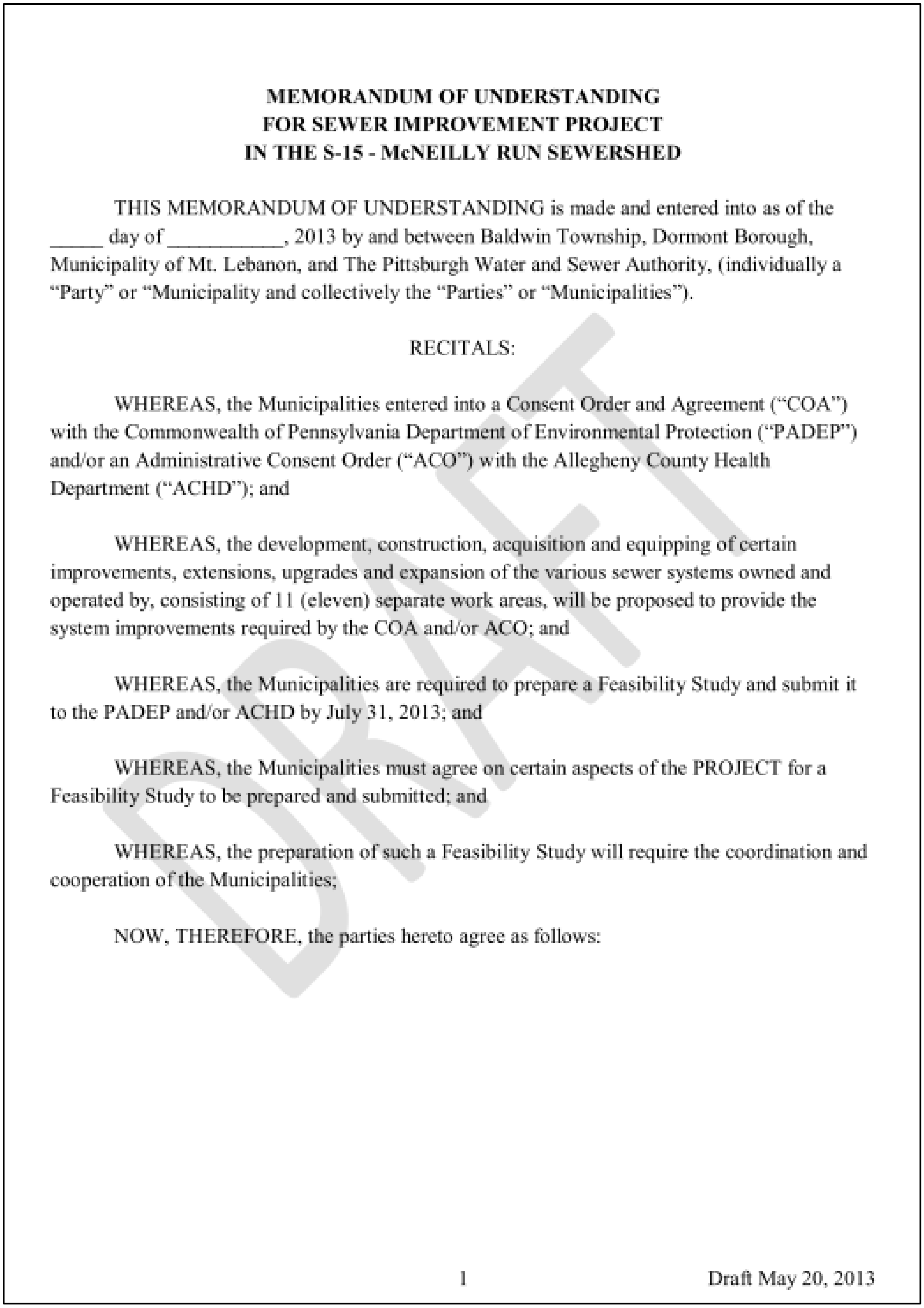
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

[4] Source: Baldwin Township's response to Request for Information from the Participating Municipalities for Complex Sewershed POC-Based Feasibility Study Reports, dated April 1, 2013.

FIGURE S15-6-2: ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.



MEMORANDUM OF UNDERSTANDING
FOR SEWER IMPROVEMENT PROJECT
IN THE S-15 - McNEILLY RUN SEWERSHED

THIS MEMORANDUM OF UNDERSTANDING is made and entered into as of the _____ day of ___________, 2013 by and between Baldwin Township, Dormont Borough, Municipality of Mt. Lebanon, and The Pittsburgh Water and Sewer Authority, (individually a "Party" or "Municipality and collectively the "Parties" or "Municipalities").

RECITALS:

WHEREAS, the Municipalities entered into a Consent Order and Agreement ("COA") with the Commonwealth of Pennsylvania Department of Environmental Protection ("PADEP") and/or an Administrative Consent Order ("ACO") with the Allegheny County Health Department ("ACHD"); and

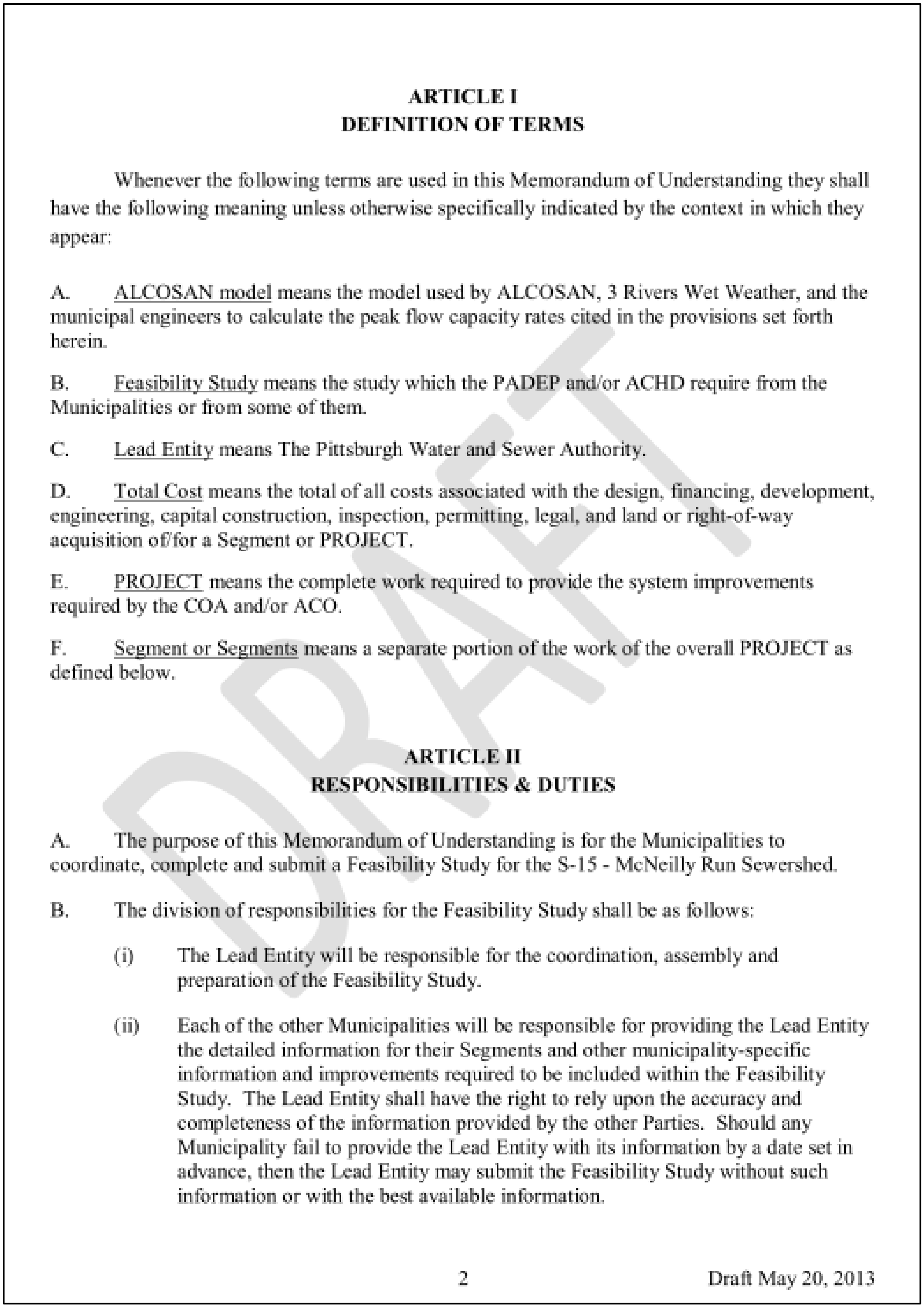
WHEREAS, the development, construction, acquisition and equipping of certain improvements, extensions, upgrades and expansion of the various sewer systems owned and operated by, consisting of 11 (eleven) separate work areas, will be proposed to provide the system improvements required by the COA and/or ACO; and

WHEREAS, the Municipalities are required to prepare a Feasibility Study and submit it to the PADEP and/or ACHD by July 31, 2013; and

WHEREAS, the Municipalities must agree on certain aspects of the PROJECT for a Feasibility Study to be prepared and submitted; and

WHEREAS, the preparation of such a Feasibility Study will require the coordination and cooperation of the Municipalities;

NOW, THEREFORE, the parties hereto agree as follows:



ARTICLE I
DEFINITION OF TERMS

Whenever the following terms are used in this Memorandum of Understanding they shall have the following meaning unless otherwise specifically indicated by the context in which they appear:

A. ALCOSAN model means the model used by ALCOSAN, 3 Rivers Wet Weather, and the municipal engineers to calculate the peak flow capacity rates cited in the provisions set forth herein.

B. Feasibility Study means the study which the PADEP and/or ACHD require from the Municipalities or from some of them.

C. Lead Entity means The Pittsburgh Water and Sewer Authority.

D. Total Cost means the total of all costs associated with the design, financing, development, engineering, capital construction, inspection, permitting, legal, and land or right-of-way acquisition of/for a Segment or PROJECT.

E. PROJECT means the complete work required to provide the system improvements required by the COA and/or ACO.

F. Segment or Segments means a separate portion of the work of the overall PROJECT as defined below.

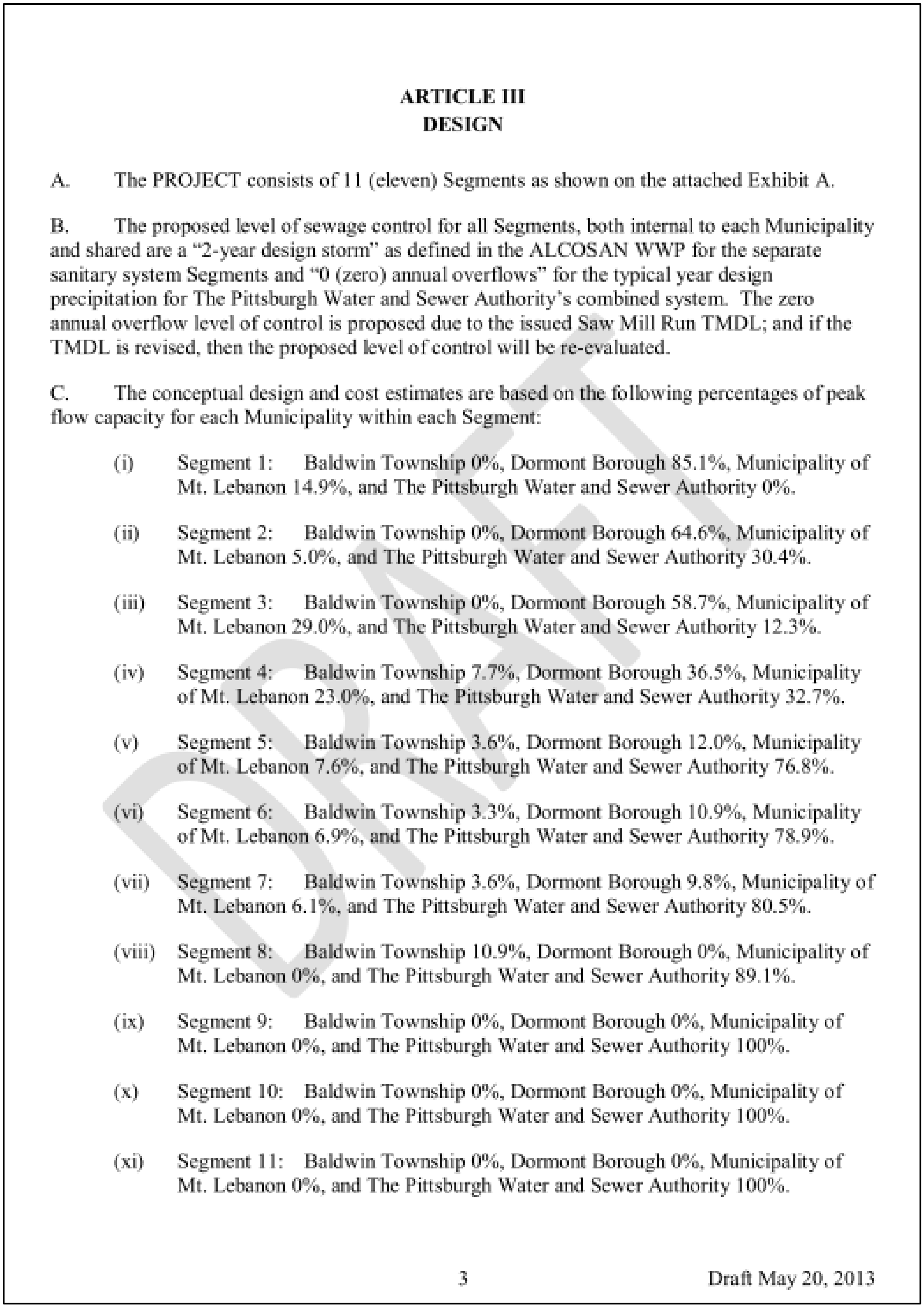
ARTICLE II
RESPONSIBILITIES & DUTIES

A. The purpose of this Memorandum of Understanding is for the Municipalities to coordinate, complete and submit a Feasibility Study for the S-15 - McNeilly Run Sewershed.

B. The division of responsibilities for the Feasibility Study shall be as follows:

(i) The Lead Entity will be responsible for the coordination, assembly and preparation of the Feasibility Study.

(ii) Each of the other Municipalities will be responsible for providing the Lead Entity the detailed information for their Segments and other municipality-specific information and improvements required to be included within the Feasibility Study. The Lead Entity shall have the right to rely upon the accuracy and completeness of the information provided by the other Parties. Should any Municipality fail to provide the Lead Entity with its information by a date set in advance, then the Lead Entity may submit the Feasibility Study without such information or with the best available information.



ARTICLE III
DESIGN

A. The PROJECT consists of 11 (eleven) Segments as shown on the attached Exhibit A.

B. The proposed level of sewage control for all Segments, both internal to each Municipality and shared are a "2-year design storm" as defined in the ALCOSAN WWP for the separate sanitary system Segments and "0 (zero) annual overflows" for the typical year design precipitation for The Pittsburgh Water and Sewer Authority's combined system. The zero annual overflow level of control is proposed due to the issued Saw Mill Run TMDL; and if the TMDL is revised, then the proposed level of control will be re-evaluated.

C. The conceptual design and cost estimates are based on the following percentages of peak flow capacity for each Municipality within each Segment:

(i) Segment 1: Baldwin Township 0%, Dormont Borough 85.1%, Municipality of Mt. Lebanon 14.9%, and The Pittsburgh Water and Sewer Authority 0%.

(ii) Segment 2: Baldwin Township 0%, Dormont Borough 64.6%, Municipality of Mt. Lebanon 5.0%, and The Pittsburgh Water and Sewer Authority 30.4%.

(iii) Segment 3: Baldwin Township 0%, Dormont Borough 58.7%, Municipality of Mt. Lebanon 29.0%, and The Pittsburgh Water and Sewer Authority 12.3%.

(iv) Segment 4: Baldwin Township 7.7%, Dormont Borough 36.5%, Municipality of Mt. Lebanon 23.0%, and The Pittsburgh Water and Sewer Authority 32.7%.

(v) Segment 5: Baldwin Township 3.6%, Dormont Borough 12.0%, Municipality of Mt. Lebanon 7.6%, and The Pittsburgh Water and Sewer Authority 76.8%.

(vi) Segment 6: Baldwin Township 3.3%, Dormont Borough 10.9%, Municipality of Mt. Lebanon 6.9%, and The Pittsburgh Water and Sewer Authority 78.9%.

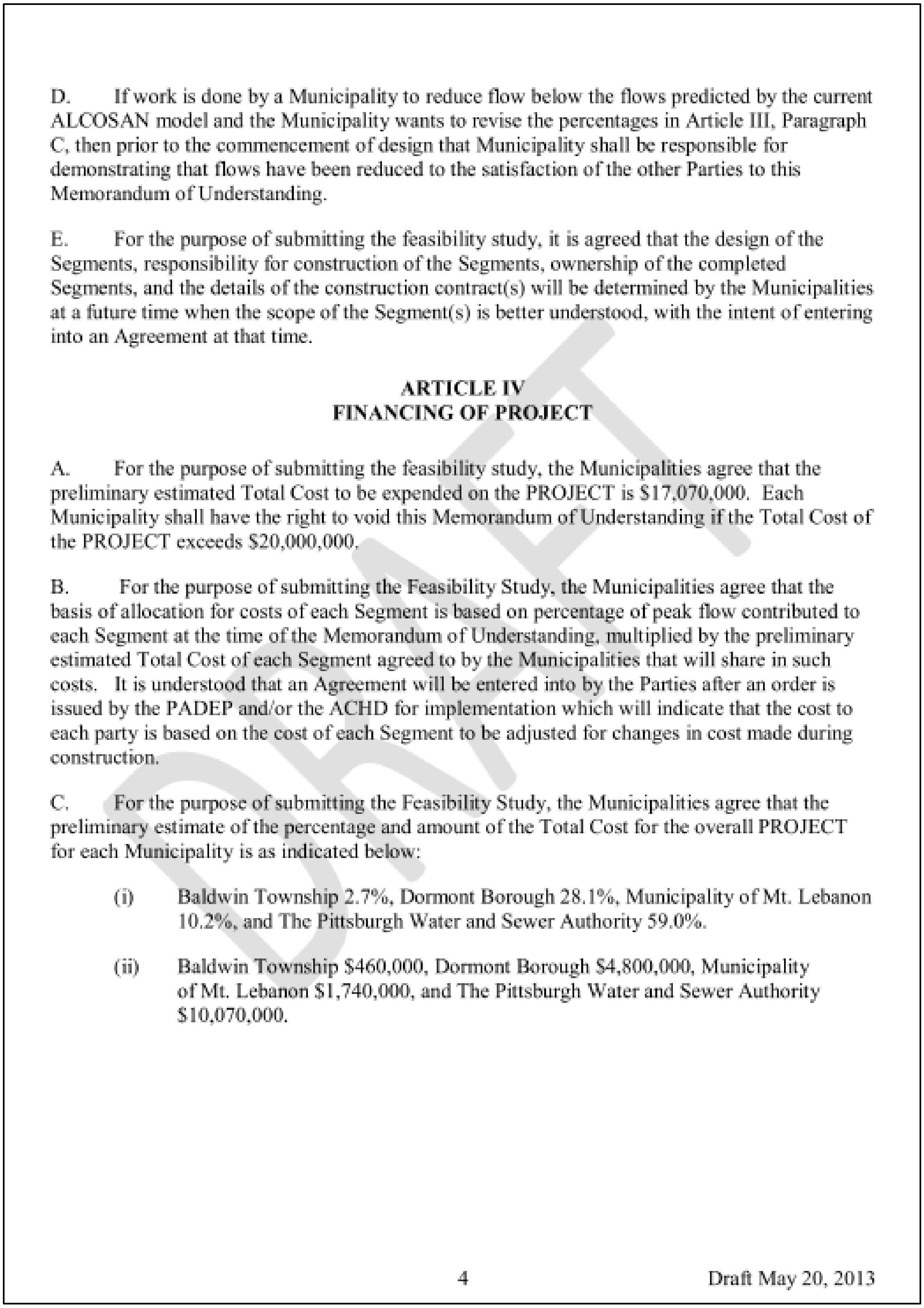
(vii) Segment 7: Baldwin Township 3.6%, Dormont Borough 9.8%, Municipality of Mt. Lebanon 6.1%, and The Pittsburgh Water and Sewer Authority 80.5%.

(viii) Segment 8: Baldwin Township 10.9%, Dormont Borough 0%, Municipality of Mt. Lebanon 0%, and The Pittsburgh Water and Sewer Authority 89.1%.

(ix) Segment 9: Baldwin Township 0%, Dormont Borough 0%, Municipality of Mt. Lebanon 0%, and The Pittsburgh Water and Sewer Authority 100%.

(x) Segment 10: Baldwin Township 0%, Dormont Borough 0%, Municipality of Mt. Lebanon 0%, and The Pittsburgh Water and Sewer Authority 100%.

(xi) Segment 11: Baldwin Township 0%, Dormont Borough 0%, Municipality of Mt. Lebanon 0%, and The Pittsburgh Water and Sewer Authority 100%.



D. If work is done by a Municipality to reduce flow below the flows predicted by the current ALCOSAN model and the Municipality wants to revise the percentages in Article III, Paragraph C, then prior to the commencement of design that Municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties to this Memorandum of Understanding.

E. For the purpose of submitting the feasibility study, it is agreed that the design of the Segments, responsibility for construction of the Segments, ownership of the completed Segments, and the details of the construction contract(s) will be determined by the Municipalities at a future time when the scope of the Segment(s) is better understood, with the intent of entering into an Agreement at that time.

ARTICLE IV
FINANCING OF PROJECT

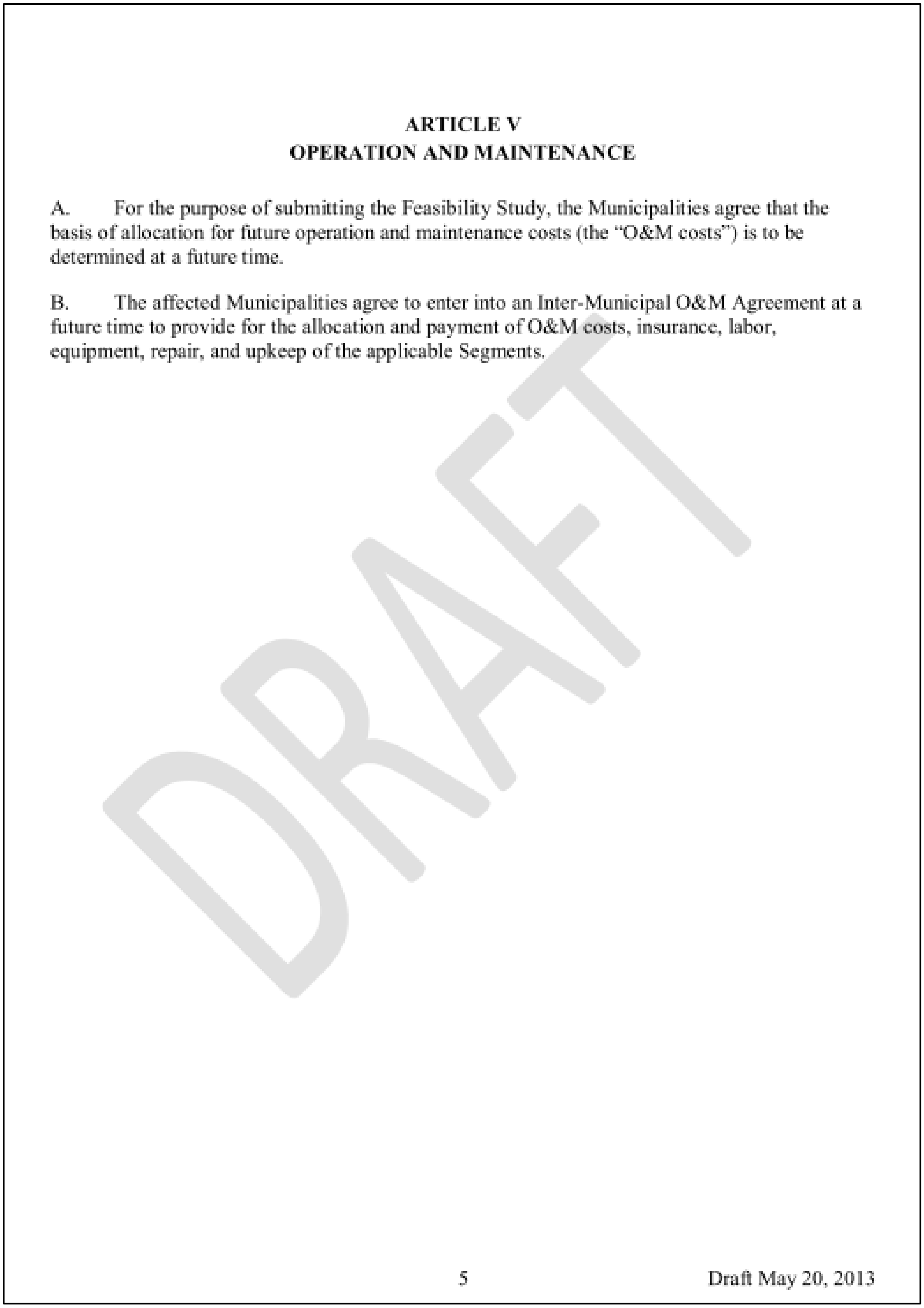
A. For the purpose of submitting the feasibility study, the Municipalities agree that the preliminary estimated Total Cost to be expended on the PROJECT is $17,070,000. Each Municipality shall have the right to void this Memorandum of Understanding if the Total Cost of the PROJECT exceeds $20,000,000.

B. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for costs of each Segment is based on percentage of peak flow contributed to each Segment at the time of the Memorandum of Understanding, multiplied by the preliminary estimated Total Cost of each Segment agreed to by the Municipalities that will share in such costs. It is understood that an Agreement will be entered into by the Parties after an order is issued by the PADEP and/or the ACHD for implementation which will indicate that the cost to each party is based on the cost of each Segment to be adjusted for changes in cost made during construction.

C. For the purpose of submitting the Feasibility Study, the Municipalities agree that the preliminary estimate of the percentage and amount of the Total Cost for the overall PROJECT for each Municipality is as indicated below:

(i) Baldwin Township 2.7%, Dormont Borough 28.1%, Municipality of Mt. Lebanon 10.2%, and The Pittsburgh Water and Sewer Authority 59.0%.

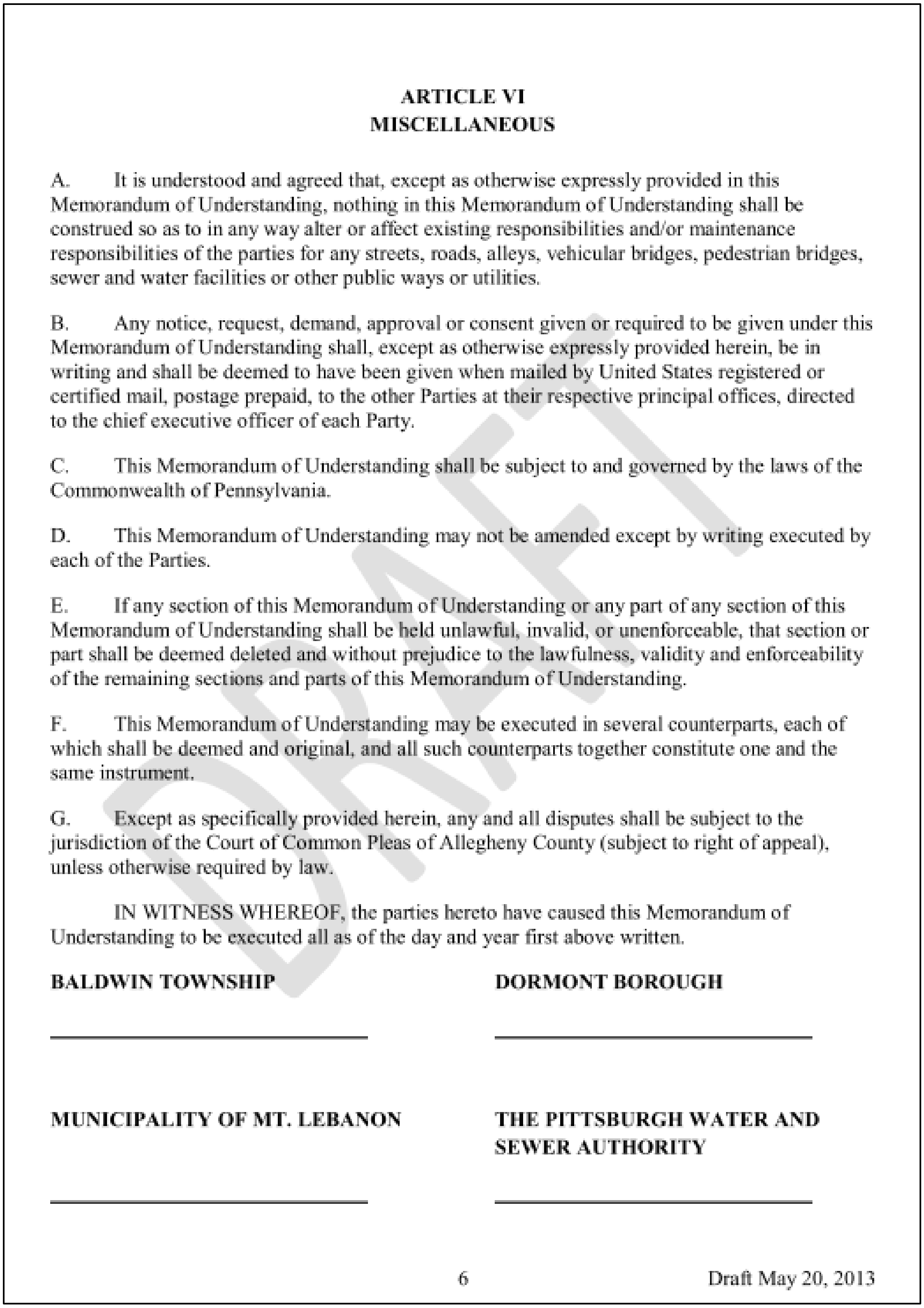
(ii) Baldwin Township $460,000, Dormont Borough $4,800,000, Municipality of Mt. Lebanon $1,740,000, and The Pittsburgh Water and Sewer Authority $10,070,000.



ARTICLE V
OPERATION AND MAINTENANCE

A. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for future operation and maintenance costs (the "O&M costs") is to be determined at a future time.

B. The affected Municipalities agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the applicable Segments.



ARTICLE VI
MISCELLANEOUS

A. It is understood and agreed that, except as otherwise expressly provided in this Memorandum of Understanding, nothing in this Memorandum of Understanding shall be construed so as to in any way alter or affect existing responsibilities and/or maintenance responsibilities of the parties for any streets, roads, alleys, vehicular bridges, pedestrian bridges, sewer and water facilities or other public ways or utilities.

B. Any notice, request, demand, approval or consent given or required to be given under this Memorandum of Understanding shall, except as otherwise expressly provided herein, be in writing and shall be deemed to have been given when mailed by United States registered or certified mail, postage prepaid, to the other Parties at their respective principal offices, directed to the chief executive officer of each Party.

C. This Memorandum of Understanding shall be subject to and governed by the laws of the Commonwealth of Pennsylvania.

D. This Memorandum of Understanding may not be amended except by writing executed by each of the Parties.

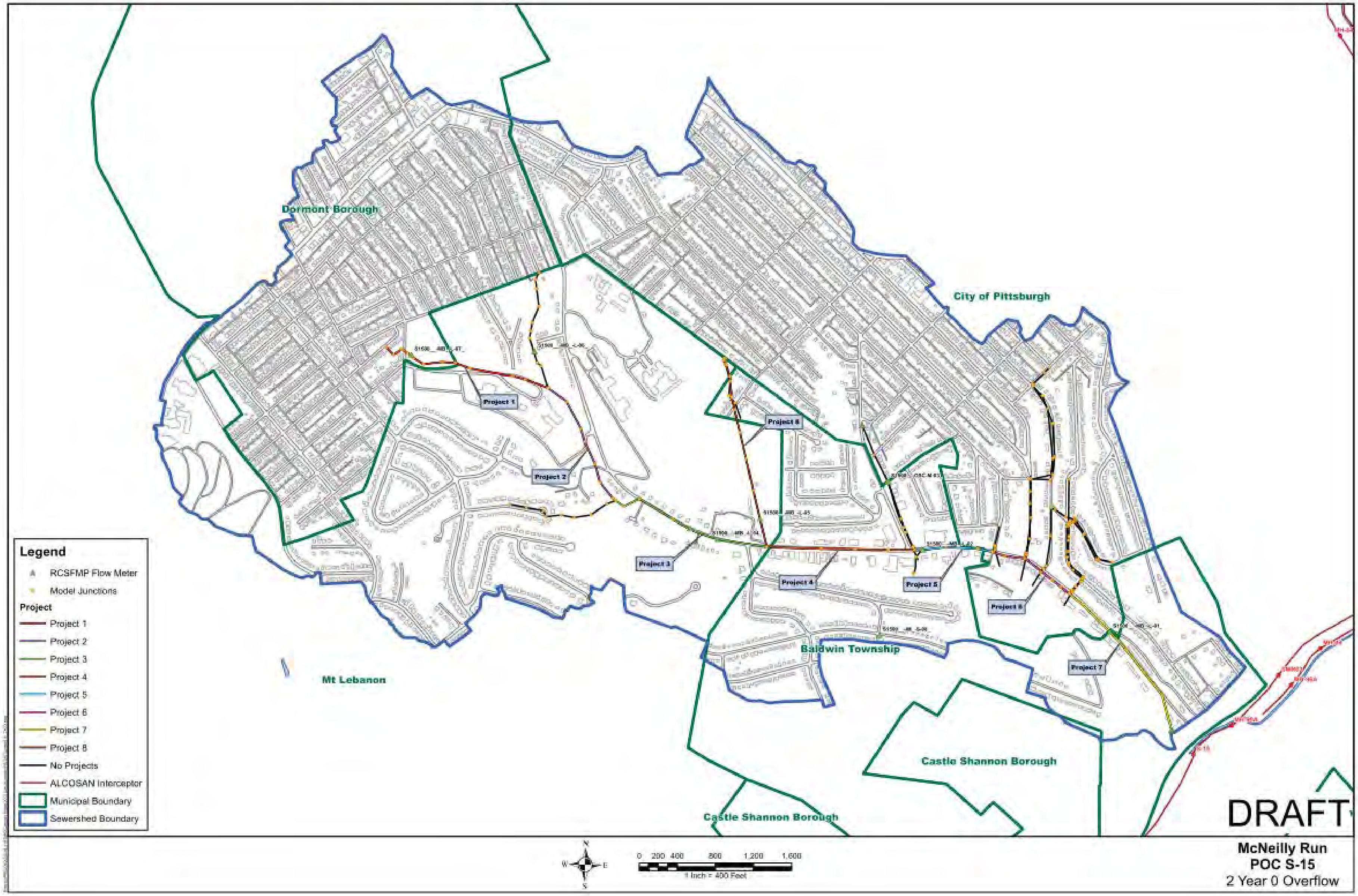
E. If any section of this Memorandum of Understanding or any part of any section of this Memorandum of Understanding shall be held unlawful, invalid, or unenforceable, that section or part shall be deemed deleted and without prejudice to the lawfulness, validity and enforceability of the remaining sections and parts of this Memorandum of Understanding.

F. This Memorandum of Understanding may be executed in several counterparts, each of which shall be deemed and original, and all such counterparts together constitute one and the same instrument.

G. Except as specifically provided herein, any and all disputes shall be subject to the jurisdiction of the Court of Common Pleas of Allegheny County (subject to right of appeal), unless otherwise required by law.

IN WITNESS WHEREOF, the parties hereto have caused this Memorandum of Understanding to be executed all as of the day and year first above written.

BALDWIN TOWNSHIP	**DORMONT BOROUGH**
______________________	______________________
MUNICIPALITY OF MT. LEBANON	**THE PITTSBURGH WATER AND SEWER AUTHORITY**
______________________	______________________


Dormont Borough
City of Pittsburgh
Mt Lebanon
Baldwin Township
Castle Shannon Borough
Castle Shannon Borough
Project 1
Project 2
Project 3
Project 4
Project 5
Project 6
Project 7
Project 8
Legend
RCSFMP Flow Meter
Model Junctions
Project
Project 1
Project 2
Project 3
Project 4
Project 5
Project 6
Project 7
Project 8
No Projects
ALCOSAN Interceptor
Municipal Boundary
Sewershed Boundary
DRAFT
N
W
E
S
0 200 400 800 1,200 1,600
1 Inch = 400 Feet
McNeilly Run
POC S-15
2 Year 0 Overflow

7.0 STAKEHOLDER INVOLVEMENT

Stakeholder meetings titled POC Sewershed Coordination Meetings, facilitated by 3RWW, were held during the site and technology selection and alternative development processes. These meetings facilitated cooperation, information exchange and consensus building between the PWSA, its stakeholders and tributary municipalities essential to the development of the PWSA Feasibility Study Report and supporting POC-based feasibility studies. For the meetings listed in Table 7-1, POC S-15 was the focus of the discussion and representatives from municipalities' tributary to the McNeilly/McDonough's Run sewershed were in attendance. Meeting topics included source reduction and green infrastructure, alternatives analysis, affordability and implementation schedule, and cost allocation. Other stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

The Wet Weather Feasibility Study Coordination Meeting, led by the PWSA, facilitated stakeholder participation between the PWSA and Baldwin Township, Dormont Borough and Municipality of Mt. Lebanon communities tributary to the McNeilly/McDonough's Run watershed. The purpose of this meeting was to coordinate the development of planning information specific to the multi-municipal sewershed, reach a consensus agreement on the recommended improvements and receive authorization to submit the results.

TABLE 7-1. MCNEILLY / MCDONOUGH'S RUN S-15 POC MEETINGS

Title/Purpose	Date	Time	Location
POC Sewershed Coordination	1/27/12	10:30 AM	Mt. Lebanon Municipal Building
POC Sewershed Coordination	3/14/12	1:30 PM	Mt. Lebanon Municipal Building
WW Feasibility Study Coordination	4/10/12	1:30 PM	PWSA Office
POC Sewershed Coordination	4/18/12	1:30 PM	Mt. Lebanon Municipal Building
POC Sewershed Coordination	5/16/12	2:30 PM	Mt. Lebanon Municipal Building
POC Sewershed Coordination	6/20/12	1:30 PM	Mt. Lebanon Municipal Building
POC Sewershed Coordination	10/25/12	1:30 PM	Mt. Lebanon Municipal Building
POC Sewershed Coordination	11/29/12	9:00 AM	Mt. Lebanon Municipal Building
POC Sewershed Coordination	1/16/13	1:30 PM	Mt. Lebanon Municipal Building
POC Sewershed Coordination	2/20/13	1:30 PM	Mt. Lebanon Municipal Building
POC Sewershed Coordination	3/13/13	1:30 PM	Mt. Lebanon Municipal Building

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
MH-80: ENGLERT STREET

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

ATTACHMENT B

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System,* dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.

- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.

- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.

- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

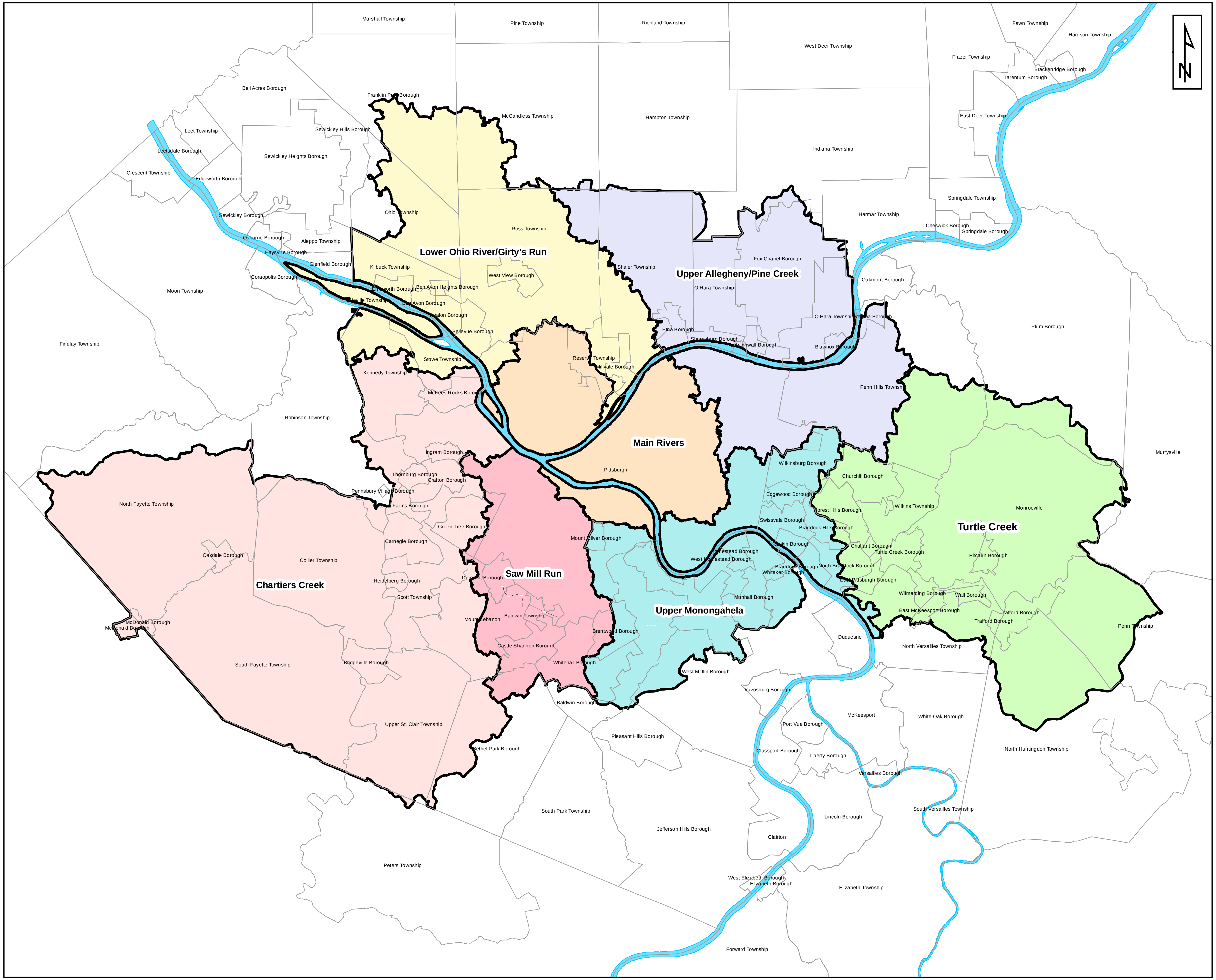
- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.
- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.
- Section 7.0 describes how stakeholders were included in the plan development.

1.2 EXISTING SYSTEM DESCRIPTION

This POC FS Report addresses POC MH-80, also known as Englert Street. The MH-80 sewershed is located in the Saw Mill Run Planning Basin. The Saw Mill Run basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: Miscellaneous Saw Mill Run Sewersheds Existing Facilities Map*. The MH-80 sewershed is served by one main trunk sewer that extends from ALCOSAN MH-80 toward the Queenston Street area via parallel sewers. One of the sewers is the main trunk sewer while the other is the primary overflow/storm sewer. The main trunk line consists of 8-inch to 12-inch vitrified clay sewer. The primary overflow/storm sewer is comprised of 15-inch to 60-inch reinforced concrete and vitrified clay sewers.

There is one PWSA CSO diversion chamber in the sewershed that overflows to Saw Mill Run at one permitted CSO. The MH-80 sewershed encompasses approximately 49 acres of the City of Pittsburgh. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to MH-80* for specific information on this POC.



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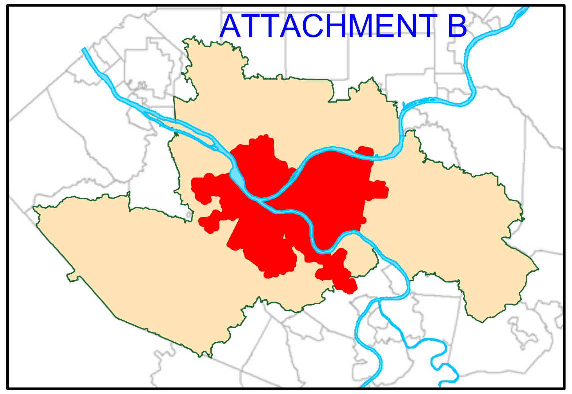

ALCOSAN Service Area Overview

Legend

- ☐ Municipal Boundary
- ▨ Chartiers Creek
- ▨ Lower Ohio River / Girty's Run
- ▨ Main Rivers
- ▨ Saw Mill Run
- ▨ Turtle Creek
- ▨ Upper Allegheny / Pine Creek
- ▨ Upper Monongahela
- ▨ River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

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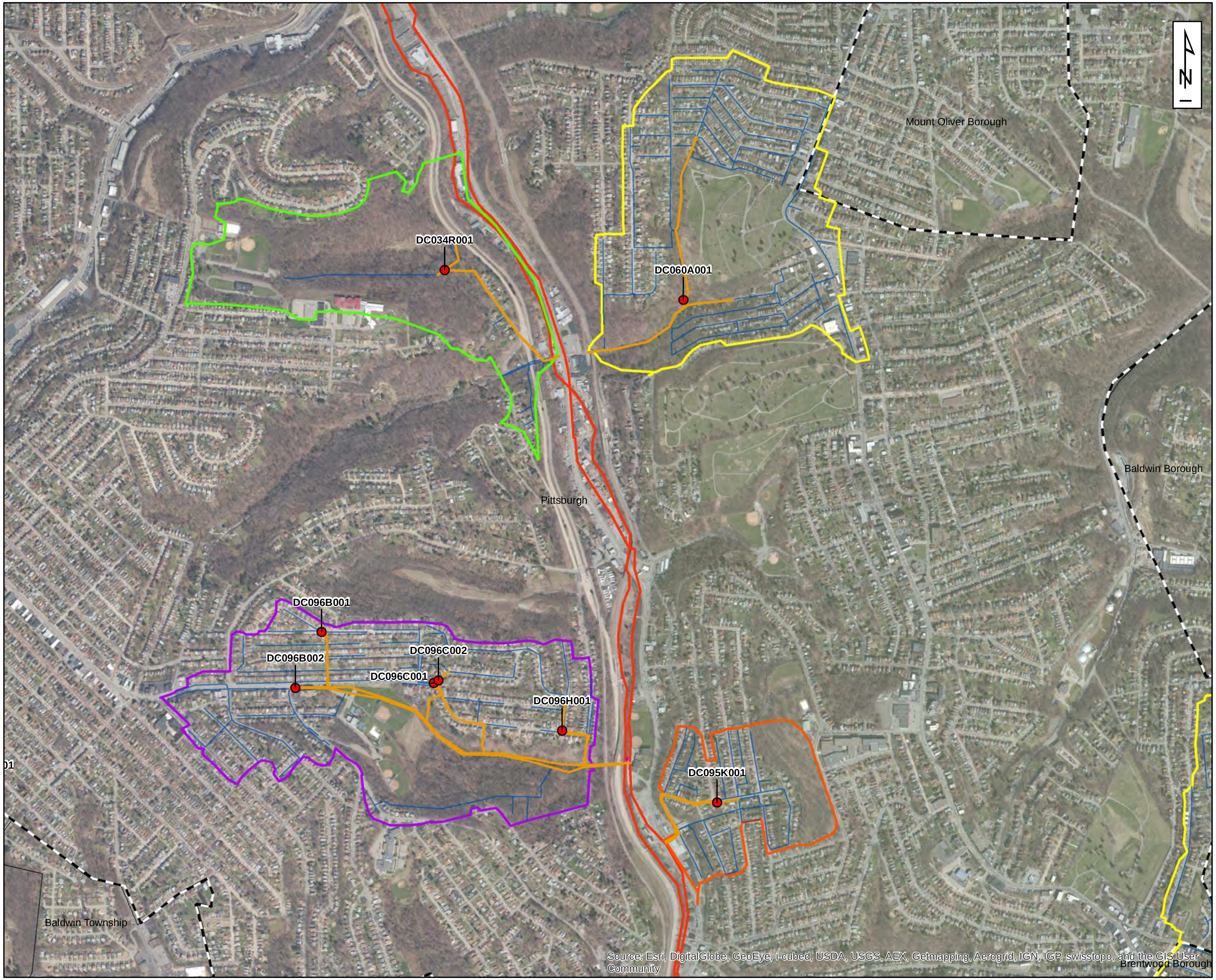
Quality Water Quality Service

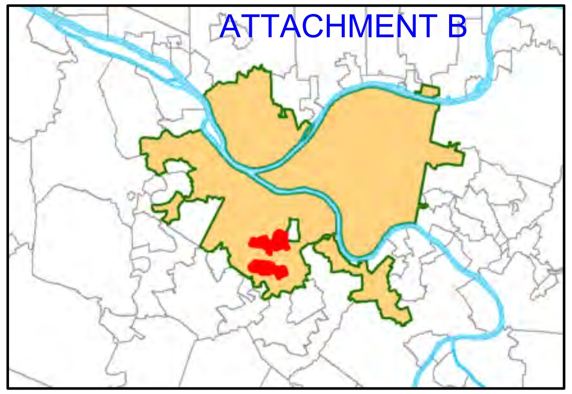
July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

● PWSA CSO Diversion Structure

— Trunk Sewer

— Collector Sewer

▭ MH-55 Sewershed Boundary

▭ MH-77 Sewershed Boundary

▭ MH-80 Sewershed Boundary

▭ S-23 Sewershed Boundary

▭ PWSA Service Area Boundary

▭ Municipal Boundary

▭ River

Existing ALCOSAN Interceptor

--- Deep Tunnel

— Shallow Cut

1,000 500 0 1,000 Feet

Figure 1 - 2: MH-55, MH-77, MH-80 & S-23 Miscelaneous Sewersheds Existing Facilities

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Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 1-2_MiscExisting Overflows.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR AREA TRIBUTARY TO MH-80

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY
	City of Pittsburgh
Tributary Area (Acres)	49
Population	521
Combined	
Inch-Miles	2.4
Linear Feet	829
Inch-Miles/Acre	0.05
Separate	
Inch-Miles	21.4
Linear Feet	13,416
Inch-Miles/Acre	0.44

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows from the upstream PWSA diversion structure ties directly into the Saw Mill Run interceptor at MH80 with no overflow structure. The Saw Mill Run interceptor conveys those flows to ALCOSAN diversion structure O-14.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to MH-80*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008).*

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO MH-80

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
095J001	DC095K001	CSO095J001	Englert Street and Saw Mill Run Boulevard	Saw Mill Run

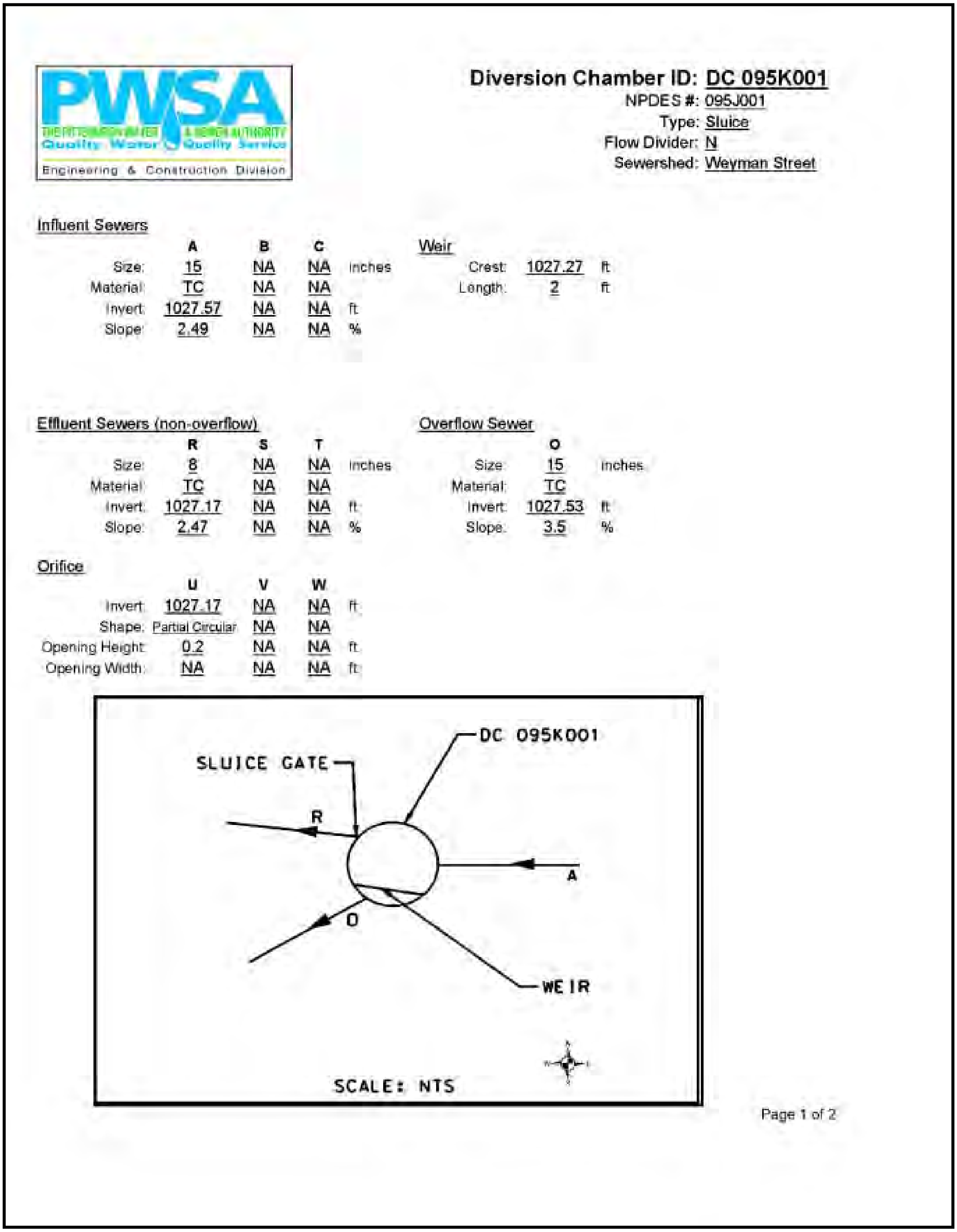
As shown in *Table 1-3: MH-80 Sewershed Typical Year Overflow Statistics*, during the typical year the single structure overflows 18 times. The largest overflow volume is 10,000 gallons per event and the total annual volume is 10,000 gallons.

TABLE 1-3: MH-80 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC095K001	18	0.36	0.02	0.01	0.01	0.00	0.00	0.01
							Total Annual Volume	**0.01**

1.2.1 Diversion Structure Sketches

The following sketches of the MH-80 diversion structure were taken from Appendix A.2 of the PWSA SICR, August 2008.



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Diversion Chamber ID: DC 095K001
NPDES #: 095J001
Type: Sluice
Flow Divider: N
Sewershed: Weyman Street

Influent Sewers

	A	B	C	
Size:	15	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1027.57	NA	NA	ft
Slope:	2.49	NA	NA	%

Weir

Crest:	1027.27	ft
Length:	2	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1027.17	NA	NA	ft
Slope:	2.47	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	1027.53	ft
Slope:	3.5	%

Orifice

	U	V	W	
Invert:	1027.17	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.2	NA	NA	ft
Opening Width:	NA	NA	NA	ft

Page 1 of 2

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Engineering & Construction Division

Diversion Chamber ID: DC 095K001

Page 2 of 2

2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC MH-80: Englert Street Sewershed through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Saw Mill Run Basin Planners (SMR_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for MH-80.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN’s wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN’s Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The flow monitoring data were used to help develop and calibrate the H&H model upon

which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. No flow meters located in the MH-80 sewershed were used in the RCS-FMP. The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).
- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.

- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.

- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the MH-80 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the MH-80 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.

- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process to represent the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table MH80-2-1.

TABLE MH80-2-1: MH-80 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[1]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-80	0.12	0.12	0.0%

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event. RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for MH-80 are presented in Table MH80-2-2.

---

[1] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.4

TABLE MH80-2-2: MH-80 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[2]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
MH-80	1.0	1.0	0.0%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year, and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure MH80-2-1 present the computed hydraulic profiles of the existing MH-80 main trunk sewer system under projected 2-year design storm peak flow conditions. As is indicated in the figure, under the current system configuration, including existing CSO diversion chamber settings, no surcharging occurs.

Figure MH80-2-2 present the computed hydraulic profiles of the existing MH-80 main trunk sewer system under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, no surcharging occurs.

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[2] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.5

Figure MH80-2-3 present the computed hydraulic profiles of the existing MH-80 main trunk sewer system under projected 10-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, no surcharging occurs.

Computed flow hydrographs for each of the design storms at POC MH-80 are presented in Figure MH80-2-4.

FIGURE MH80-2-1: MH-80 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

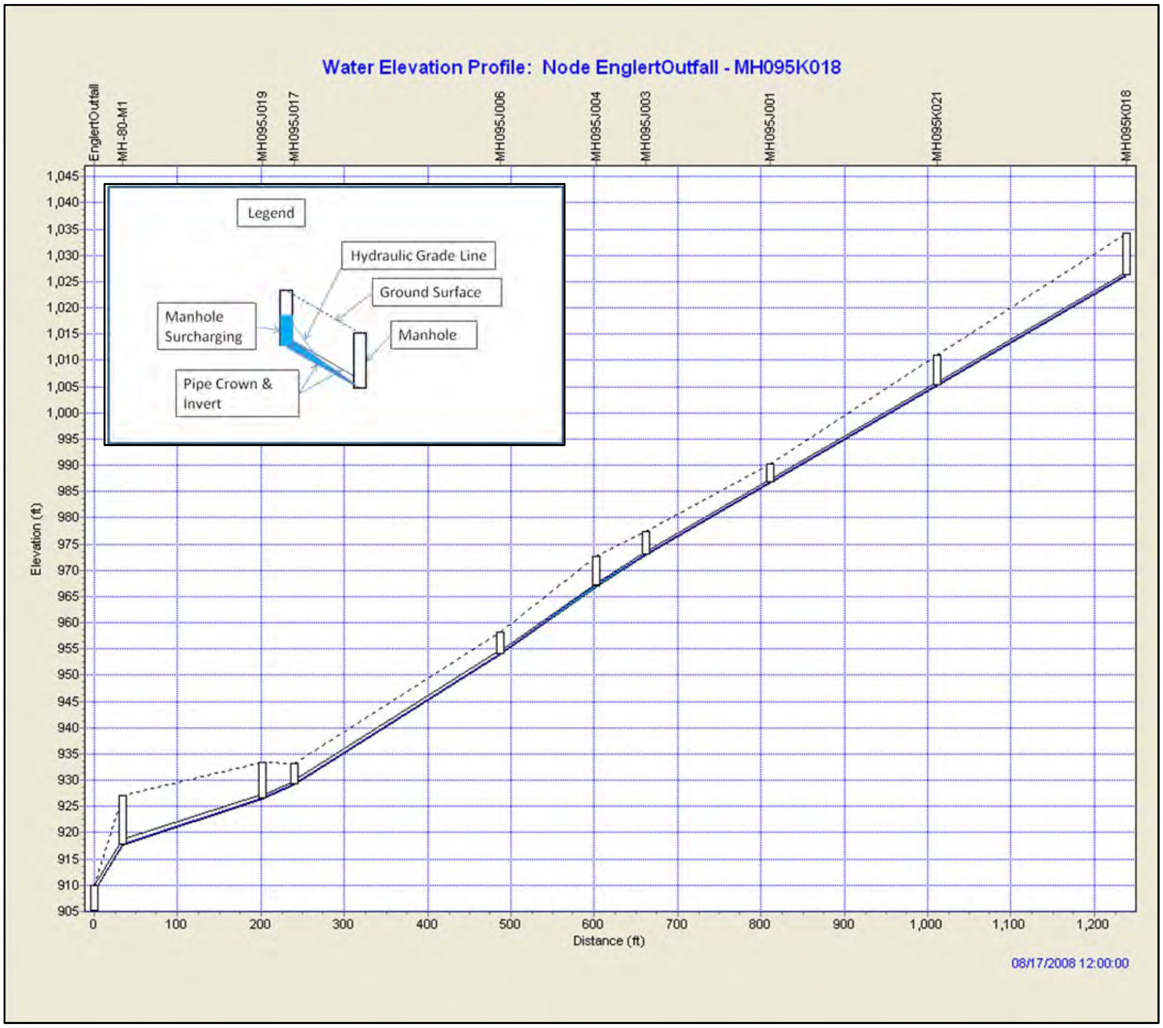


FIGURE MH80-2-2: MH-80 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

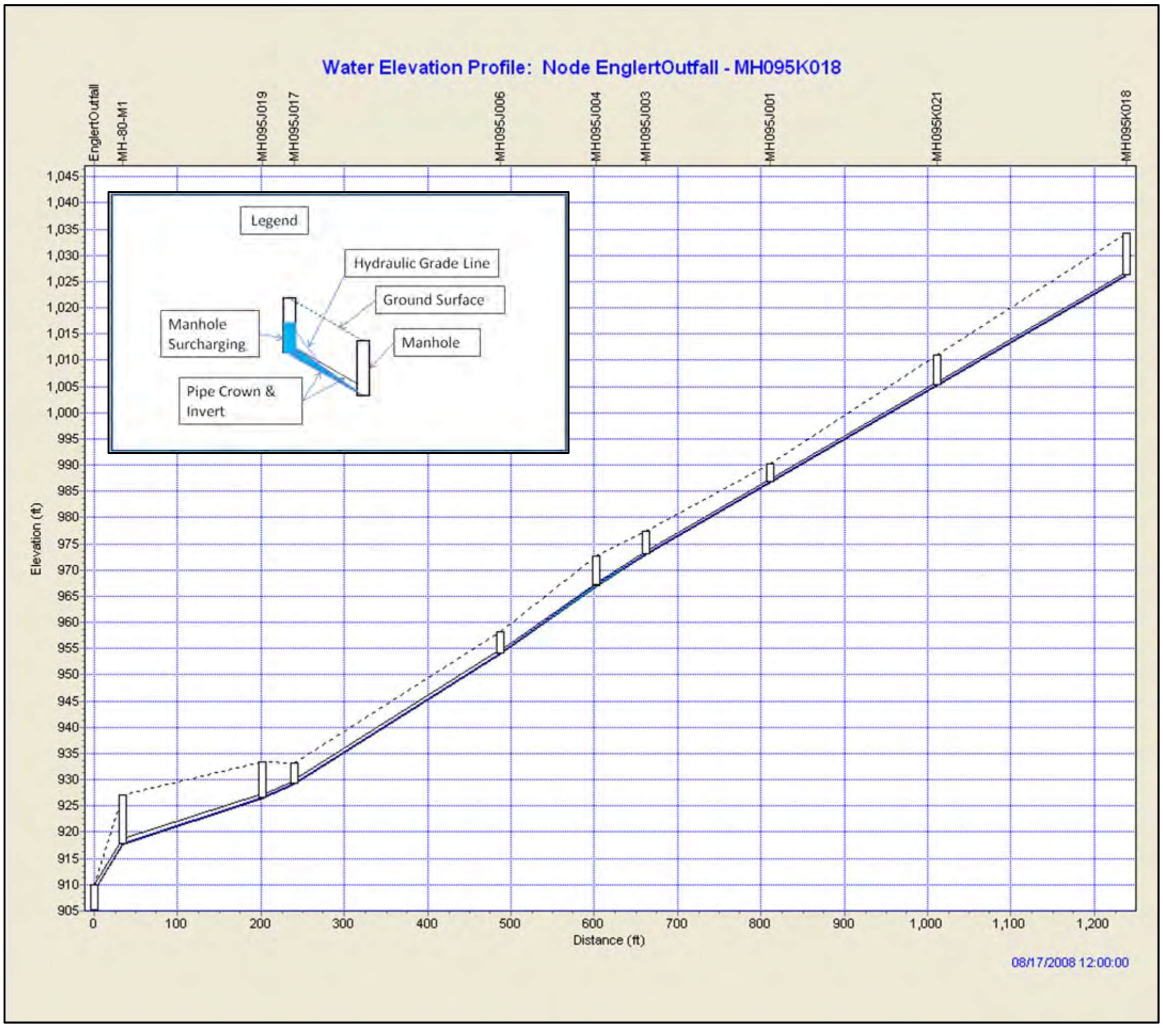


FIGURE MH80-2-3: MH-80 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

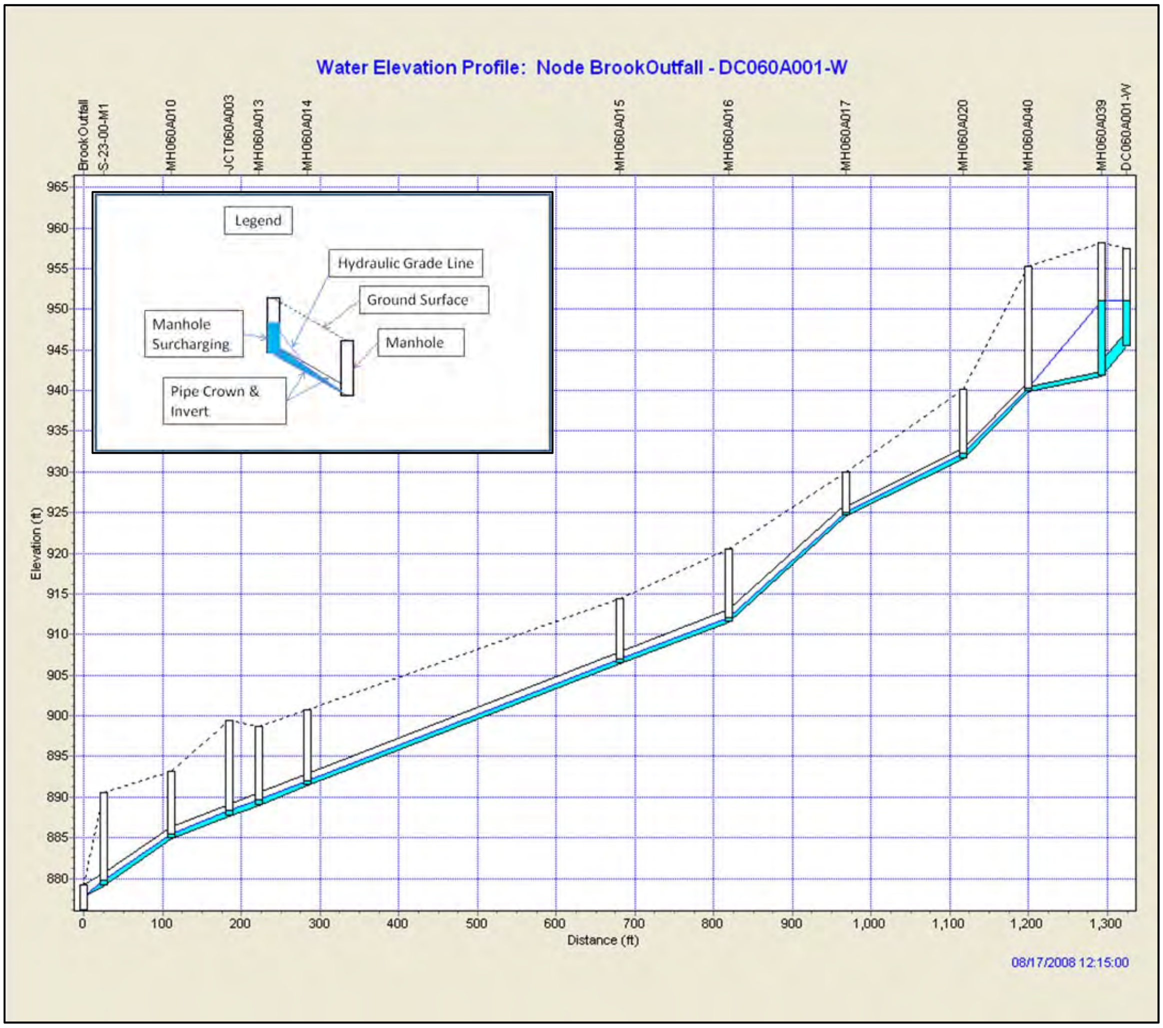
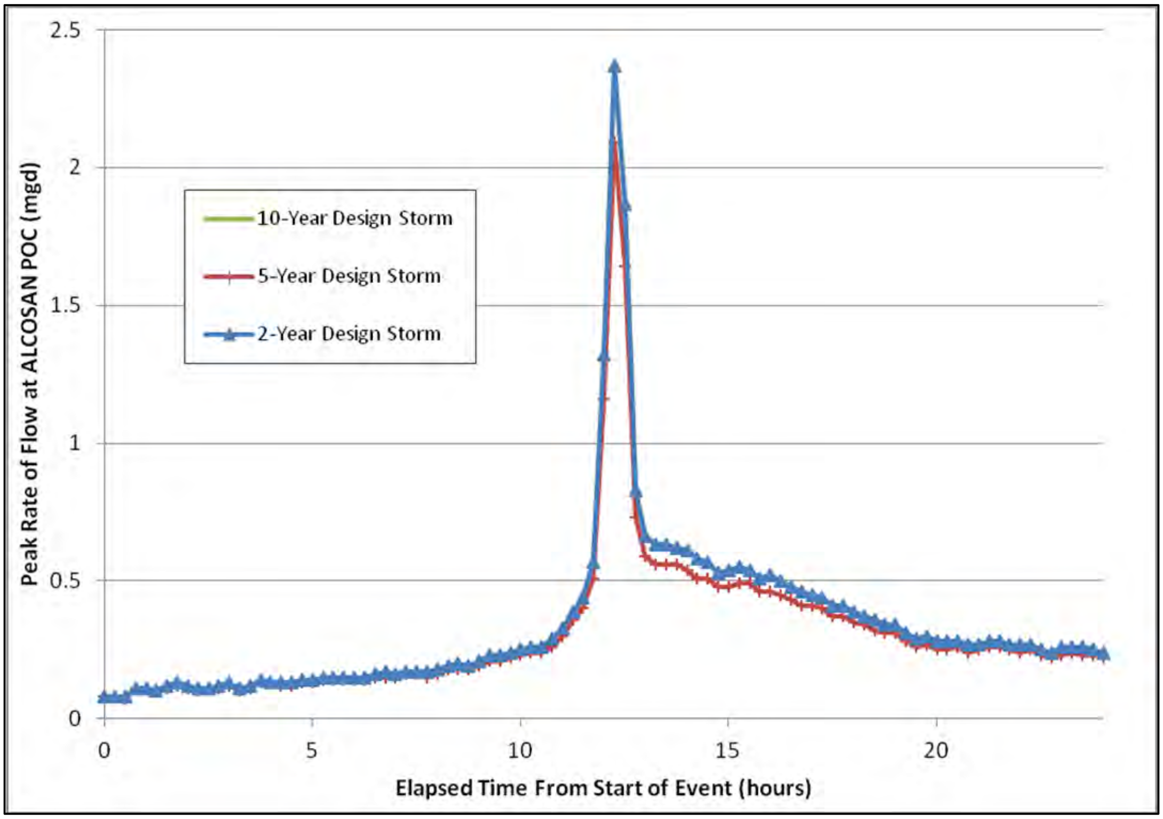


FIGURE MH80-2-4: MH-80 SEWERSHED PEAK FLOW RATES TO THE POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

PWSA investigated but did not locate any chronic basement flooding locations within the PWSA portion of the MH-80 sewershed. The neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. The results are based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the MH-80 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures MH80-2-5 and MH80-2-6. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figures show that under this range of operating conditions, the existing trunk sewer systems does not exhibit surcharging while conveying the required flows to the ALCOSAN point of connection.

FIGURE MH80-2-5: MH-80 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

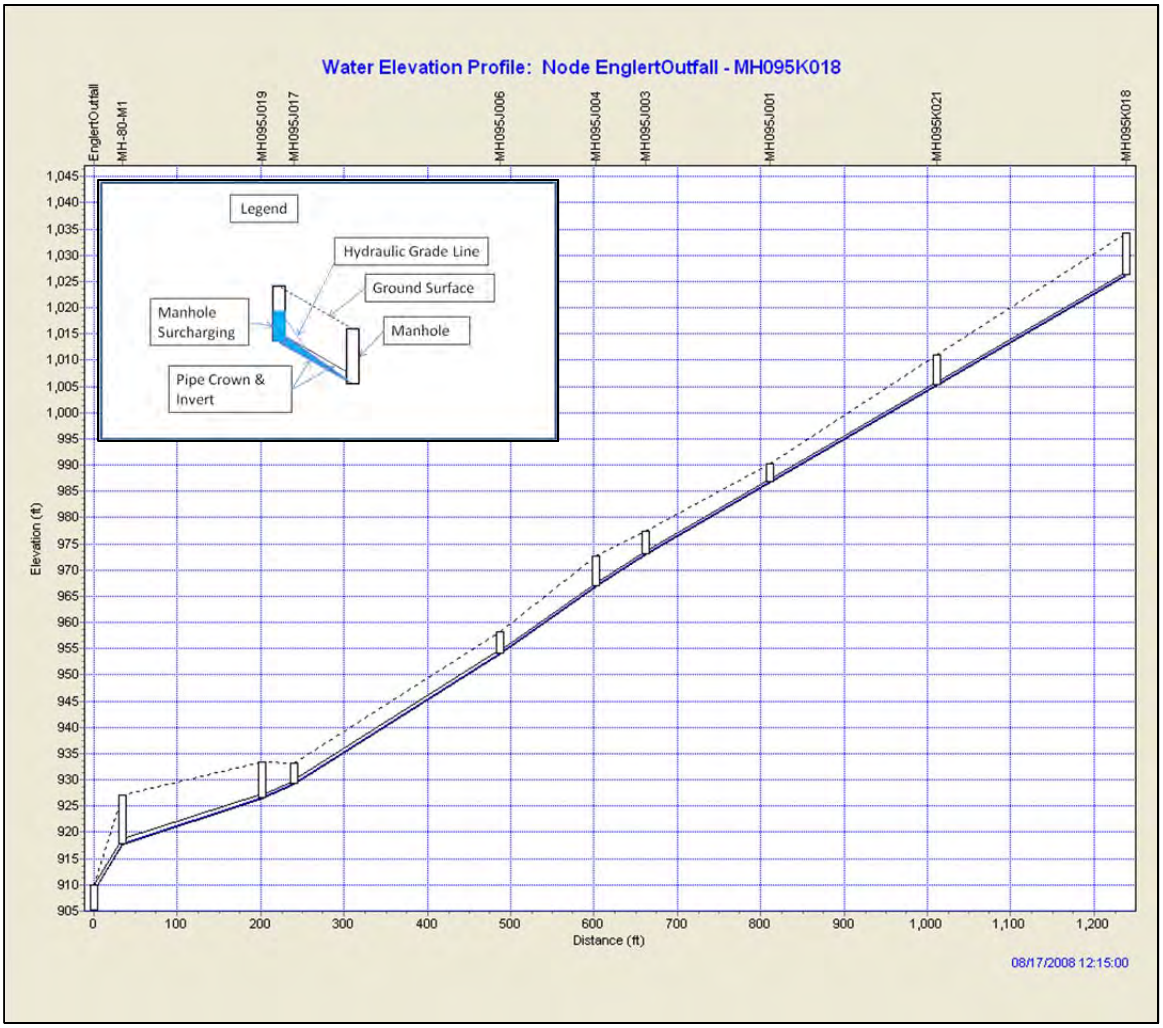
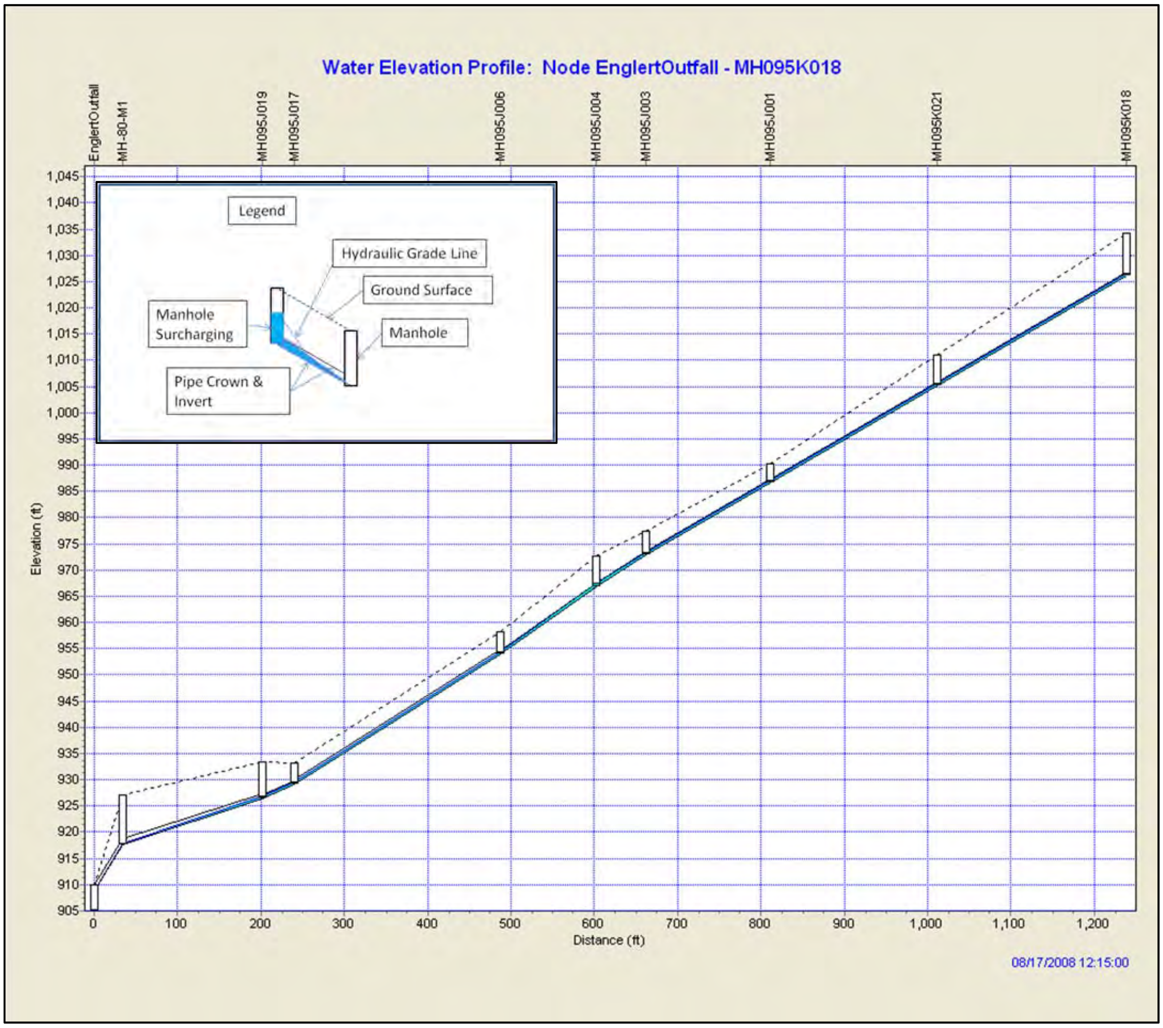


FIGURE MH80-2-6: MH-80 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the MH-80 sewer system performed by PWSA produced the following computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table MH80-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the MH-80: Englert Street sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. One (1) of these outfalls is found within the MH-80: Englert Street Sewershed, as shown in Table MH80-3-1.

TABLE MH80-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE MH-80: ENGLERT STREET SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF095J001	SMR	MH-80	Saw Mill Run	WWF[1]	N	Y

As shown in the table, the one (1) PWSA owned outfall discharges into Saw Mill Run. This is classified as warm water fisheries (WWF) and currently do not meet their assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.

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[1] Warm Water Fishery

- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives. This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream, including Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical

characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

The receiving water characterization field program resulted in certain findings within Saw Mill Run. In general, the DO concentrations for Saw Mill Run did not meet regulatory limits during wet weather which is likely related to CSO discharges during the storm events and/or wet weather discharges from upstream municipalities. Saw Mill Run also showed DO concentrations not meeting standards during dry weather indicating that CSO discharges are not likely causing the condition.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters, including Saw Mill Run and its tributaries within the PWSA limits, with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL. For Saw Mill Run, the concentration during the recreational season exceeded the 200 cfu/100mL limit in 100% of the samples and exceeded the 400 cfu/100mL limit in 80% of the samples.

Saw Mill Run has an in-stream target concentration of 0.035 mg/L for total phosphorus (TP) which was exceeded by 75% of the samples. TP appears to be a concern throughout Saw Mill Run, with CSO discharges being a potentially significant source in wet weather.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan*, *January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal Coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS. However for Saw Mill Run, it is judged that a higher level of control is needed due to the need to reduce phosphorus levels (see next section).

3.2.2 Saw Mill Run TMDL Report

A TMDL report was completed for Saw Mill Run and its tributaries which showed phosphorus TMDL results are shown below in Table MH80-3-2.

TABLE MH80-3-2: SAW MILL RUN PHOSPHORUS TMDL RESULTS

Total Phosphorus Load	CSO Load	SSO Load
Existing Load (Ib/Growing Season)	7,161.9	1,950.4
Allocated Load (Ib/ Growing Season)	177.5	0.0
Percent Reduction (%)	98%	100%

The implication of this is that substantial reductions of CSOs and complete elimination of SSOs is necessary for compliance. For CSOs, it is judged that a control level of 0 overflows per year will be required.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a “typical year” of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, such as Saw Mill Run, pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA’s Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6 overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the MH-80 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO

controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the MH-80 sewershed, Table MH80-3-3 lists the untreated CSO statistics that were computed for each control level.

TABLE MH80-3-3: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE MH-80 SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC095K001	0	0	4	0.02	6	0.03

As will be described later in this report, the MH-11 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year and 10-year return frequency events).

Since Saw Mill Run has a TMDL which requires a high level of Phosphorous removal (98%), a higher CSO control level will be required. While 10, 4 and 0 OF/yr are analyzed, it is judged that 0 OF/yr will be necessary for compliance.

A range of design storms (2-yr, 5-yr, and 10-yr) were evaluated for transport of flows. PWSA plans to use the 2-yr storm which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

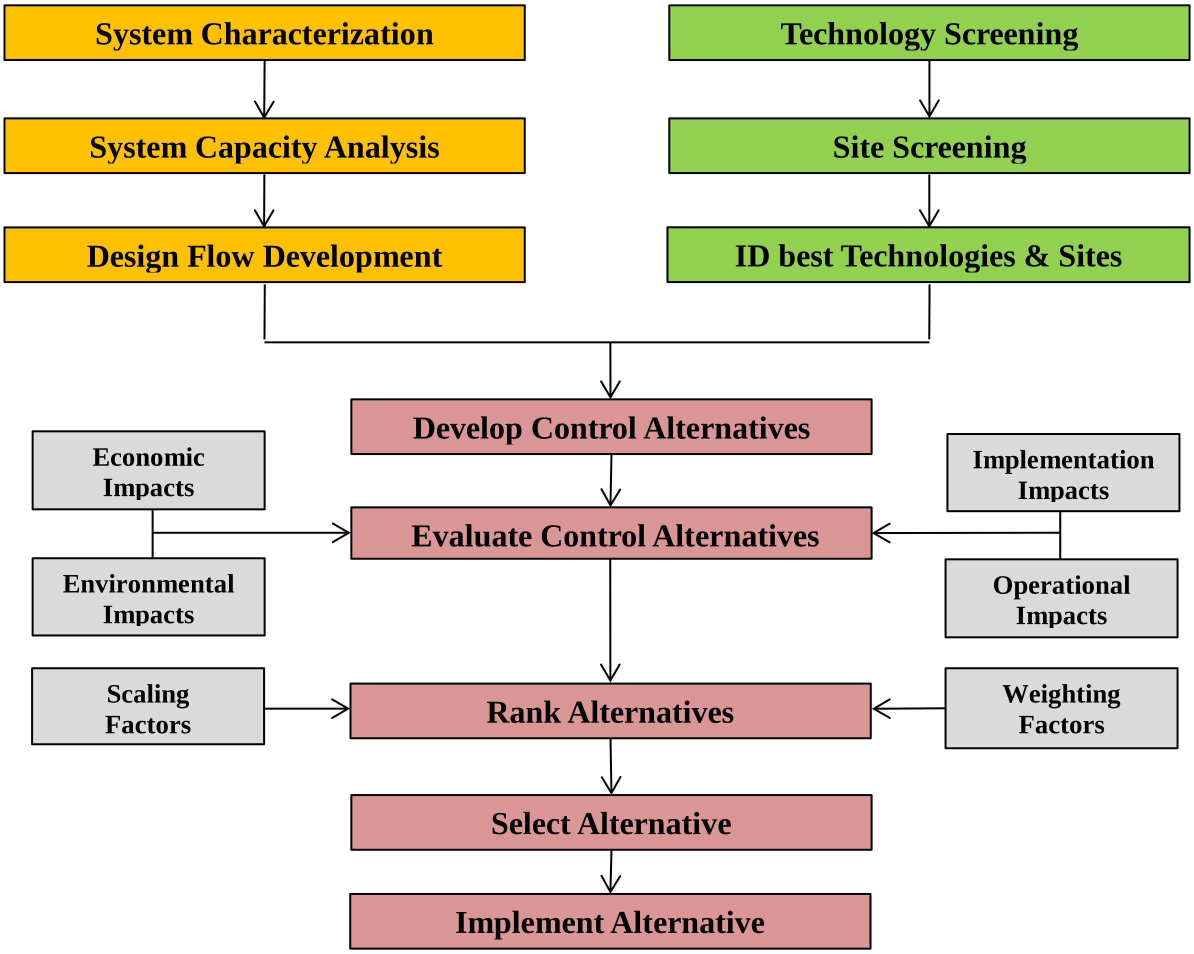
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure MH80-4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE MH80-4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table MH80-8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered “feasible” for use in the MH-80 sewershed are shown below in Table MH80-4-1.

TABLE MH80-4-1: MH-80 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies were identified for the MH-80 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table MH80-4-2.

There are no other municipalities tributary to the MH-80 sewershed.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning "Objective Scores" to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as the waterways.

TABLE MH80-4-2: MH-80 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 095J001	No activations during the typical year.	No control required.
Consolidated Outfalls 095E001 to 095J001	CS4 095E001 to 095J001: Sewer separation	Complete sewer separation of tributary area.
	S2-095E001 to 095J001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-095E001 to 095J001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-095E001 to 095J001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-095E001 to 095J001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-095E001 to 095J001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-095E001 to 095J001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Regional Controls – MH-80: Englert St Controls		
Outfalls 095J001	CS4-S-18 to CSO 095J001: Sewer Separation	Complete sewer separation of tributary areas.
	S2-S-18 to CSO 095J001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-S-18 to CSO 095J001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-S-18 to CSO 095J001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-S-18 to CSO 095J001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-S-18 to CSO 095J001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-S-18 to CSO 095J001: Screening and Disinfection	A stand-alone screening and disinfection facility.

CSO(s)	Control Alternative(s)	Description
Sub-system Controls - Saw Mill Run Controls		
Outfalls 095J001	SMR-1a: Tunnel Storage[2]	A 2.8 mile long tunnel O-14 to the S-30 POC. The MH-80 CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • S-18 TO 095J001 - Sub-Surface Storage
	SMR-1b: Tunnel Storage[2]	
	SMR-2a: Tunnel Storage[2]	A 5.7 mile long tunnel from O-14 to the MH-80 POC. The MH-80 CSO will be conveyed to a drop shaft near the MH-80 POC.
	SMR-2b: Tunnel Storage[2]	

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

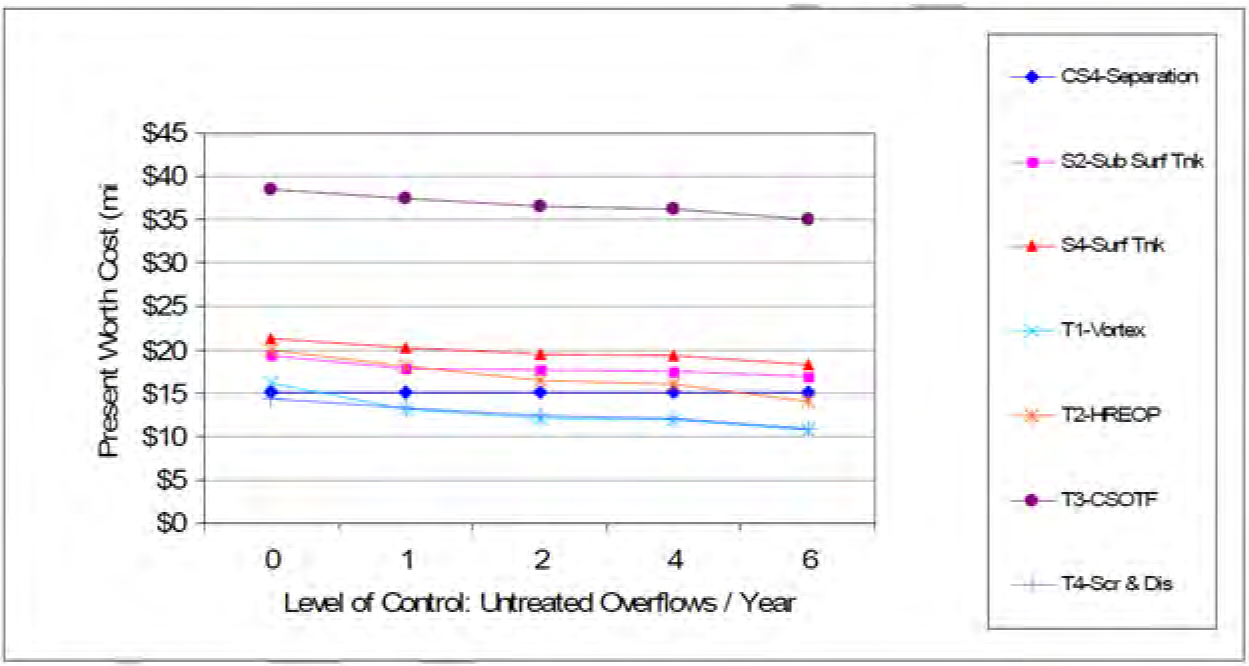
The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

Outfall 095J001: Outfall 095J001 did not activate the typical year, and no control alternatives were required.

Outfall 095E001 TO 095J001: Cost estimates were produced for outfall-specific control alternatives CS4 095E001 TO 095J001: Sewer separation, S2-095E001 TO 095J001: Sub-Surface Storage, S4-095E001 TO 095J001: Surface Storage, T1-095E001 TO 095J001: Suspended Solids Control, T2-095E001 TO 095J001: High Rate End of Pipe Treatment, T3-095E001 TO 095J001: CSO Treatment Facility, and T4-095E001 TO 095J001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure MH80-4-2 illustrates the ranges of estimated present worth costs for these alternatives.

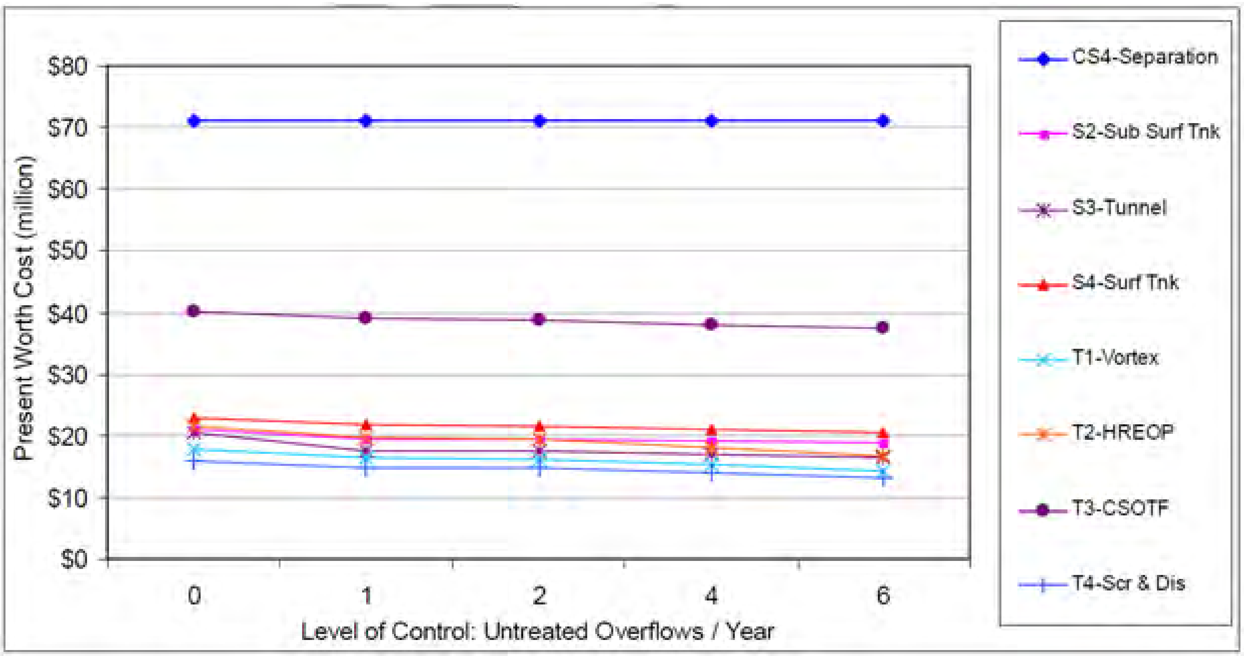
FIGURE MH80-4-2: OUTFALL 095E001 TO 095J001 ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

Cost estimates were produced for regional control alternatives developed for the S-18 to CSO 095J001 Region. Figure MH80-4-3 illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE MH80-4-3: S-18 to CSO 095J001 REGION ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Saw Mill Run sub-system. Table MH80-4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Saw Mill Run subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume

responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE MH80-4-3: SAW MILL RUN SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
SMR-1a	249.3	2.1	272.1
SMR-1b	253.3	1.9	274.0
SMR-2a	246.2	1.6	265.1
SMR-2b	251.8	1.5	269.0

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the “highest ranked alternative” for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining “Objective Scores” relative to each evaluation criteria.
- Applying “scaling” and “weighting” factors.
- Determining “Weighted Objective Scores” relative to each evaluation criteria.
- Ranking each alternative based on the sum of its “Weighted Objective Scores”.

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a

score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table MH80-4-4.

TABLE MH80-4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13

criteria were determined. The results of the workshop are presented in the following Table, taken from Section 7 of the Wet Weather Feasibility Study.

TABLE MH80-4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 095E001 to 095J001: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in Table MH80-4-6.

TABLE MH80-4-6: WEIGHTED SUBJECTIVE SCORING - CS4 095E001 to 095J001: SEWER SEPARATION

Alternative:	**CS4-Separation**		**Control Level:**	**0 Overflows / Year**
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	5	1.00	0.147	0.147
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.108	0.016
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	5	1.00	0.033	0.033
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.733**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that

their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

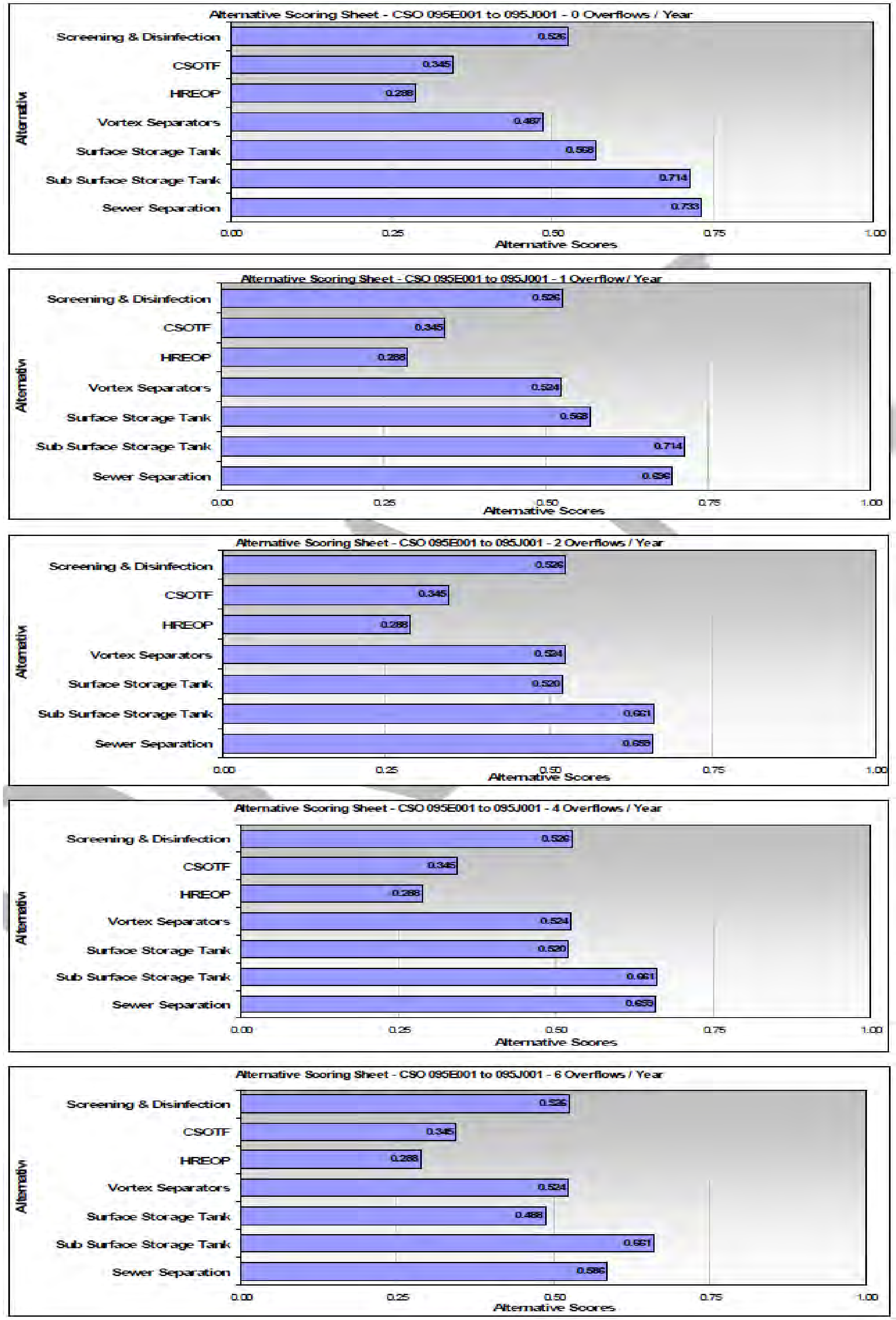
The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 095J001: According to the results of the H&H model, this outfall had no activations throughout the typical year. This “no activation” outfall was not considered further in the alternatives analysis process alone.

Outfall 095E001 TO 095J001: The results of the control alternative evaluation process are shown in Figure MH80-4-4. For control level 0, it is recommended that *Alternative CS4-095E001 to 095J001: Sewer Separation* be carried forward and re-evaluated with the results of the system-wide alternatives analyses. For control levels 1 through 6, it is recommended that *Alternative S2-095E001 to 095J001: Sub-Surface Storage* be carried forward and re-evaluated with the results of the system-wide alternatives analyses.

FIGURE MH80-4-4: ALTERNATIVE SCORING - OUTFALL 095E001 TO 095J001



4.4.2 Regional Control Alternatives

S-18 to CSO 095J001 Region: The results of the regional control alternative evaluation process are shown below in Figure MH80-4-5. For control levels 0, 1, 2, and 4, it is recommended that *S2 – S-18 to CSO 095J001 Region: Sub-Surface Storage* be carried forward and re-evaluated with the results of the system-wide analysis. For control level 6, it is recommended that *CS4-S-18 to CSO 095J001 Region: Sewer Separation* be carried forward and re-evaluated with the results of the system-wide analysis. It should be noted that Sewer Separation is significantly higher in cost compared to the second ranked alternative, Sub-Surface Storage, for these control levels.

4.4.3 Sub-System Control Alternatives

Saw Mill Run. The results of the sub-system control alternative evaluation process are shown below in Figure MH80-4-6. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative SMR-2b: Tunnel Storage* is carried forward as the Saw Mill Run component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative SMR-2b: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative SMR-2b* included only those components required to deliver flows to the MH-80 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the MH-80 POC would become the responsibility of ALCOSAN.

FIGURE MH80-4-5: ALTERNATIVE SCORING - S-18 to CSO 095J001 REGION

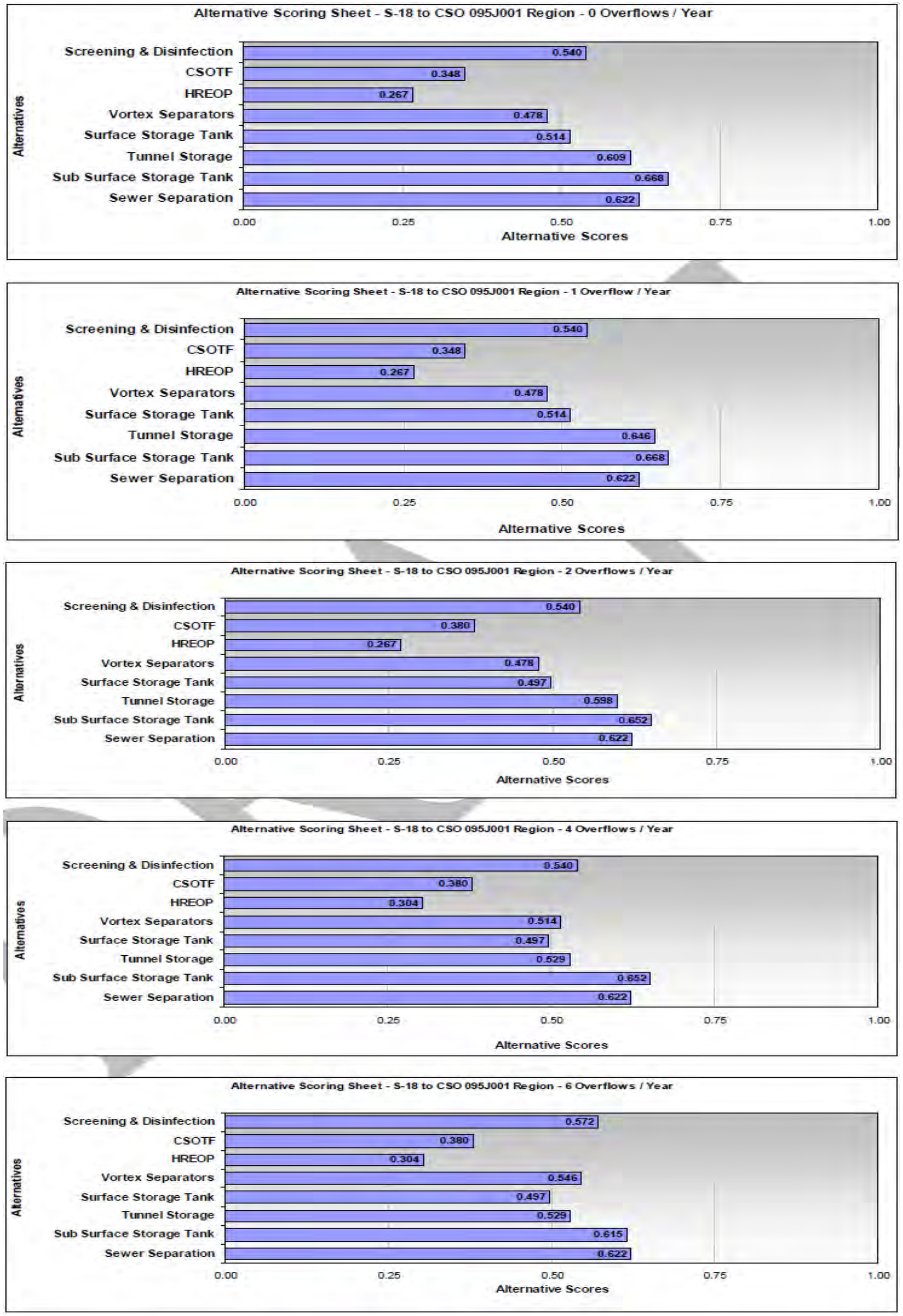
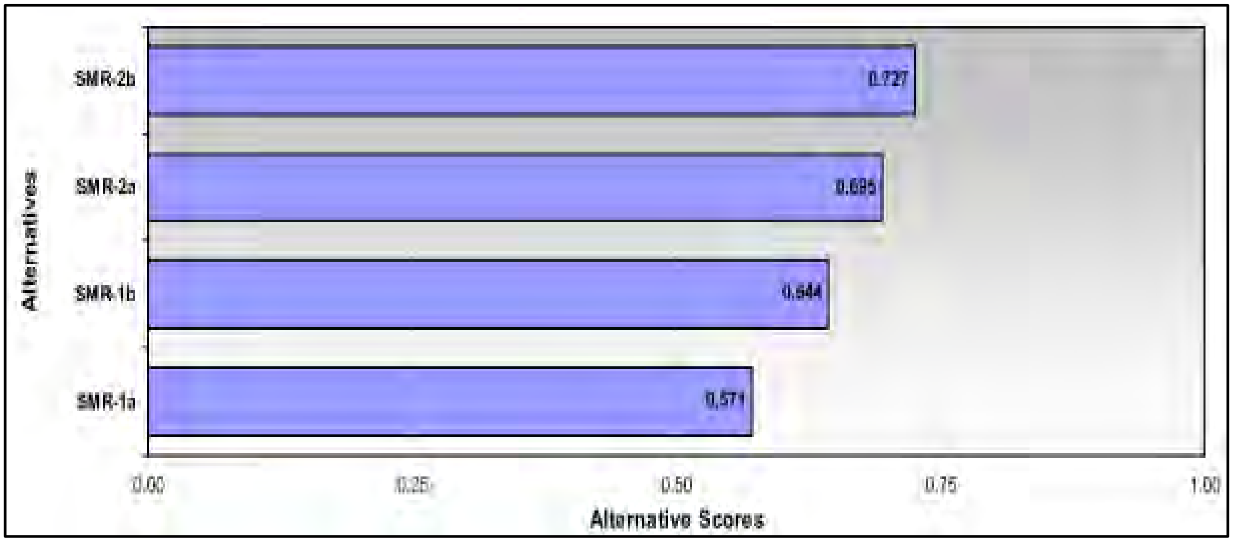


FIGURE MH80-4-6: ALTERNATIVE SCORING – SAW MILL RUN SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Saw Mill Run sewershed would best be accomplished by implementing *Alternative SMR-2b: Tunnel Storage*. Within the MH-80 sewershed, implementation of this alternative would equate to the current “Convey All Flows” concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the PWSA permitted CSO to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the MH-80 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative SMR-2b* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-MH80-C-0*, *POC-MH80-C-4* and *POC-MH80-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **MH80 -** The POC sewershed serviced.

- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.
- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the MH-80 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the MH-80 sewershed is zero untreated overflows per year. The recommended control alternative for the MH-80 Englert Street sewershed has been designated as POC-MH80-C-0. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **MH80** The MH-80 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **0** The selected level of control is zero untreated overflows/year.

The components of alternative POC-MH80-C-0 are summarized in Table MH80-5-1.

TABLE MH80-5-1: ALTERNATIVE POC-MH80-C-0 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
MH-80	DC095K001	095J001	C*	0

*To be achieved via regulator modifications (screening).

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, stream removal projects that may be included, its integration with the ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-MH80-C-4 and/or POC-MH80-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

The July 2012 Feasibility Study included four smaller Saw Mill Run sewersheds together and referred to them as the "Miscellaneous Saw Mill Run Sewersheds." The other miscellaneous sewersheds being S-23 Brook Street, MH-77 Brookline Boulevard, and MH-55 Timberland Street. As described in Section 4 of this POC report, the *PWSA Feasibility Study Report (October 2008)* determined that the optimal method of increasing the level of control of CSO overflows in the Brook Street, Brookline Boulevard and Englert Street sewersheds would be to adjust the diversion structure controls to reduce the amount of wet weather flows that are diverted from the system as necessary to achieve the target levels of control. To accomplish this in MH-80, the PWSA municipalities must:

- Implement diversion structure modifications via the installation of outfall screening to screen overflows before discharge.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

Some of the miscellaneous sewershed diversion structures produce fewer than the control level number of overflows during the typical year. In those cases, sewer separation would not be required and changes to the diversion chamber settings would not be made so as not to increase the current frequency of CSO discharges. For the diversion structure in the MH-80 sewershed, the H&H model was employed to identify the type and extent of modifications required to achieve zero overflows during the typical year.

The required modifications to the flow diversion settings were determined by the current typical year overflow statistics. Table MH80-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control.

TABLE MH80-5-2: ALTERNATIVE POC-MH80-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC095K001	Diversion structure screening	0.6	0.6	0.6

5.1.2 Consolidation Piping

The H&H model was employed to assess the ability of the existing trunk sewer system to convey the flows that will result from the system modifications. The modeling was accomplished by modifying the model representation of the diversion structure to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

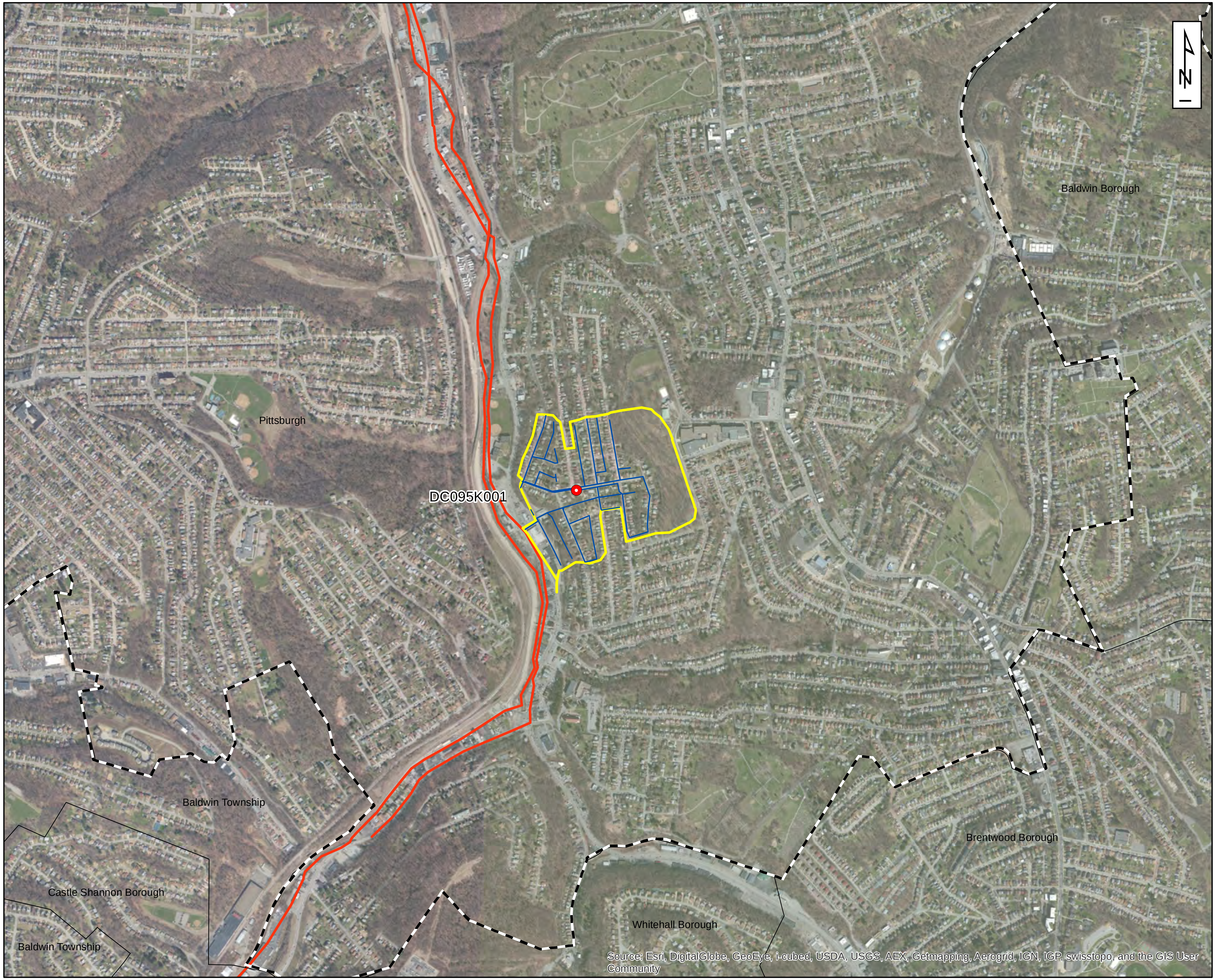
Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system has sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding. Under this range of operating conditions, it was found that only the existing Brook Street S-23 and Brookline Boulevard MH-77 trunk sewer systems do not have sufficient capacity to convey the required flows to the ALCOSAN POC without significant manhole surcharging and flooding.

5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table MH80-5-3. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 3.3 MG in the typical year.

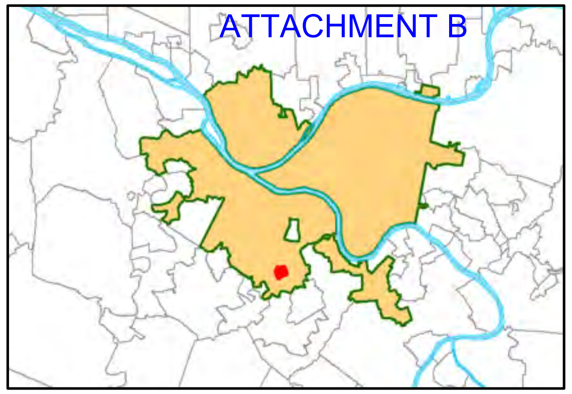
TABLE MH80-5-3: MH-80 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name					
	POC-MH80-C-0		POC-MH80-C-4		POC-MH80-C-10	
	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)
DC095K001	0	0	4	0.02	6	0.03
Total Volume		0		0.02		0.03



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT B



PWSA Service Area Overview

Legend

- ● PWSA Diversion Structure Modification
- — Collector Sewer selection
- ▭ MH-80 Sewershed Boundary
- ▭ PWSA Service Area Boundary
- ▭ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- - - - Deep Tunnel
- — Shallow Cut

1,000 500 0 1,000 Feet

Figure MH80-5-1: POC MH-80-C-0 Diversion Structure Modification

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The typical year peak flow rates to the MH-80 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-MH80-C-0, POC-MH80-C-4 and POC-MH80-C-10 are presented in Figure MH80-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the MH-80 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table MH80-5-4.

FIGURE MH80-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE MH-80 POC

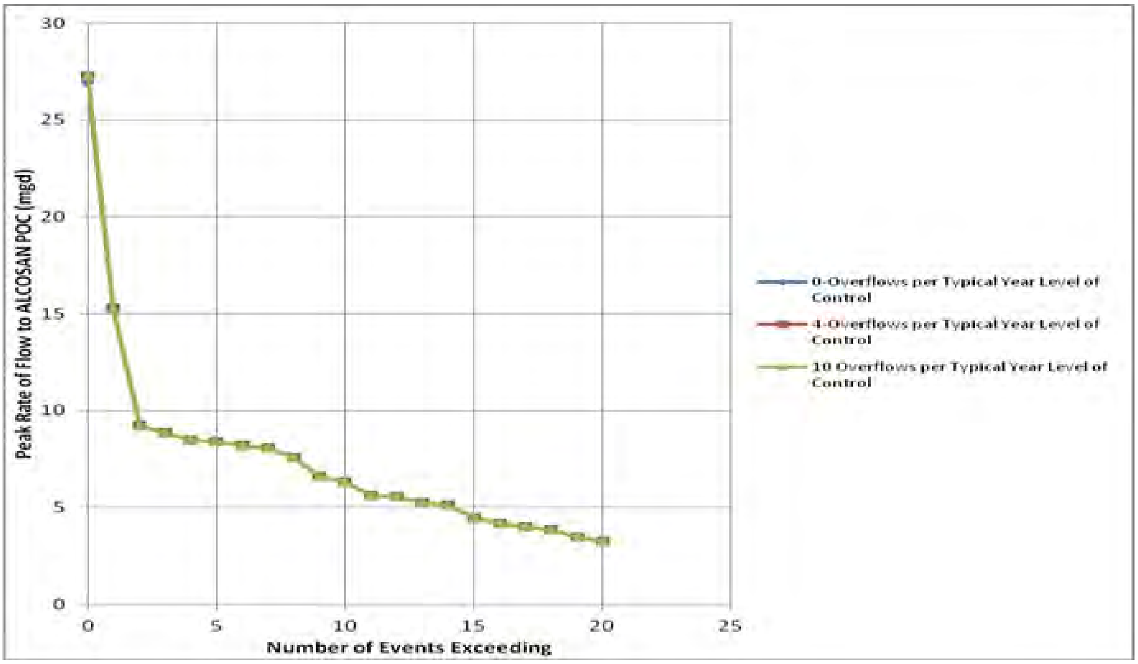


TABLE MH80-5-4: MH-80 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-MH80-C-0	0.7	0.7	0.7	0.3	0.4	0.4
POC-MH80-C-4	0.6	0.6	0.6	0.3	0.3	0.3
POC-MH80-C-10	0.6	0.6	0.6	0.2	0.3	0.3

5.1.5 Recommended Control Alternative Integration

The MH-80 collection system and MH-80 POC does not contain/convey any upstream flow from surrounding municipalities. As a result, integration is limited to PWSA and its downstream sewage treatment provider ALCOSAN which is explained further in Section 5.7 of this POC report.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

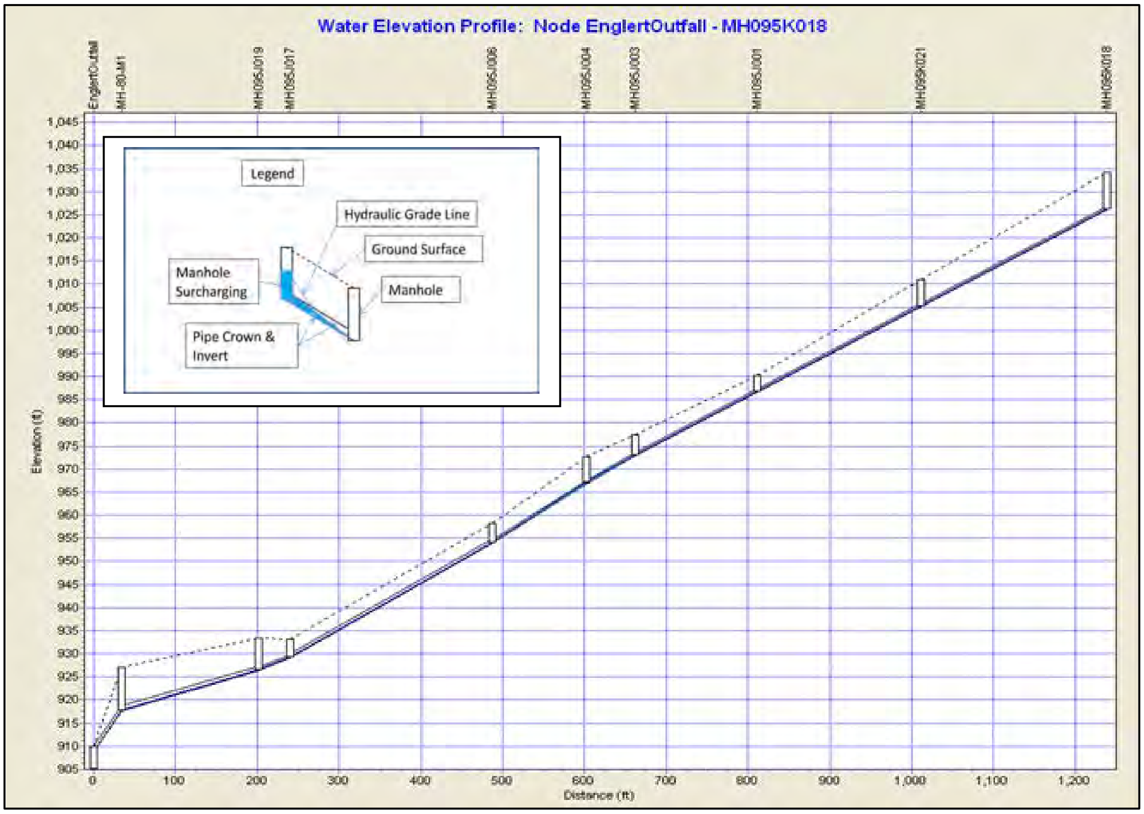
The following paragraphs discuss the hydraulic capacity characteristics of the MH-80 sewershed, both before and after implementation of the recommended alternative:

- Peak flow hydraulic grade line (HGL) of the trunk sewer
- 2046 peak flows and volumes to the MH-80 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figure 3 from that report presented a profile of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. This figure is reproduced below as Figure MH80-5-3.

FIGURE MH80-5-3: MH-80 MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure 3, under the current system configuration, including existing CSO diversion chamber settings, no surcharging occurs in the trunk sewer.

5.2.2 2046 Peak Flows and Volumes to MH-80 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known

municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would “Convey all Flows” to the PWSA system. ALCOSAN made similar assumptions[1], and once flows had been conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structure (screening) to achieve zero overflows per typical year. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the MH-80 sewershed.

The PWSA’s plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances from ALCOSAN WWP

ALCOSAN’s recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This contrasts with the PWSA’s water quality based decision to recommend a zero OF/yr level of control within the Saw Mill Run planning basin.

However, the control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA’s recommended alternative does not vary from ALCOSAN’s WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the MH-80 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

MH-80 is not a multi-municipal POC and therefore has no upstream tributary municipalities.

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structure (screening) to achieve zero overflows per typical year. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes regulator modifications (screening) to control CSOs from the PWSA diversion structure to zero overflows per year. At the MH-80 POC, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts in Saw Mill Run and Englert Street due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-MH80-C-0 are diversion structure modifications via CSO screening facilities. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment MH80-5-1.

5.4.1 Consolidation Piping

In the MH-80 sewershed, additional conveyance capacity was not required to convey flows to the MH-80 POC.

5.4.2 CSO Screening Facilities

It was assumed that the outfall location DC095K001 will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

As a result of the alternatives analysis, traditional diversion structure modifications (replacement) is not required for this POC therefore diversion structure modification costs will not apply.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure MH80-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible "knee of the curve" is evident from this data.

These costs are also presented in a tabular format in Table MH80-5-5.

The selected level of CSO control - 0 OF/yr - was determined based upon water quality considerations. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-MH80-C-0 are summarized in Table MH80-5-6. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE MH80-5-4: MH-80 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

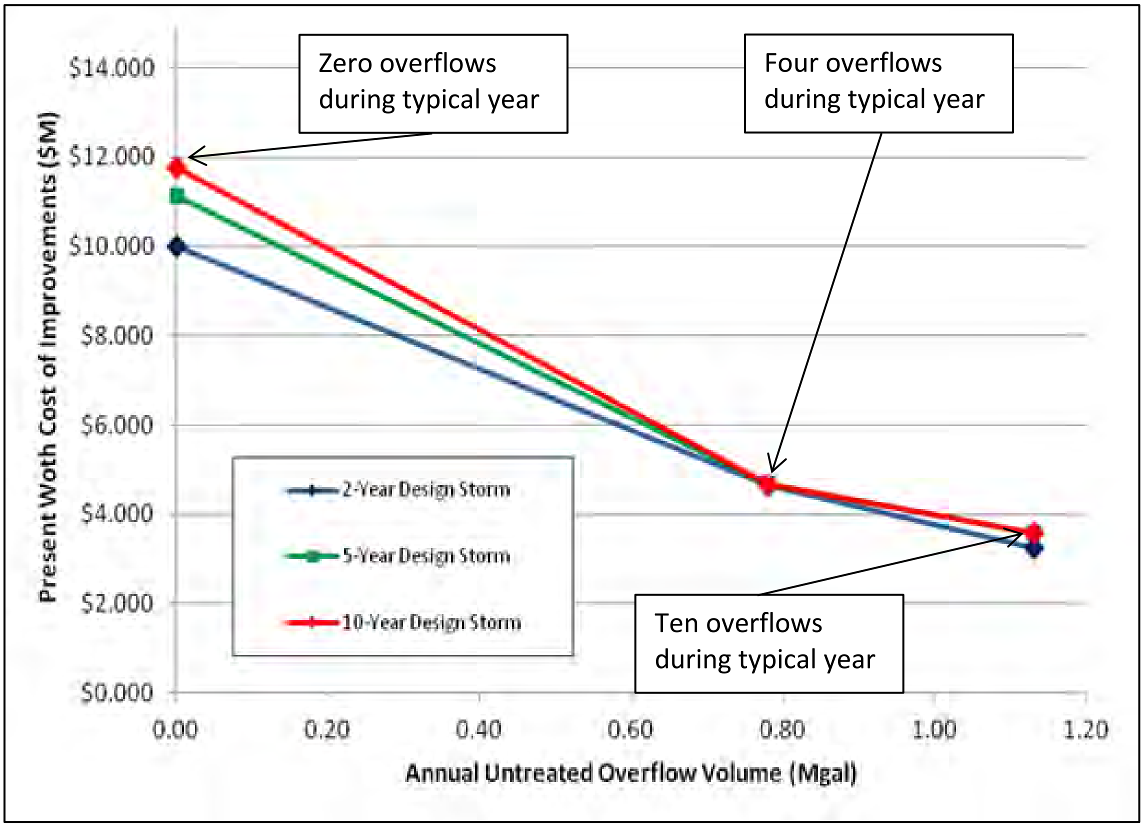


*Figure represents a combination of POCs S23, MH77, MH80 and MH55 curves.

TABLE MH80-5-5: MH-80 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control (DC095K001)				
	Untreated CSO Volume (MG)	**CSO Control Level (OF/yr)**	**PW Capital Cost ($MM)**	**PW O&M Cost* ($MM)**	**TPW CSO Control ($MM)**
POC-MH80-C-0	0	0	$0.45	$0.01	$0.46
POC-MH80-C-4	0.02	4	$0.45	$0.01	$0.46
POC-MH80-C-10	0.03	10	$0.45	$0.01	$0.46
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-MH80-C-0	0	2-year	$0	$0	$0
POC-MH80-C-4	0	2-year	$0	$0	$0
POC-MH80-C-10	0	2-year	$0	$0	$0

TABLE MH80-5-6: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-MH80-C-0

Capital Improvements	Size/Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)
Diversion structure screening DC095K001	0 OF/yr Each	$0.45	$0.46

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

MH-80 is not a multi-municipal POC and therefore has no upstream tributary municipalities. As a result, an Inter-Municipal O&M Agreement is not required.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the MH-80 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC MH-80 overflow is not intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the "Selected Plan" to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the "Recommended Plan". This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the "Selected Plan" is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

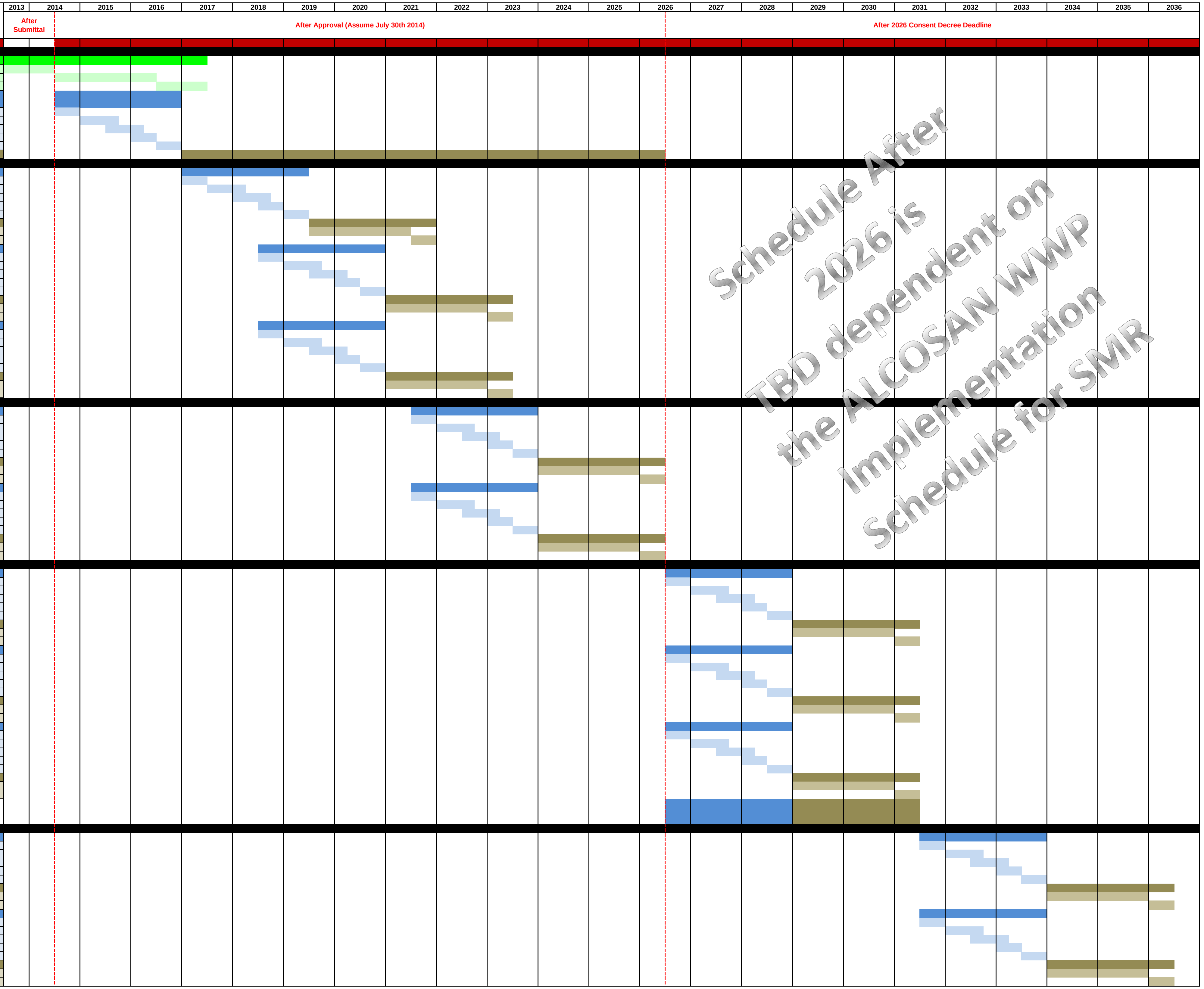
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it's important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the SMR portion of the regional plan is not being implemented by 2026, and an implementation date is not specified in the plan. Therefore, an implementation schedule for MH-80 improvements cannot be specified at this time as it depends on the ALCOSAN WWP' SMR implementation schedule. The deadline shown in the schedule for MH-80, which is shown in Figure MH18-5-5, is for reference purposes only.

ATTACHMENT B

FIGURE MH80-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the MH-80 sewershed. The PWSA is the only stakeholder municipality/ authority in this sewershed. Therefore, Inter-Municipal Agreements are not applicable. The considerations regarding the MH-80 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

There are no cost allocation needs for the improvements in this sewershed.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

There are no inter-municipal agreements needed for the improvements in this sewershed.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this subsection, PWSA provides the plan and schedule for implementing the recommended MH-80 system improvements and the plan to meet regulatory reporting obligations during and after MH-80 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

Phase I	2013 through 2017
Phase II	2017 through 2023
Phase III	2021 through 2026
Phase IV	TBD
Phase V	TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities

that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure MH80-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

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[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

6.3.2 Joint Municipal Planning and Implementation

There are no Joint Municipal Planning and Implementation needs for the improvements in this sewershed.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$451,000.
- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance
- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA collection systems that are not directly attributed to the recommended alternative.

For the purpose of submitting the Feasibility Study, inter-municipal agreements regarding O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative is not needed for the improvements in this sewershed.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table MH80-6-1. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE MH80-6-1: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	**Annual Costs**		
	Current 2012	**First Year After Alternatives are implemented -2027**[2]	**2046**
City of Pittsburgh[3]	$399	$1,113	$1,638

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure MH80-6-1.

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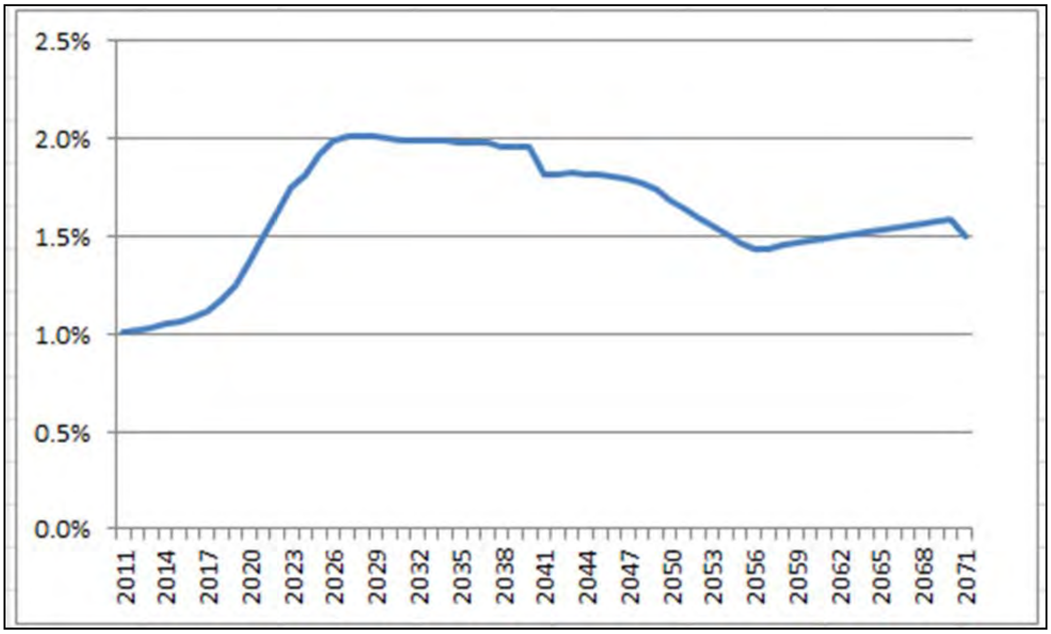
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

FIGURE MH80-6-1 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.

7.0 STAKEHOLDER INVOLVEMENT

For the purpose of developing the PWSA Feasibility Study and this POC-based feasibility study, the PWSA is the sole contributor of flow to the Englert Street sewershed. Due to the absence of flow from neighboring municipalities, the PWSA did not lead a Wet Weather Feasibility Study Coordination Meeting to facilitate stakeholder participation. Additionally, stakeholder meetings facilitated by 3RWW, titled POC Sewershed Coordination Meetings, were not held for POC MH-80. Other PWSA stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
S-23: BROOK STREET

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

TABLE OF CONTENTS

1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh and Mount Oliver Borough. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.

- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.

- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.

- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.

- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.

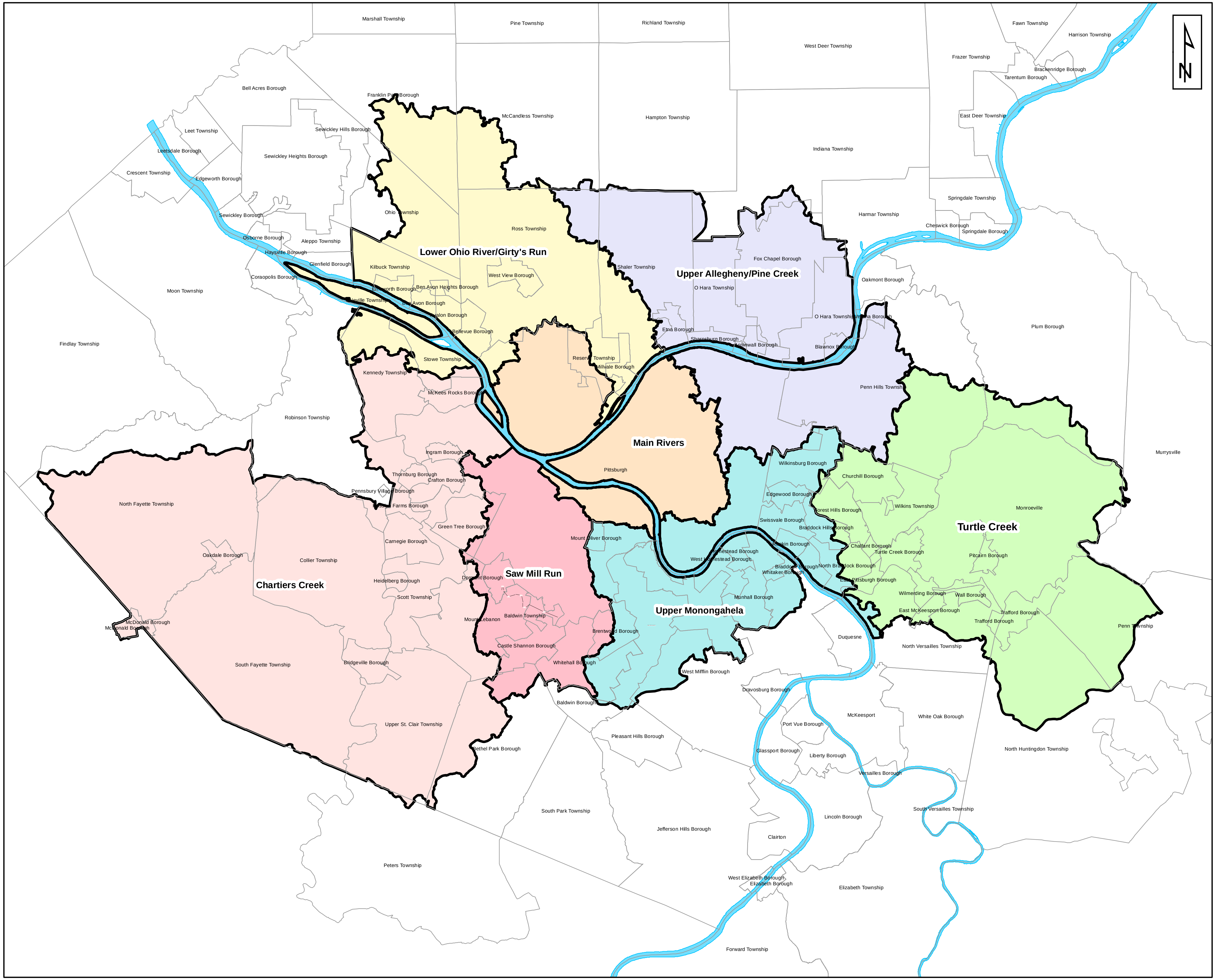
- Section 7.0 describes how stakeholders were included in the plan development.

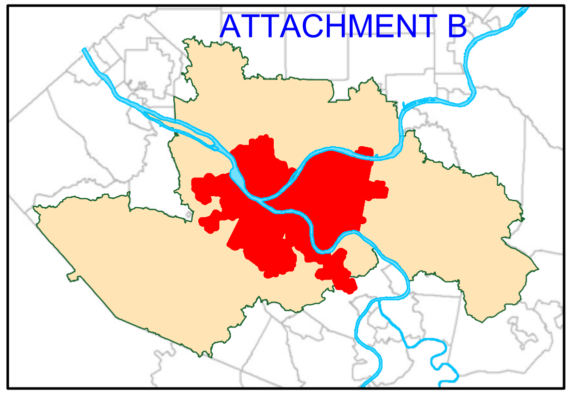
1.2 EXISTING SYSTEM DESCRIPTION

This POC FS Report addresses POC S-23, also known as Brook Street. The S-23 sewershed is located in the Saw Mill Run Planning Basin. The Saw Mill Run basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: Miscellaneous Saw Mill Run Sewersheds Existing Facilities Map*. The S-23 sewershed is served by one trunk sewer that conveys flow from the western end of Brook Street at Tarigona Street in a southwesterly direction toward ALCOSAN diversion chamber S-23. The vitrified clay trunk sewer ranges in size from 8-in to 18-in in diameter.

There is one PWSA CSO diversion chamber in the sewershed that overflows to Saw Mill Run at two permitted CSOs. The S-23 sewershed encompasses approximately 177 acres. The sewershed is made up of 176 acres of the City of Pittsburgh and 1 acre of Mount Oliver Borough. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to S-23* for specific information on this POC.





ALCOSAN Service Area Overview

Legend

- ☐ Municipal Boundary
- 🟥 Chartiers Creek
- 🟨 Lower Ohio River / Girty's Run
- 🟧 Main Rivers
- 🟥 Saw Mill Run
- 🟩 Turtle Creek
- 🟪 Upper Allegheny / Pine Creek
- 🟦 Upper Monongahela
- 🟦 River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins
Feasibility Study Report

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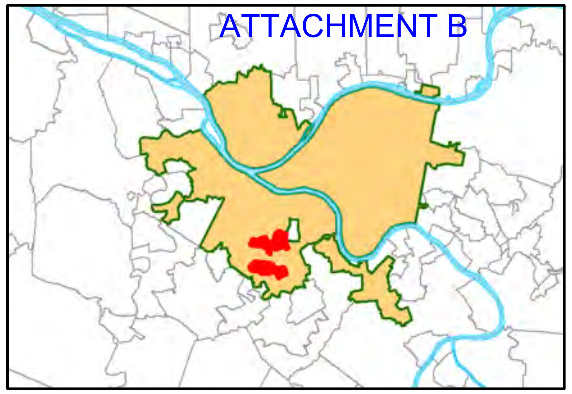
Quality Water Quality Service

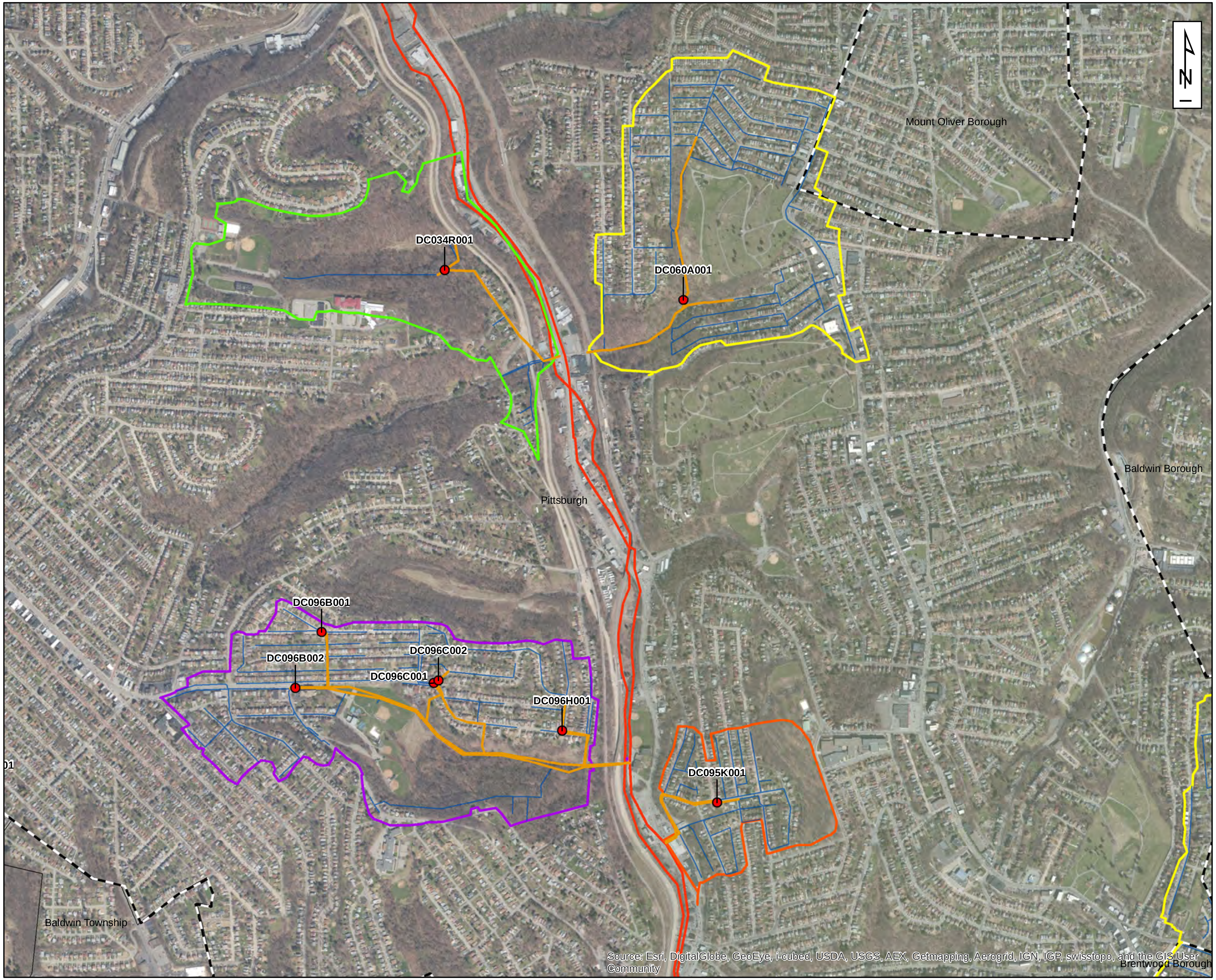
July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd

ATTACHMENT B



PWSA Service Area Overview



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 1 - 2: MH-55, MH-77, MH-80 & S-23 Miscelaneous Sewersheds Existing Facilities

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TABLE 1-1: SEWERSHED CHARACTERISTICS FOR AREA TRIBUTARY TO S-23

COMPLEX SHED CHARACTERISTICS	**MUNICIPALITY**	
	City of Pittsburgh	**Mount Oliver Borough**
Tributary Area (Acres)	176	1
Population	1,556	34
Combined		
Inch-Miles	54.9	0
Linear Feet	21,025	0
Inch-Miles/Acre	0.31	0
Separate		
Inch-Miles	21.7	0.7
Linear Feet	12,450	459
Inch-Miles/Acre	0.12	0.70

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows from the upstream PWSA diversion structure ties directly into the Saw Mill Run interceptor with no overflow structure. The Saw Mill Run interceptor conveys those flows to ALCOSAN diversion structure O-14.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to S-23*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO S-23

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
060A001	DC060A001	CSO060A001	Brook Street	Tributary to Saw Mill Run

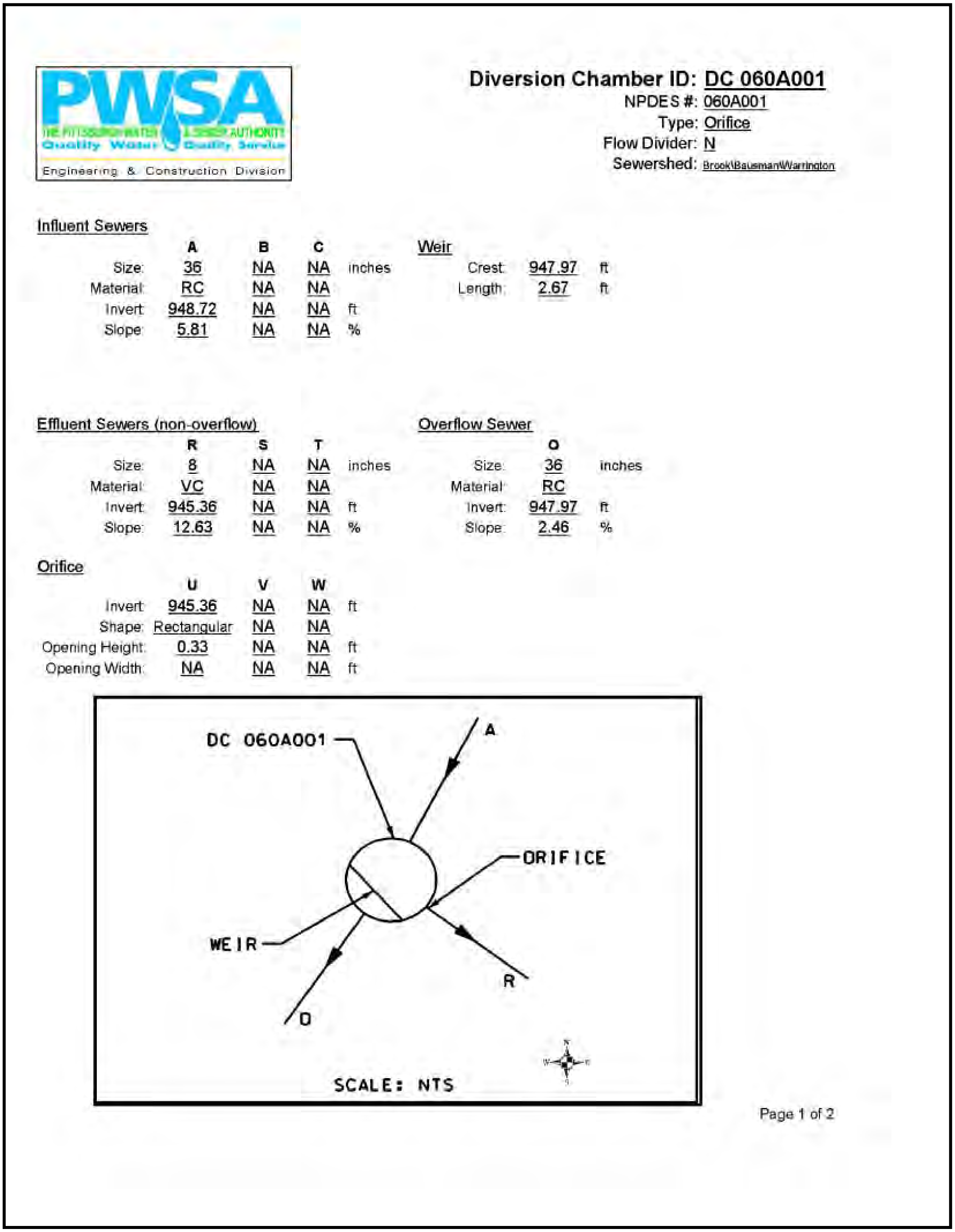
As shown in *Table 1-3: S-23 Sewershed Typical Year Overflow Statistics*, during the typical year the single structure overflows 22 times. The largest overflow volume is 700,000 gallons per event and the total annual volume is 2.0 million gallons.

TABLE 1-3: S-23 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC060A001	22	20.92	4.08	1.90	0.70	0.09	0.04	1.99
							Total Annual Volume	**1.99**

1.2.1 Diversion Structure Sketches

The following sketches of the S-23 diversion structure were taken from Appendix A.2 of the PWSA SICR, August 2008.



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Diversion Chamber ID: DC 060A001
NPDES #: 060A001
Type: Orifice
Flow Divider: N
Sewershed: Brook\Bausman\Warrington

Influent Sewers

	A	B	C	
Size:	36	NA	NA	inches
Material:	RC	NA	NA	
Invert:	948.72	NA	NA	ft
Slope:	5.81	NA	NA	%

Weir

Crest:	947.97	ft
Length:	2.67	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	VC	NA	NA	
Invert:	945.36	NA	NA	ft
Slope:	12.63	NA	NA	%

Overflow Sewer

	O	
Size:	36	inches
Material:	RC	
Invert:	947.97	ft
Slope:	2.46	%

Orifice

	U	V	W	
Invert:	945.36	NA	NA	ft
Shape:	Rectangular	NA	NA	
Opening Height:	0.33	NA	NA	ft
Opening Width:	NA	NA	NA	ft

Page 1 of 2

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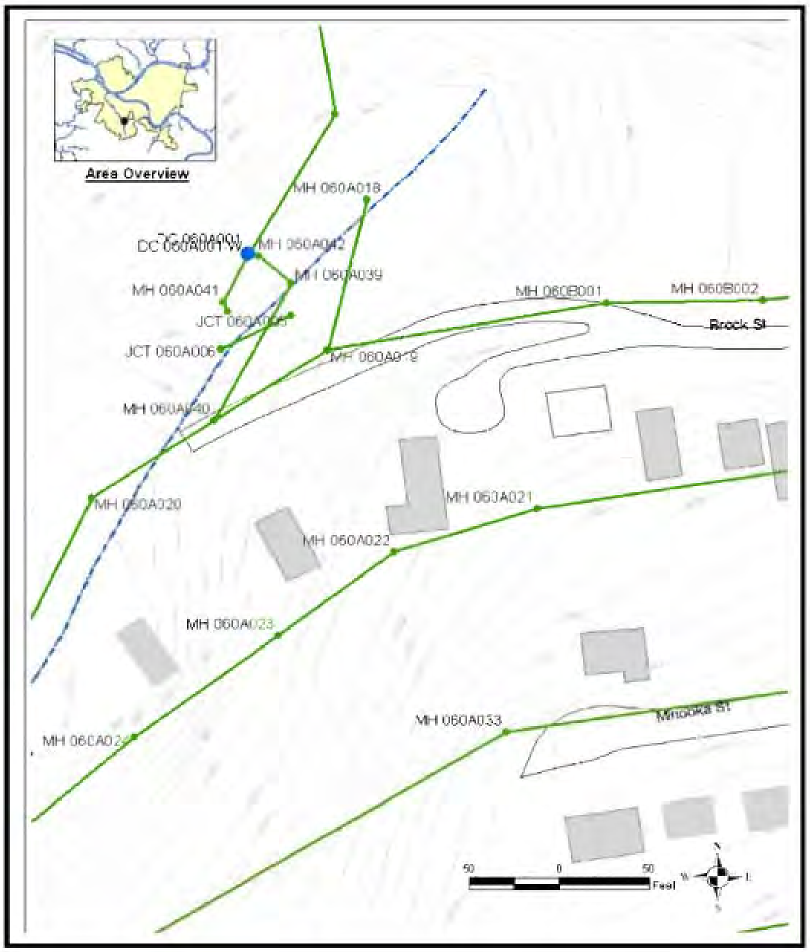
Diversion Chamber ID: DC 060A001



Page 2 of 2

2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC S-23: Brook Street Sewershed through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Saw Mill Run Basin Planners (SMR_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for S-23.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 o of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The

flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. One (1) flow meter located within the S-23 sewershed was used in the RCS-FMP. Details on the one (1) RCS-FMP flow monitor installed within the S-23 sewershed are found in Table S23-2-1.

TABLE S23-2-1: S-23 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Term[1]
S-23-00-M1	City of Pittsburgh	L

[1]L=Long Term: 1-year minimum to 21-month maximum.

---

[1]The flow monitor information in this Table is from a file titled "Summary of Program Monitors by Name, Type and Dates.xls". This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled "Summary and Report of Flow Monitoring June 2009".

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).
- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.
- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.
- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the S-23 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the S-23 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.
- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process to represent the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The average daily flows, GWI ratio, and GWI per inch-mile of sewer for the flow monitor within the S-23 sewershed are listed in Table S23-2-2. The GWI ratio is an estimated amount of the DWF that can be associated with GWI compared to the DWF peaking factor (i.e. Average Daily Maximum Flow vs. Average Daily Minimum Flow).

TABLE S23-2-2: S-23 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

Flow Monitor[1]	Average Daily Flow (ADF)		DWF Peaking Factor (ADF Max/ ADF Min)	GWI Ratio (min/avg)
	(mgd)	(gpcpd)		
S-23-00-M1	0.3	180	1.7	0.7

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[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Saw Mill Run Planning Basin – Table 4-2.

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table S23-2-3.

TABLE S23-2-3: S-23 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	Total Average Dry Weather Flow		
	Baseline Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
S-23	0.44	0.45	2.2%

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event. RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for S-23 are presented in Table S23-2-4.

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[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.4

TABLE S23-2-4: S-23 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
S-23	1.0	1.0	0.0%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year, and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure S23-2-1 present the computed hydraulic profiles of the existing S-23 main trunk sewer system under projected 2-year design storm peak flow conditions. As is indicated in the figure, under the current system configuration, including existing CSO diversion chamber settings, some surcharging occurs only in the upper portion of the trunk sewer, immediately downstream of the diversion chamber.

Figure S23-2-2 present the computed hydraulic profiles of the existing S-23 main trunk sewer system under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including

---

[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.5

existing CSO diversion chamber settings, some surcharging occurs only in the upper portion of the trunk sewer, immediately downstream of the diversion chamber.

Figure S23-2-3 present the computed hydraulic profiles of the existing S-23 main trunk sewer system under projected 10-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, some surcharging occurs only in the upper portion of the trunk sewer, immediately downstream of the diversion chamber.

Computed flow hydrographs for each of the design storms at POC S-23 are presented in Figure S23-2-4.

FIGURE S23-2-1: S-23 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

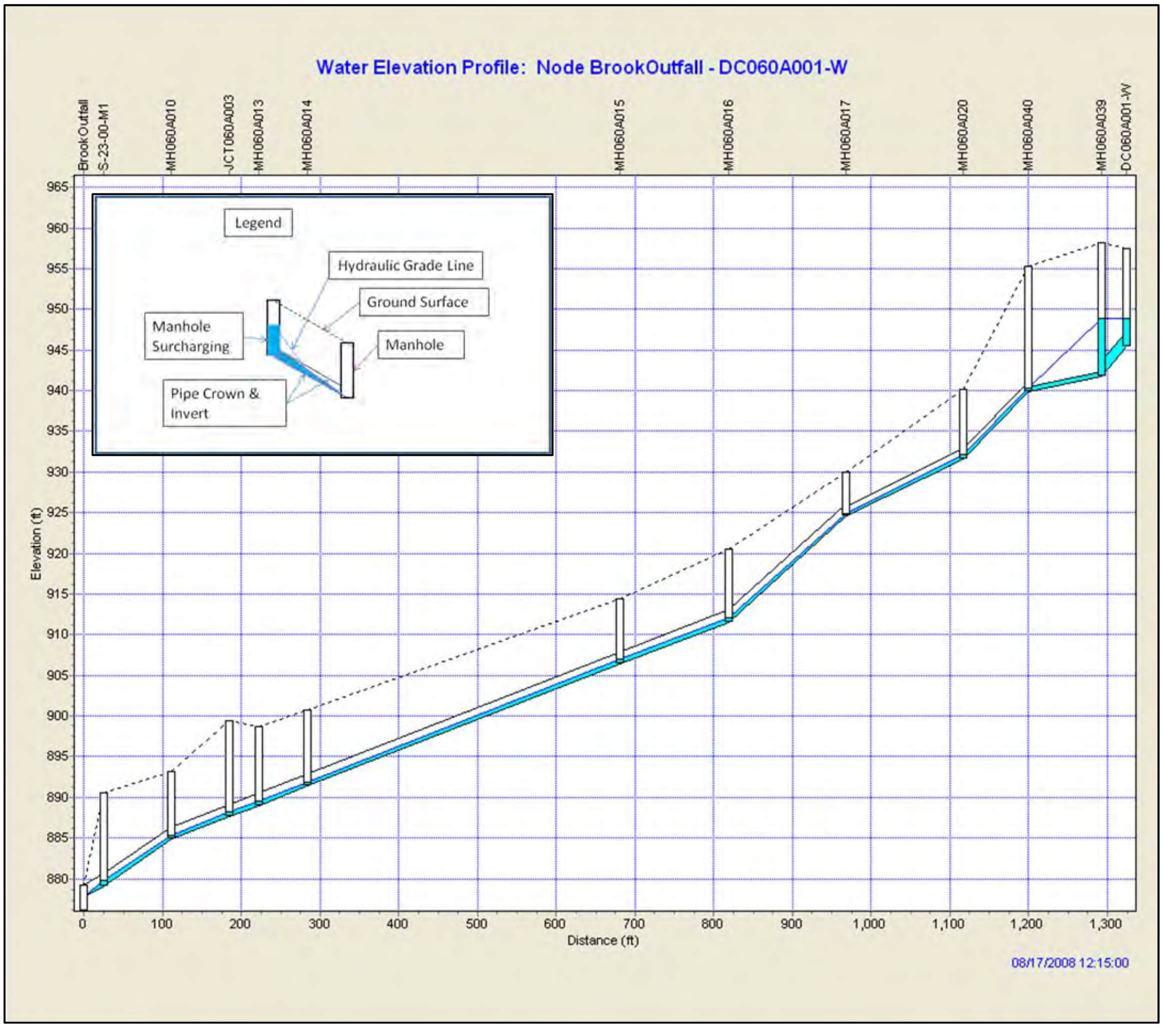


FIGURE S23-2-2: S-23 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 5-Year Design Storm and Future Baseline Conditions

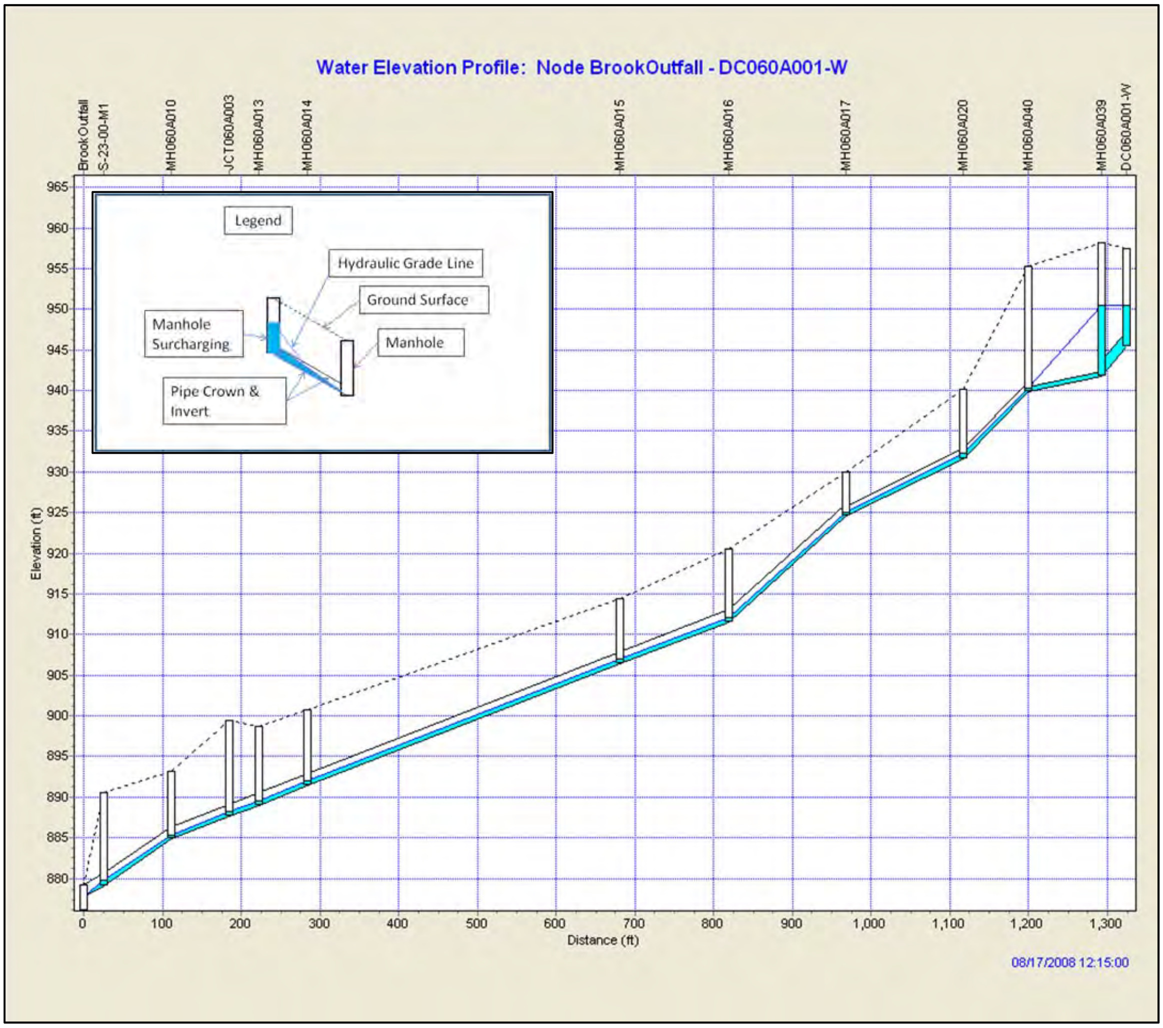


FIGURE S23-2-3: S-23 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 10-Year Design Storm and Future Baseline Conditions

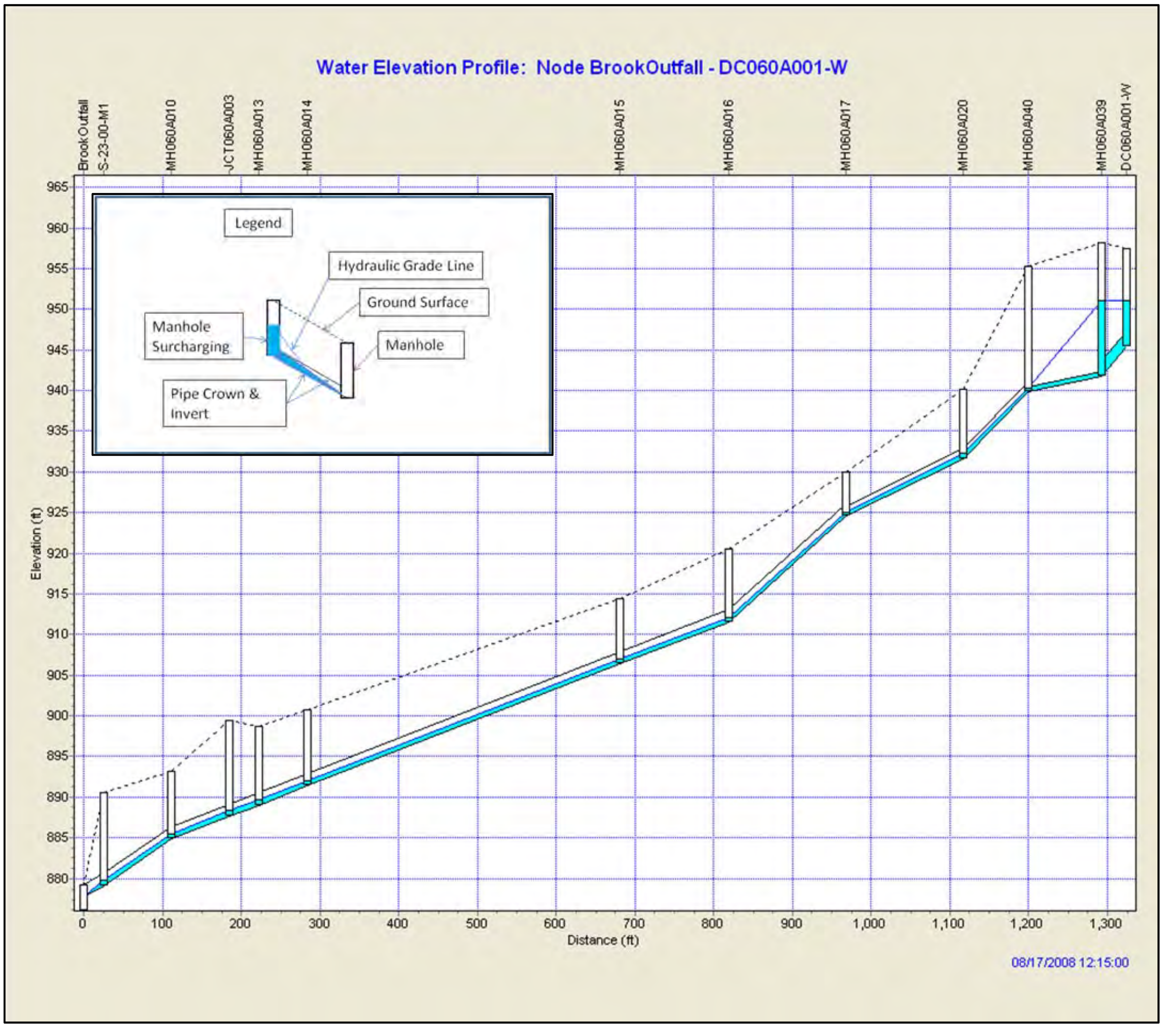
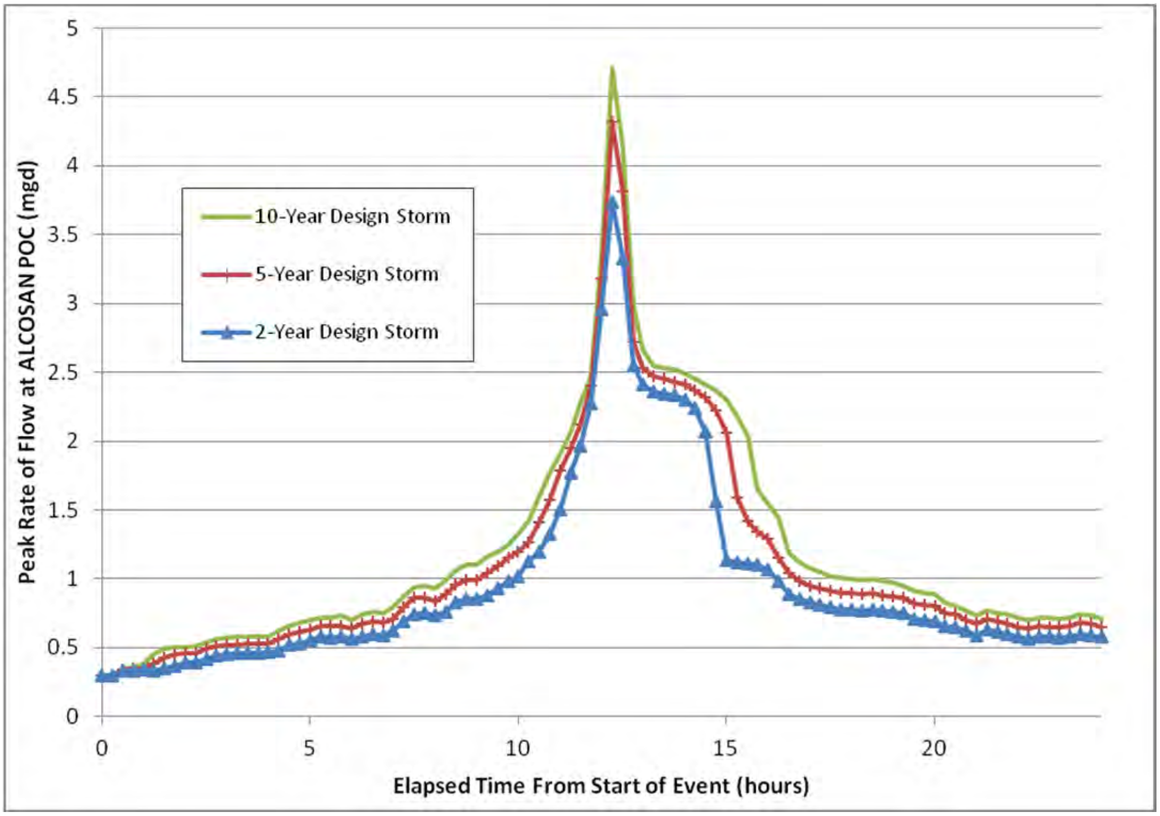


FIGURE S23-2-4: S-23 SEWERSHED PEAK FLOW RATES TO THE POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

PWSA investigated but did not locate any chronic basement flooding locations within the PWSA portion of the S-23 sewershed. The neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. The results are based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the S-23 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures S23-2-5 and S23-2-6. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figures show that under this range of operating conditions, the existing Brook Street trunk sewer system does not have sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding.

FIGURE S23-2-5: S-23 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

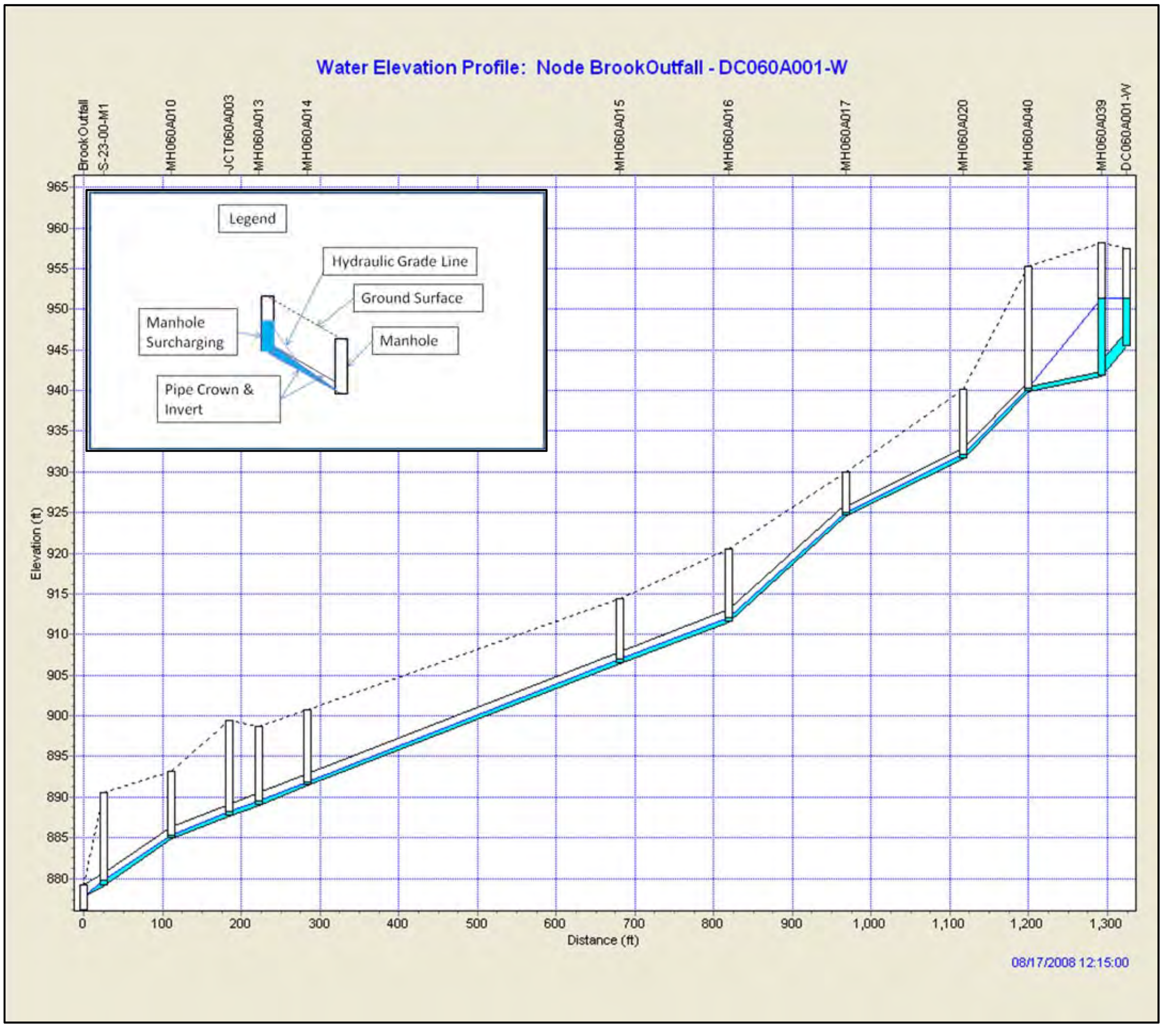
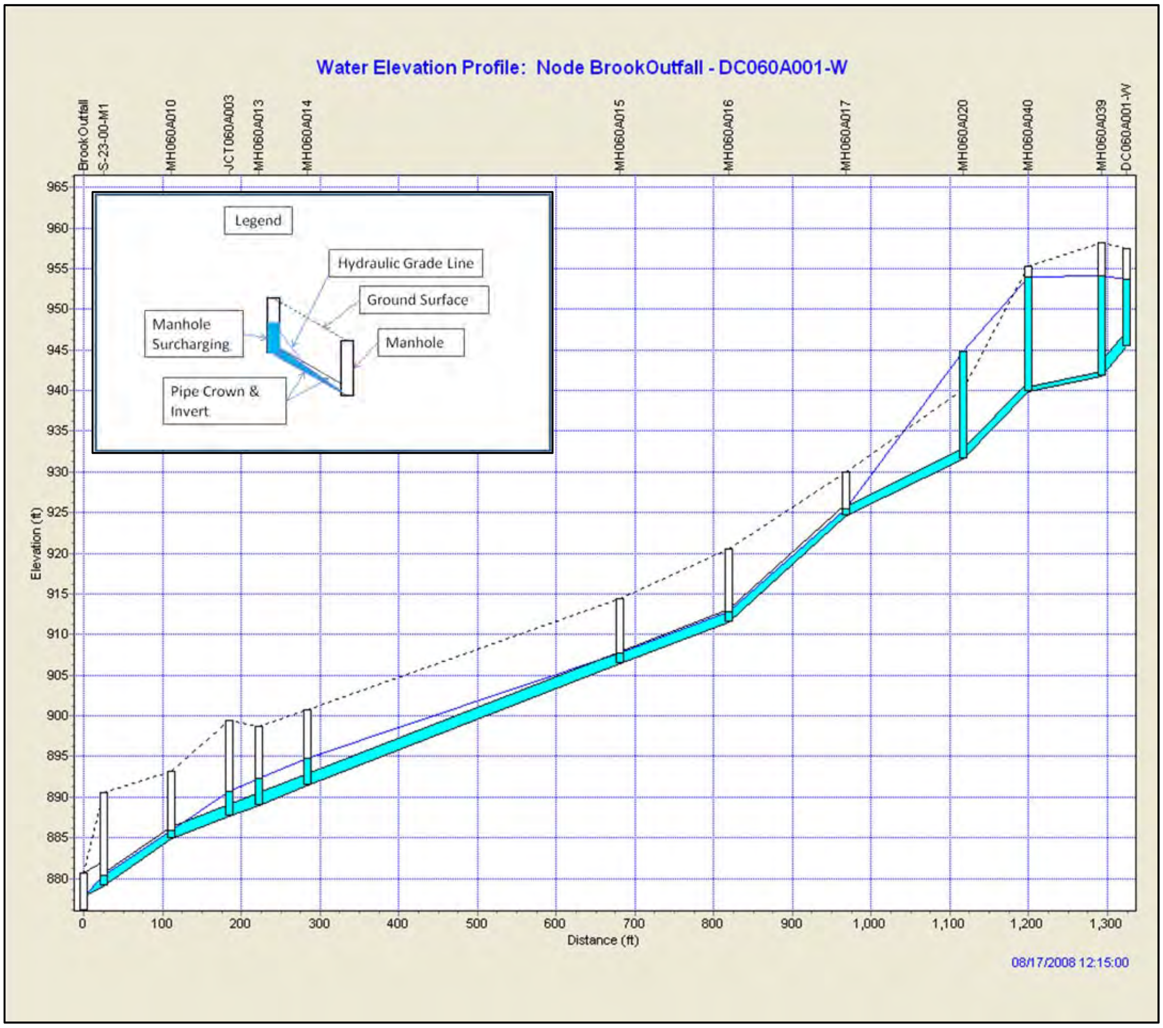


FIGURE S23-2-6: S-23 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the S-23 sewer system performed by PWSA produced the following computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table S23-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the S-23: Brook Street sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. One (1) of these outfalls is found within the S-23: Brook Street Sewershed, as shown in Table S23-3-1.

TABLE S23-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE S-23: BROOK STREET SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF060A001	SMR	S-23-00	Saw Mill Run	WWF[1]	N	Y

As shown in the table, the one (1) PWSA owned outfall discharges into Saw Mill Run. This is classified as warm water fisheries (WWF) and currently do not meet their assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.

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[1] Warm Water Fishery

- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives.

This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream, including Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

The receiving water characterization field program resulted in certain findings within Saw Mill Run. In general, the DO concentrations for Saw Mill Run did not meet regulatory limits during wet weather which is likely related to CSO discharges during the storm events and/or wet weather discharges from upstream municipalities. Saw Mill Run also showed DO concentrations not meeting standards during dry weather indicating that CSO discharges are not likely causing the condition.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters, including Saw Mill Run and its tributaries within the PWSA limits, with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL. For Saw Mill Run, the concentration during the recreational season exceeded the 200 cfu/100mL limit in 100% of the samples and exceeded the 400 cfu/100mL limit in 80% of the samples.

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

Saw Mill Run has an in-stream target concentration of 0.035 mg/L for total phosphorus (TP) which was exceeded by 75% of the samples. TP appears to be a concern throughout Saw Mill Run, with CSO discharges being a potentially significant source in wet weather.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal Coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS. However for Saw Mill Run, it is judged that a higher level of control is needed due to the need to reduce phosphorus levels (see next section).

3.2.2 Saw Mill Run TMDL Report

A TMDL report was completed for Saw Mill Run and its tributaries which showed phosphorus TMDL results are shown below in Table S23-3-2.

TABLE S23-3-2: SAW MILL RUN PHOSPHORUS TMDL RESULTS

Total Phosphorus Load	CSO Load	SSO Load
Existing Load (Ib/Growing Season)	7,161.9	1,950.4
Allocated Load (Ib/ Growing Season)	177.5	0.0
Percent Reduction (%)	98%	100%

The implication of this is that substantial reductions of CSOs and complete elimination of SSOs is necessary for compliance. For CSOs, it is judged that a control level of 0 overflows per year will be required.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, such as Saw Mill Run, pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6

overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the S-23 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the S-23 sewershed, Table S23-3-3 lists the untreated CSO statistics that were computed for each control level.

TABLE S23-3-3: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE S-23 SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC060A001	0	0	4	0.67	10	0.97

As will be described later in this report, the MH-11 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year and 10-year return frequency events).

Since Saw Mill Run has a TMDL which requires a high level of Phosphorous removal (98%), a higher CSO control level will be required. While 10, 4 and 0 OF/yr are analyzed, it is judged that 0 OF/yr will be necessary for compliance.

A range of design storms (2-yr, 5-yr, and 10-yr) were evaluated for transport of flows. PWSA plans to use the 2-yr storm which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

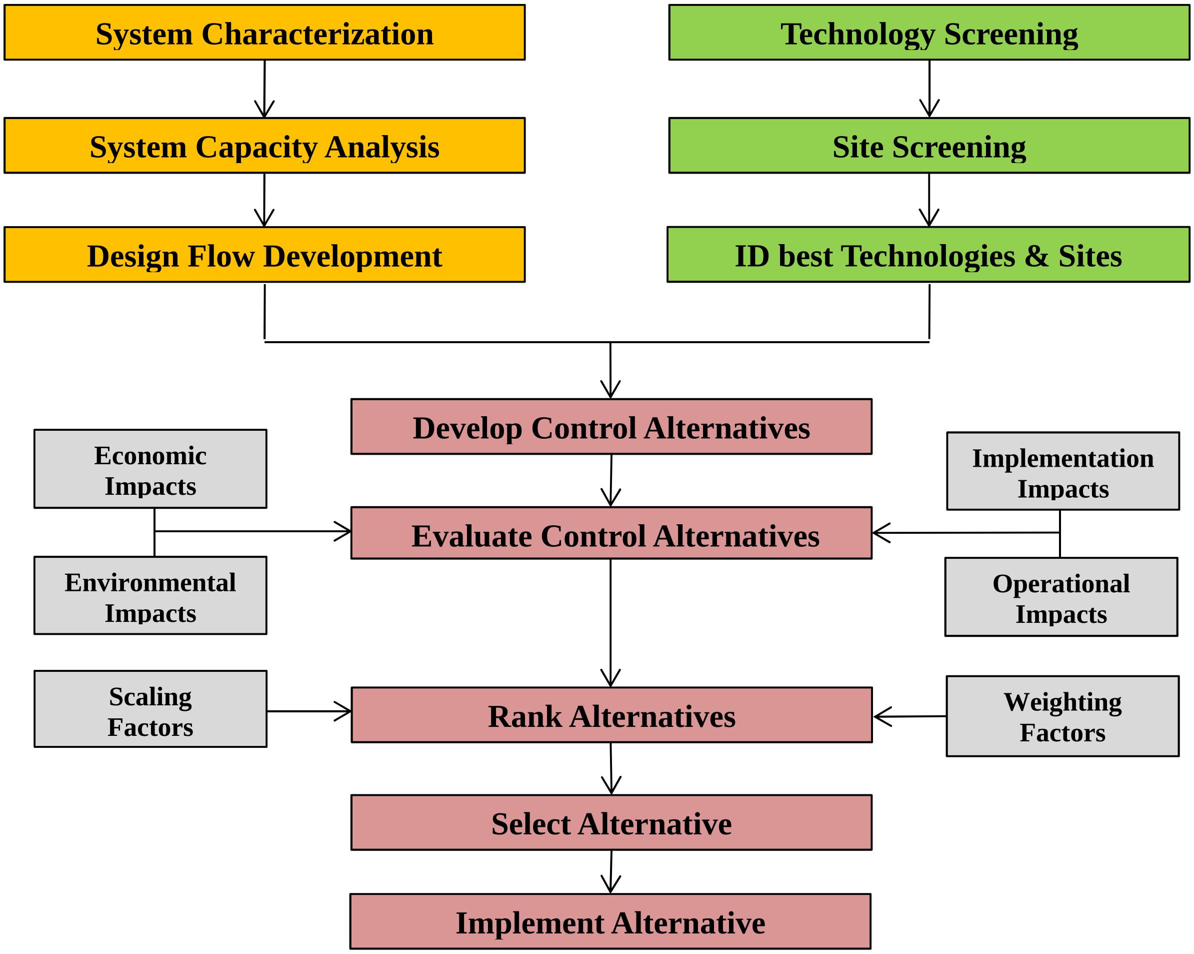
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure S23-4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable S23-control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE S23-4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table S23-8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered “feasible” for use in the S-23 sewershed are shown below in Table S23-4-1.

TABLE S23-4-1: S-23 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn’t included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA’s plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies were identified for the S-23 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table S23-4-2.

There are no other municipalities tributary to the S-23 sewershed.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning "Objective Scores" to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as the waterways.

TABLE S23-4-2: S-23 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 061DS23 and 061DS24	CS4 061DS23 and 061DS24: Sewer separation	Complete sewer separation of tributary area.
	S2-061DS23 and 061DS24: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-061DS23 and 061DS24: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-061DS23 and 061DS24: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-061DS23 and 061DS24: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-061DS23 and 061DS24: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-061DS23 and 061DS24: Screening and Disinfection	A stand-alone screening and disinfection facility.
Outfall 060A001	CS4 060A001: Sewer separation	Complete sewer separation of tributary area.
	S2-060A001: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-060A001: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-060A001: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-060A001: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-060A001: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-060A001: Screening and Disinfection	A stand-alone screening and disinfection facility.
Regional Controls – S-23 to S-29: Brook St Controls		
Outfalls 061DS23 and 060A001	CS4-S-23 to S-29: Sewer Separation	Complete sewer separation of tributary areas.
	S2-S-23 to S-29: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-S-23 to S-29: Surface Storage	An above grade storage tank to temporarily store CSOs.

CSO(s)	Control Alternative(s)	Description
	T1-S-23 to S-29: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-S-23 to S-29: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-S-23 to S-29: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-S-23 to S-29: Screening and Disinfection	A stand-alone screening and disinfection facility.
Sub-system Controls - Saw Mill Run Controls		
Outfalls 061DS23 and 060A001	SMR-1a: Tunnel Storage[2]	A 2.8 mile long tunnel O-14 to the S-30 POC. The S-23 CSOs will be controlled using the highest ranked outfall-specific and/or regional alternative(s): • S-23 to S-29 - Sub-Surface Storage
	SMR-1b: Tunnel Storage[2]	
	SMR-2a: Tunnel Storage[2]	A 5.7 mile long tunnel from O-14 to the S-23 POC. The S-23 CSO will be conveyed to a drop shaft near the S-23 POC.
	SMR-2b: Tunnel Storage[2]	

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008).* It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

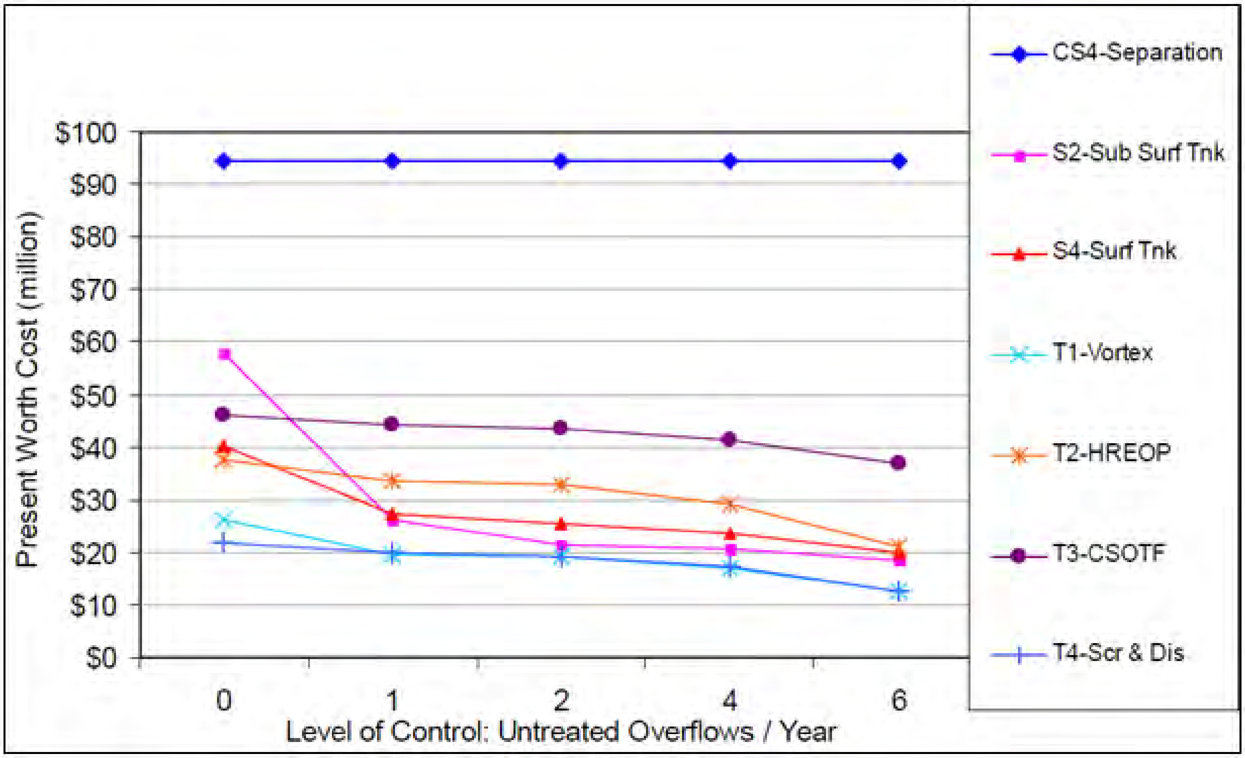
PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

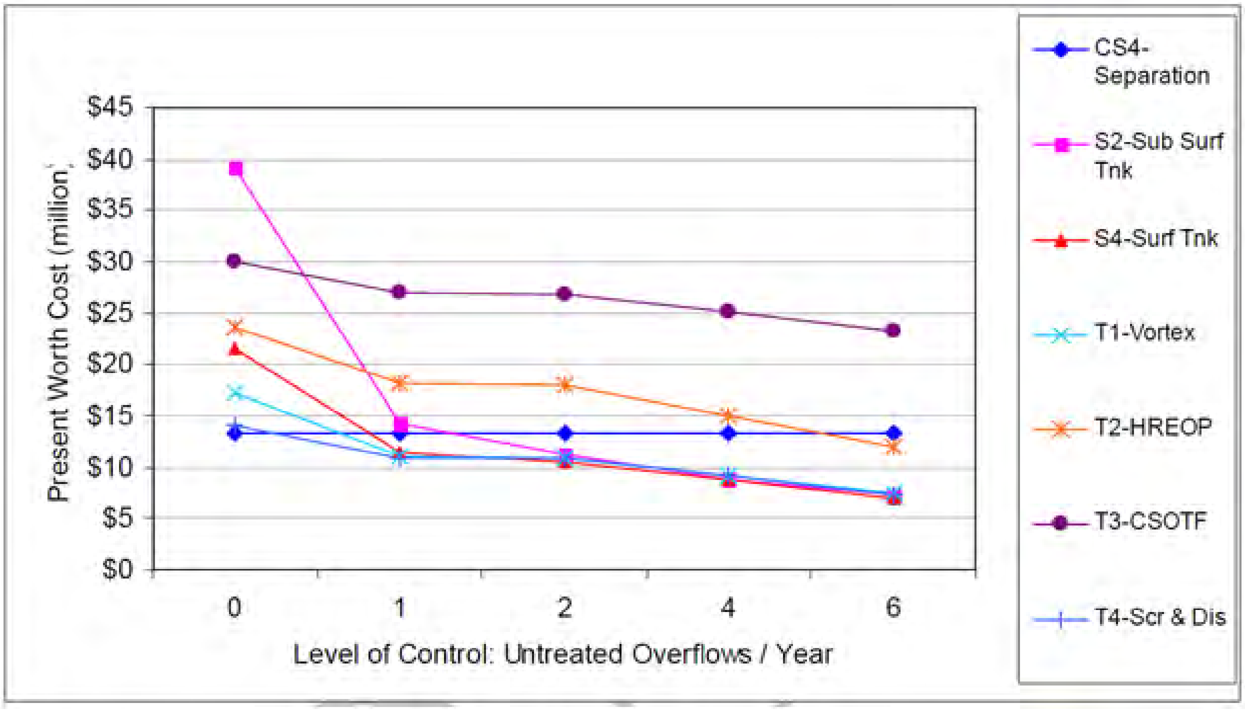
Outfall 061DS23 and 061DS24: Cost estimates were produced for outfall-specific control alternatives CS4 061DS23 and 061DS24: Sewer separation, S2-061DS23 and 061DS24: Sub-Surface Storage, S4-061DS23 and 061DS24: Surface Storage, T1-061DS23 and 061DS24: Suspended Solids Control, T2-061DS23 and 061DS24: High Rate End of Pipe Treatment, T3-061DS23 and 061DS24: CSO Treatment Facility, and T4-061DS23 and 061DS24: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure S23-4-2a illustrates the ranges of estimated present worth costs for these alternatives.

FIGURE S23-4-2A: OUTFALL S23 TO S24 ALTERNATIVE COSTS



Outfall 060A001: Cost estimates were produced for outfall-specific control alternatives CS4 060A001: Sewer separation, S2-060A001: Sub-Surface Storage, S4-060A001: Surface Storage, T1-060A001: Suspended Solids Control, T2-060A001: High Rate End of Pipe Treatment, T3-060A001: CSO Treatment Facility, and T4-060A001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure S23-4-2b illustrates the ranges of estimated present worth costs for these alternatives.

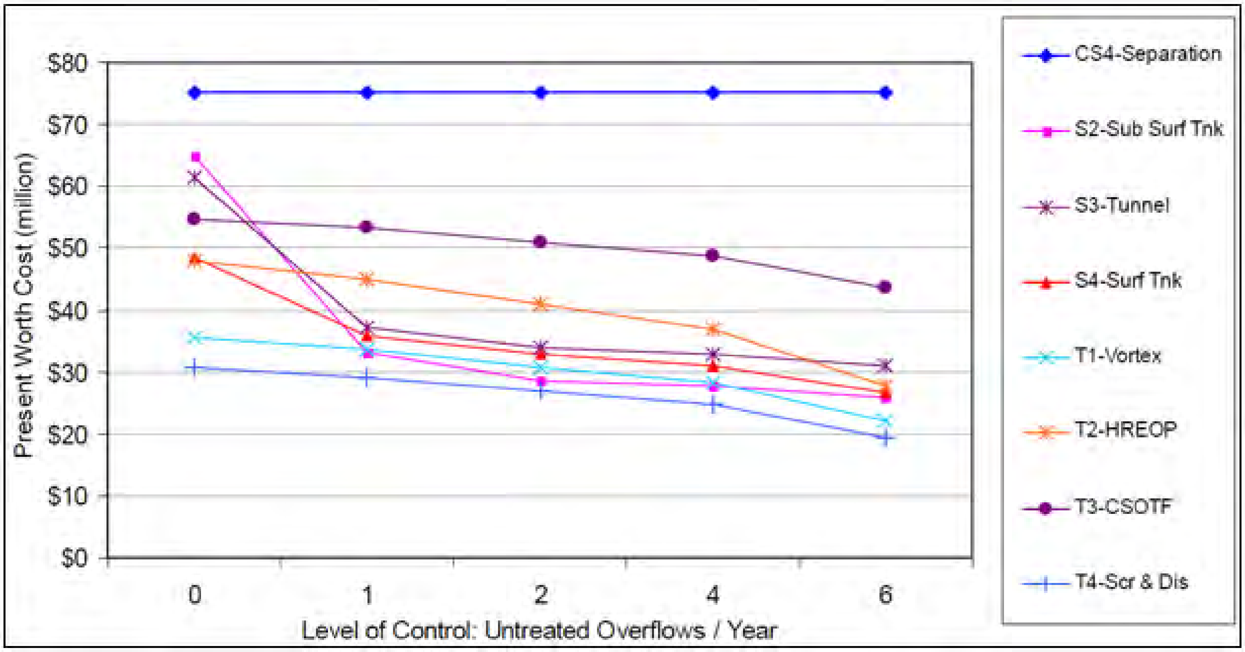
FIGURE S23-4-2B: OUTFALL 060A001ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

Cost estimates were produced for regional control alternatives developed for the S-23 to S-29 Region. Figure S23-4-3 illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE S23-4-3: S-23 TO S-29 REGION ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Saw Mill Run sub-system. Table S23-4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Saw Mill Run subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between “complete” sub-system alternatives. It remains PWSA’s assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE S23-4-3: SAW MILL RUN SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
SMR-1a	249.3	2.1	272.1
SMR-1b	253.3	1.9	274.0
SMR-2a	246.2	1.6	265.1
SMR-2b	251.8	1.5	269.0

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the “highest ranked alternative” for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining “Objective Scores” relative to each evaluation criteria.
- Applying “scaling” and “weighting” factors.
- Determining “Weighted Objective Scores” relative to each evaluation criteria.
- Ranking each alternative based on the sum of its “Weighted Objective Scores”.

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table S23-4-4.

TABLE S23-4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

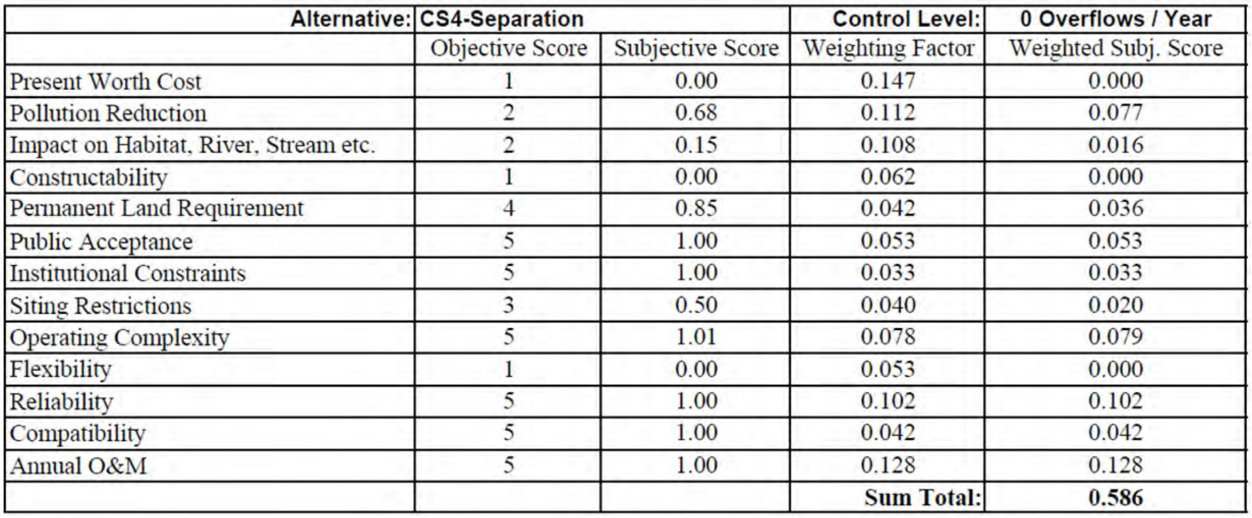
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in the following Table, taken from Section 7 of the Wet Weather Feasibility Study.

TABLE S23-4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 061DS23 and 061DS24: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in Table S23-4-6.

TABLE S23-4-6: WEIGHTED SUBJECTIVE SCORING - CS4 061DS23 AND 061DS24: SEWER SEPARATION



Alternative:	**CS4-Separation**		**Control Level:**	**0 Overflows / Year**
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	1	0.00	0.147	0.000
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.108	0.016
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	5	1.00	0.033	0.033
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.586**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that

their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

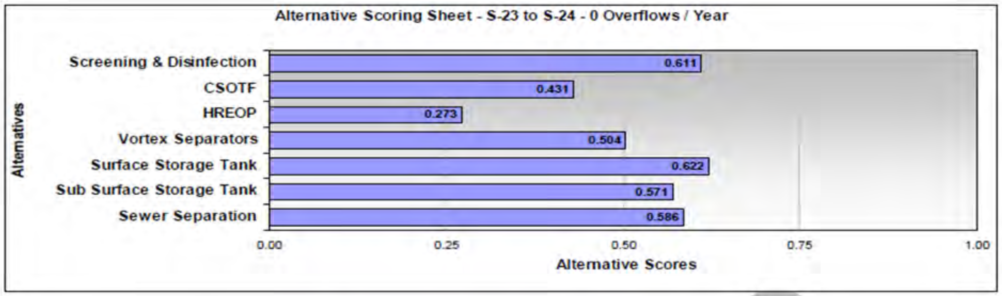
The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

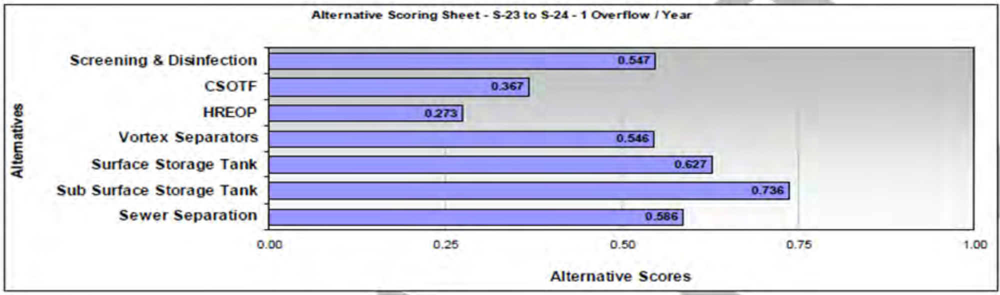
4.4.1 Outfall-Specific Control Alternatives

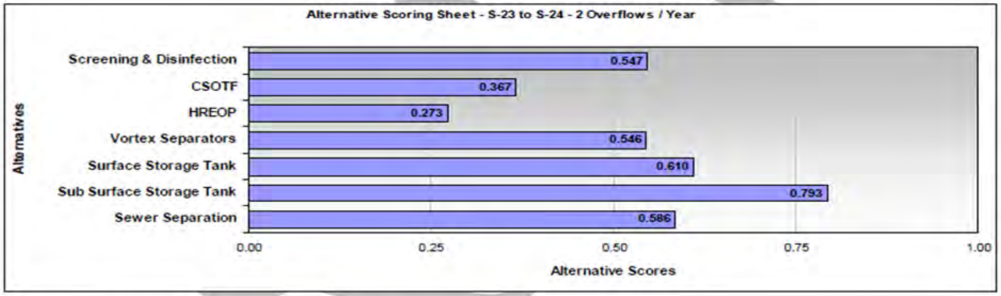
Outfall 061DS23 and 061DS24: The results of the control alternative evaluation process are shown in Figure S23-4-4a. For control level 0, it is recommended that Alternative S4-S-23 and S-24: Surface Storage be carried forward and re-evaluated with the results of the system-wide alternatives analyses. For control levels 1 through 6, it is recommended that Alternative S2-S-23 and S-24: Sub-Surface Storage be carried forward.

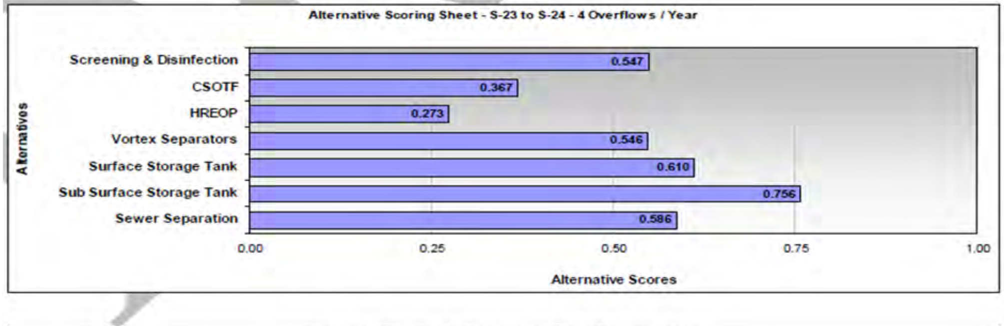
Outfall 060A001: The results of the control alternative evaluation process are shown in Figure S23-4-4b. For control level 0, it is recommended that *Alternative CS2-060A001: Separation* be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses. For control level 1, it is recommended that *Alternative S4-060A001: Surface Storage* be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses. For control levels 2 through 6, it is recommended that *Alternative S2- Outfall 060A001: Sub-Surface Storage* be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses.

FIGURE S23-4-4A: ALTERNATIVE SCORING - OUTFALL S23 AND S24









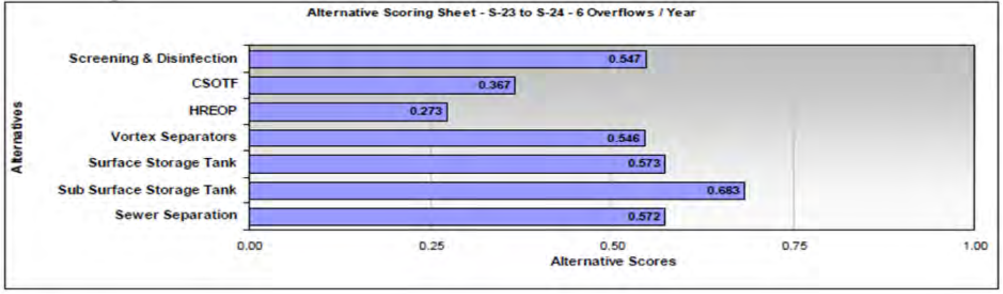
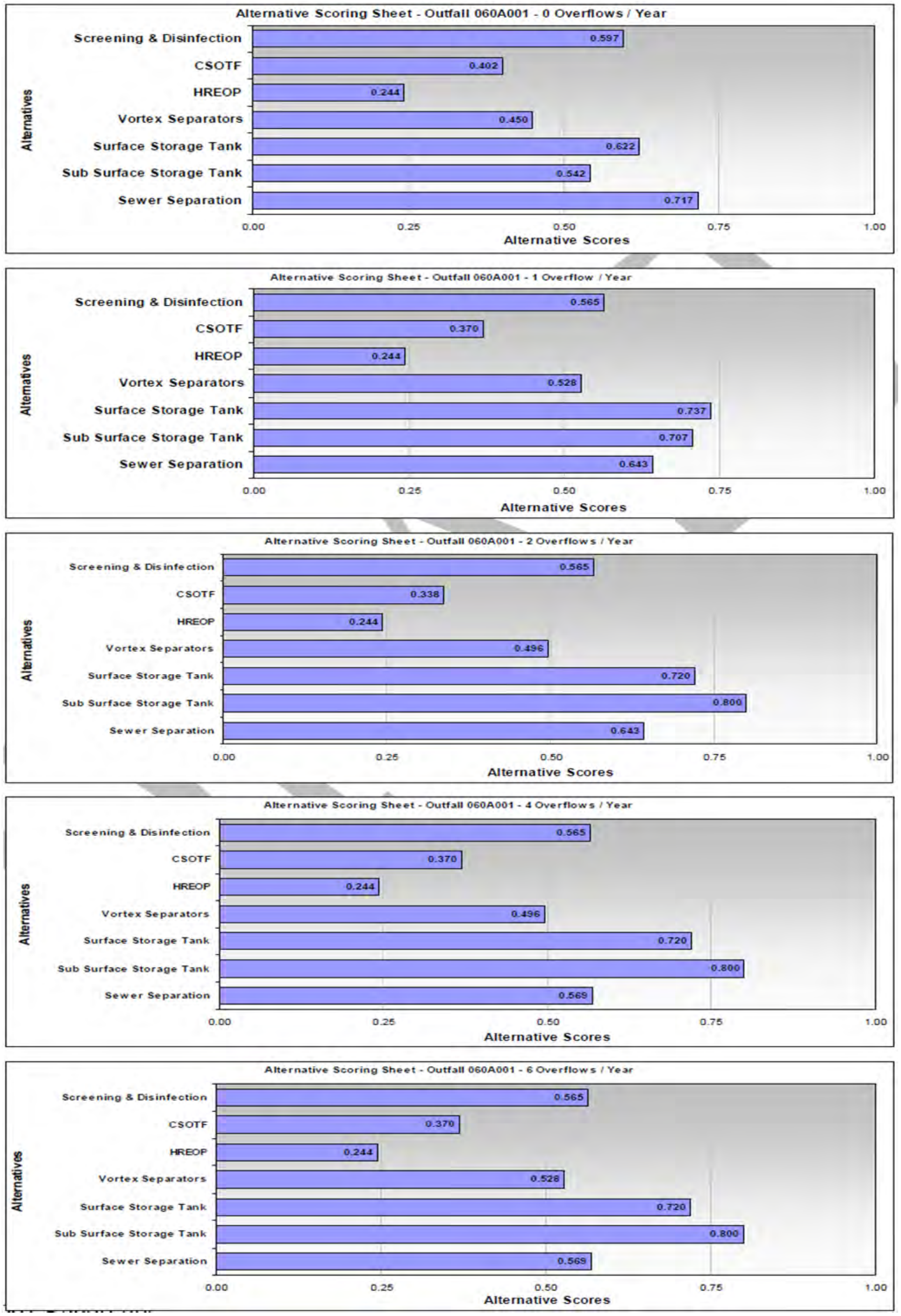


FIGURE S23-4-4B: ALTERNATIVE SCORING - OUTFALL 060A001



4.4.2 Regional Control Alternatives

S-23 to S-29 Region: The results of the regional control alternative evaluation process are shown below in Figure S23-4-5. For control level 0, it is recommended that Alternative *T4- S-23 to S-30 Region: Screening and Disinfection* be carried forward and re-evaluated with the results of the system-wide alternatives analyses. For control levels 1 through 6, it is recommended that *S2- S-23 to S-30 Region: Sub-Surface Storage* be carried forward and re-evaluated with the results of the system-wide analysis.

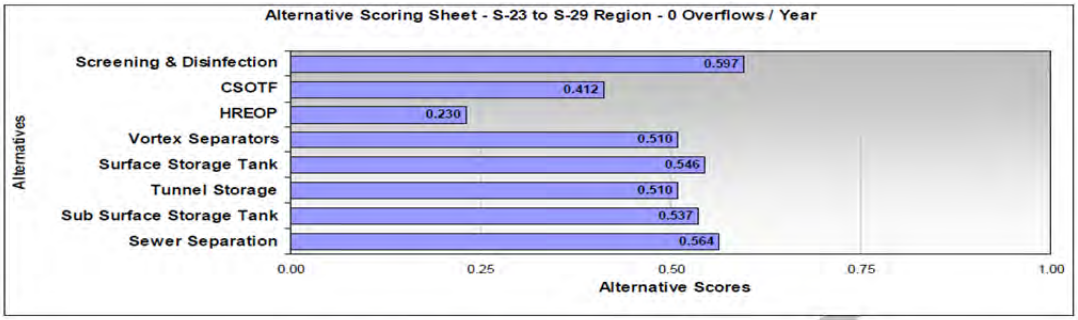
4.4.3 Sub-System Control Alternatives

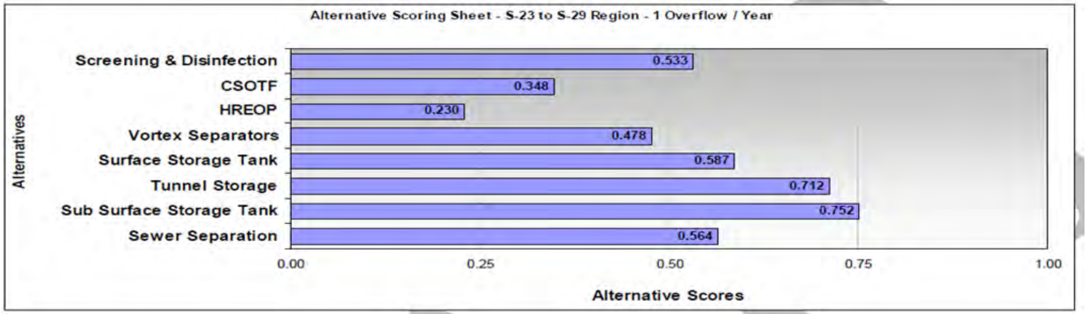
Saw Mill Run. The results of the sub-system control alternative evaluation process are shown below in Figure S23-4-6. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

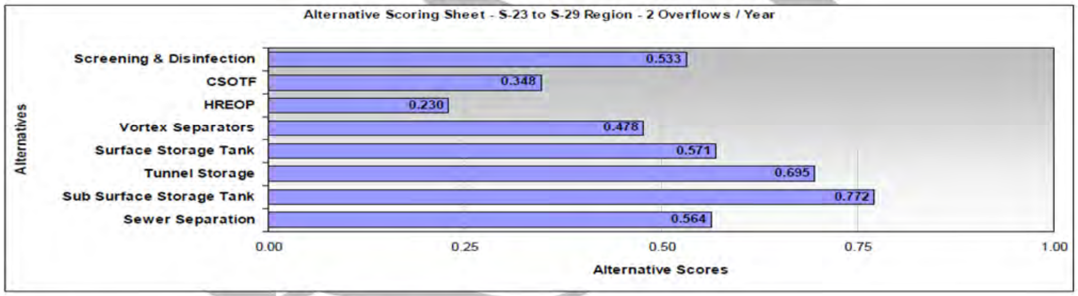
It was recommended that *Alternative SMR-2b: Tunnel Storage* be carried forward as the Saw Mill Run component of the PWSA's overall wet weather control solution.

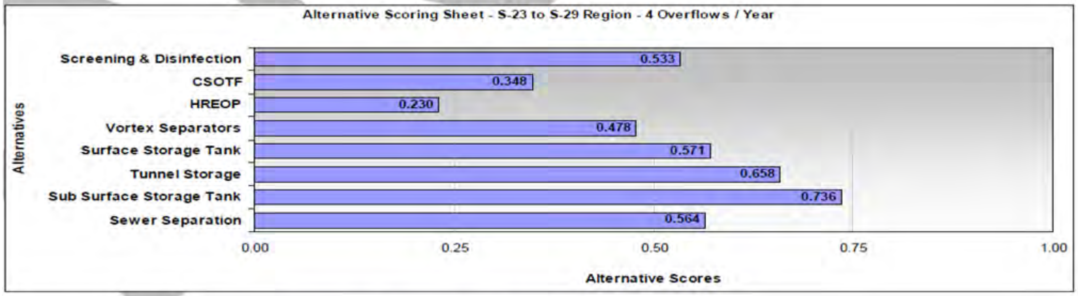
Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative SMR-2b: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative SMR-2b* included only those components required to deliver flows to the S-23 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the S-23 POC would become the responsibility of ALCOSAN.

FIGURE S23-4-5: ALTERNATIVE SCORING - S-23 TO S-29 REGION









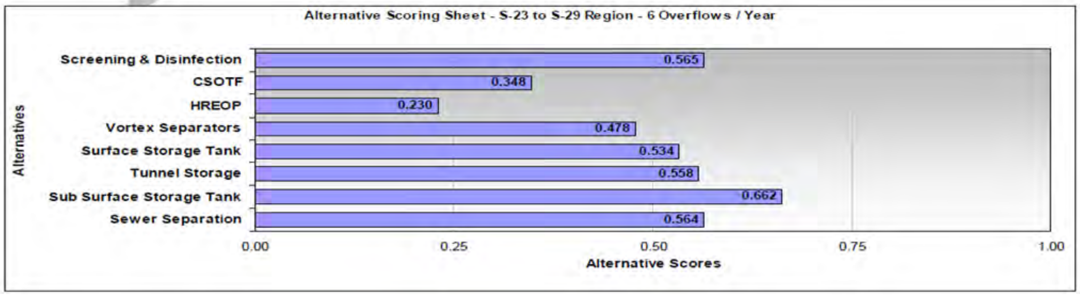
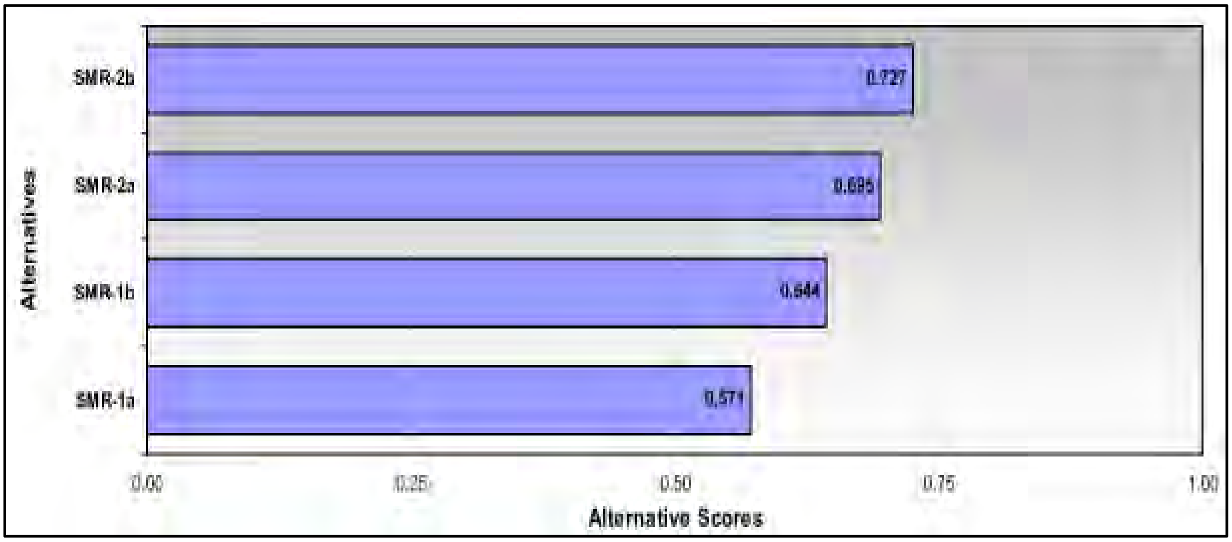


FIGURE S23-4-6: ALTERNATIVE SCORING – SAW MILL RUN SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Saw Mill Run sewershed would best be accomplished by implementing *Alternative SMR-2b: Tunnel Storage*. Within the S-23 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the PWSA permitted CSO to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the S-23 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative SMR-2b* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-S23-C-0*, *POC-S23-C-4* and *POC-S23-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **S23 -** The POC sewershed serviced.

- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.
- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the S-23 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the S-23 sewershed is zero untreated overflows per year. The recommended control alternative for the S-23 Brook Street sewershed has been designated as POC-S23-C-0. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **S23** The S-23 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **0** The selected level of control is zero untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of zero (0) untreated overflows per year, the required consolidation / conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-S23-C-0 are summarized in Table S23-5-1.

TABLE S23-5-1: ALTERNATIVE POC-S23-C-0 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID	Outfall	Required Improvements	Level of Control (OF/yr)
S-23	DC060A001	060A001	C*	0

*To be achieved via additional conveyance piping and regulator modifications.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, stream removal projects that may be included, its integration with ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-S23-C-4 and/or POC-S23-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. Both analyses determined that the optimal method of increasing the level of control of CSO overflows in the S-23 sewershed would be to reduce the number of overflows by conveying the additional wastewater to the ALCOSAN point of connection. To accomplish this, the PWSA and/or their tributary municipalities must:

- Modify existing diversion structure to achieve desired level(s) of control.
- Construct additional consolidation piping to convey remaining CSOs to the POC.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

For the single diversion structure in the S-23 sewershed, the H&H model was employed to identify the type and extent of modifications required to achieve zero overflows during the typical year.

The required modifications to the flow diversion settings were determined by the current typical year overflow statistics. Table S23-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control.

TABLE S23-5-2: ALTERNATIVE POC-S23-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC060A001	Diversion structure replacement*	27.0	7.0	5.3

*The installation of screening is planned for the PWSA diversion structure.

As can be seen from the table, new consolidation piping to convey flows at the zero OF/yr level of control must be designed to carry flows up to 27 mgd.

5.1.2 Consolidation Piping

The H&H model was employed to identify the capacity improvements necessary to consolidate and convey increased flows from the existing diversion structure to the S-23 POC. The modeling was accomplished by modifying the model representation of the diversion structure to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the S-23 POC without significant manhole surcharging and flooding. These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008)* that anticipated the construction of consolidation / relief sewers to supplement the capacity of the existing trunk sewer system.

It was anticipated that the required increase in conveyance capacity would be achieved by constructing parallel relief sewers, as necessary, designed to convey flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table S23-5-3 and in Figure S23-5-1.

TABLE S23-5-3: POC-S23-C-0 CONSOLIDATION PIPING

Diameter (in)	Length (ft)
24	1,863
30	116

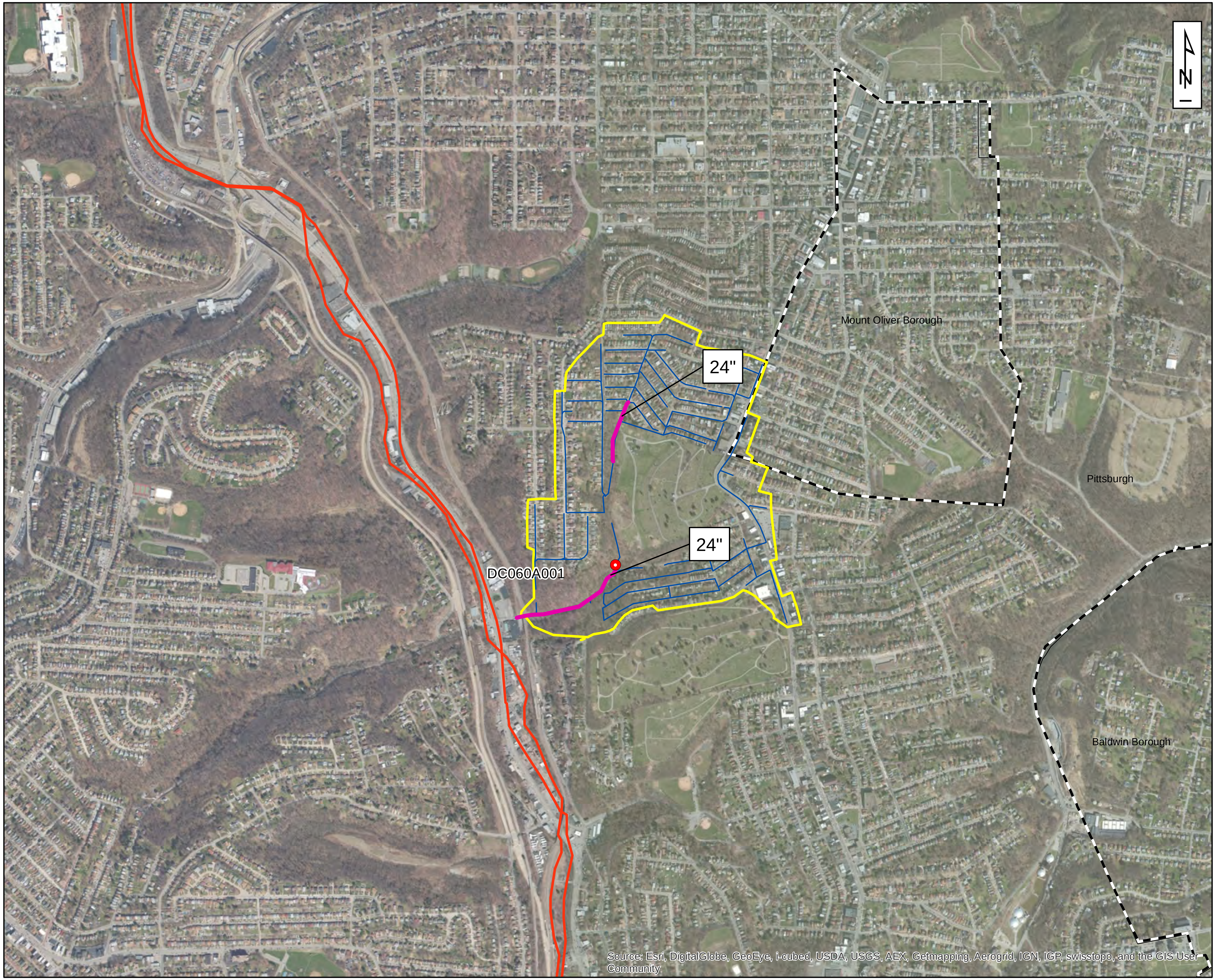
*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

5.1.3 Future Untreated CSO Volumes

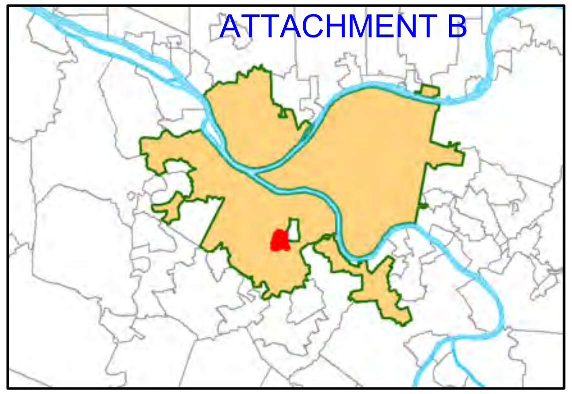
Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table S23-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 3.3 MG in the typical year.

TABLE S23-5-4: S-23 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name					
	POC-S23-C-0		POC-S23-C-4		POC-S23-C-10	
	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)
DC060A001	0	0	4	0.7	10	1.0
Total Volume		0		0.7		1.0



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



PWSA Service Area Overview

Legend

- ⦿ PWSA Diversion Structure Modification
- ━ Relief/Consolidation Sewers
- ─ Collector Sewer selection
- ☐ S-23 Sewershed Boundary
- ⬚ PWSA Service Area Boundary
- ☐ Municipal Boundary
- ■ River

Existing ALCOSAN Interceptor

- ╍ Deep Tunnel
- ─ Shallow Cut

1,000 500 0 1,000 Feet

Figure S23-5-1: POC-S23-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 5-1_S-23.mxd

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The combination of regulator modifications and additional consolidation piping will result in increased flow rates and volumes to the S-23 POC. Peak flow rates to the S-23 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-S23-C-0, POC-S23-C-4 and POC-S23-C-10 are presented in Figure S23-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the S-23 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table S23-5-5.

FIGURE S23-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE S-23 POC

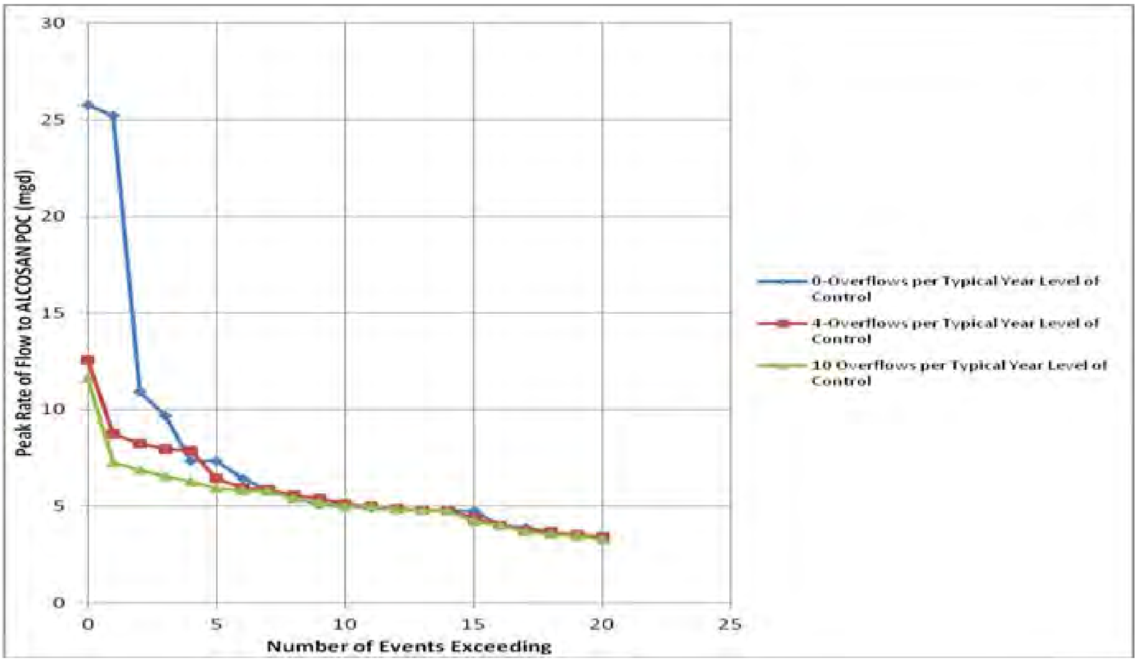


TABLE S23-5-5: S-23 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-S23-C-0	28.3	28.9	29.0	2.1	2.5	3.0
POC-S23-C-4	8.7	9.0	9.3	1.4	1.6	1.8
POC-S23-C-10	3.9	4.9	4.9	1.0	1.1	1.2

5.1.5 Recommended Control Alternative Integration

The S-23 collection system and S-23 POC does not contain/convey any upstream flow from surrounding municipalities. As a result, integration is limited to PWSA and its downstream sewage treatment provider ALCOSAN which is explained further in Section 5.7 of this POC report.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-S23C-0 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through the construction of parallel relief sewers designed to convey flows associated with zero overflows per typical year, under 2-year design storm conditions (0 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the S-23 sewershed, both before and after implementation of the recommended alternative:

- Peak flow hydraulic grade line (HGL) of the trunk sewer
- 2046 peak flows and volumes to the S-23 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities

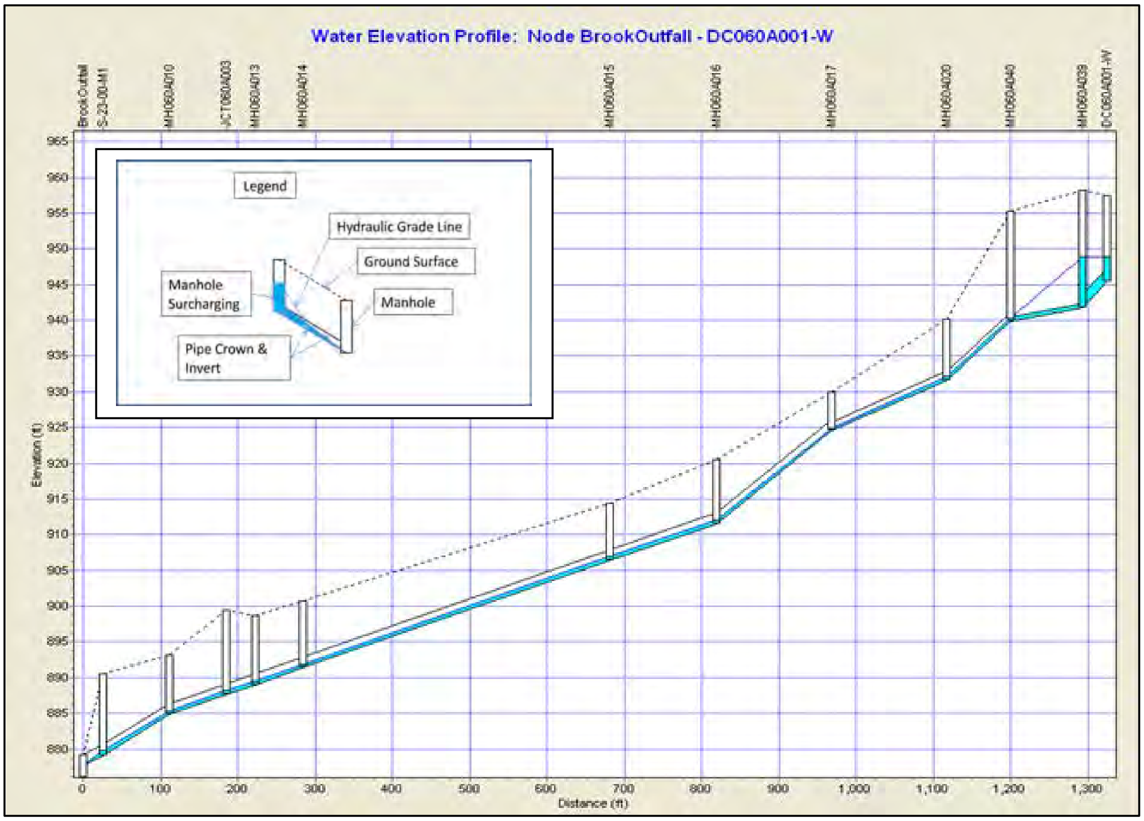
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figure 3 from that report presented a profile of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. This figure is reproduced below as Figure S23-5-3.

The HGL along the main trunk sewer following implementation of alternative POC-S23-C-0 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, modification of the diversion structure combined with additional conveyance capacity (0 OF/yr; 2-yr storm) will satisfactorily reduce manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE S23-5-3: S-23 MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure 3, under the current system configuration, including existing CSO diversion chamber settings, some surcharging occurs only in the upper portion of the trunk sewer, immediately downstream of the diversion chamber.

5.2.2 2046 Peak Flows and Volumes to S-23 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the PWSA system. ALCOSAN made similar assumptions[1], and once flows had been

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structure to achieve zero overflows per typical year, as well as additional consolidation piping to convey increased flows to the S-23 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the S-23 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances from ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This contrasts with the PWSA's water quality based decision to recommend a zero OF/yr level of control within the Saw Mill Run planning basin.

However, the control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the S-23 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

S-23 is not a multi-municipal POC and therefore has no upstream tributary municipalities.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structure to achieve zero overflows per typical year, as well as increased conveyance piping to convey increased flows to the S-23 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of regulator modifications and additional consolidation piping designed to control CSOs from the PWSA diversion structure to zero overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the S-23 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts in Saw Mill Run due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-S23-C-0 are consolidation piping, CSO screening facilities, and diversion structure modifications. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment S23-5-1.

5.4.1 Consolidation Piping

In the S-23 sewershed, additional conveyance capacity was provided through the use of parallel relief sewers to convey flows to the S-23 POC. As detailed earlier, relief sewers were added to areas of the system that exhibited manhole flooding or surcharging at any time during the 24-hour design storm events. All improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewer.

Parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete

- Sidewalk and Curb Restoration – Assumed restoration on one side of street

- Other values included in the cost – Trench excavations and backfill, rock excavation, trench wall support, street opening, clearing and grubbing, street restoration, flow maintenance, traffic maintenance

5.4.2 CSO Screening Facilities

It was assumed that each outfall location will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

It was assumed that adjustments to existing regulator settings, including more effective and improved methods of flow control and monitoring, improved access, etc., would be sufficiently extensive as to make it more cost effective to simply replace the existing structure. The unit cost associated with the installation of each new diversion structure was assumed to be $200,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $360,000.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure S23-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible "knee of the curve" is evident from this data.

These costs are also presented in a tabular format in Table S23-5-6.

The selected level of CSO control - 0 OF/yr - was determined based upon water quality considerations. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-S23-C-0 are summarized in Table S23-5-7. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE S23-5-4: S-23 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

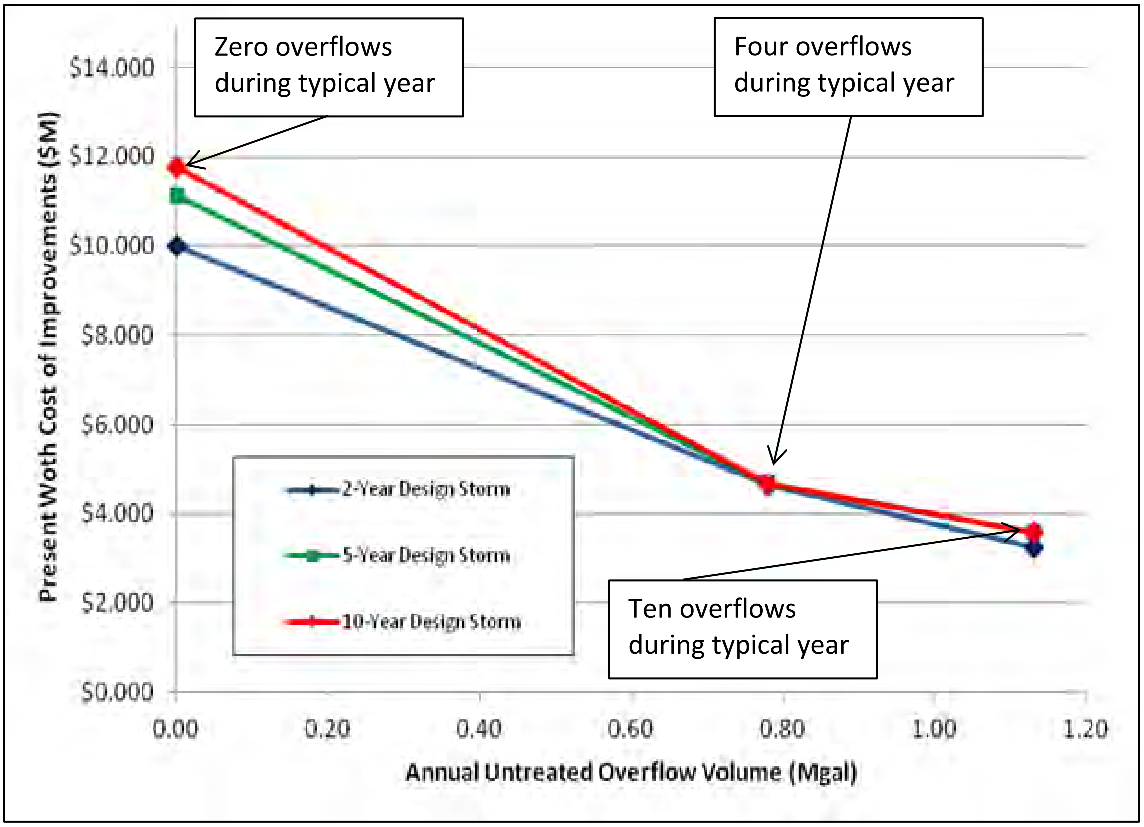


TABLE S23-5-6: S-23 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control (DC060A001)				
	Untreated CSO Volume (MG)	**CSO Control Level (OF/yr)**	**PW Capital Cost ($MM)**	**PW O&M Cost* ($MM)**	**TPW CSO Control ($MM)**
POC-S23-C-0	0	0	$2.80	$0.06	$2.86
POC-S23-C-4	0.7	4	$0.92	$0.01	$0.93
POC-S23-C-10	1.0	10	$0.81	$0.01	$0.82
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-S23-C-0	0	2-year	$0	$0	$0
POC-S23-C-4	0	2-year	$0	$0	$0
POC-S23-C-10	0	2-year	$0	$0	$0

TABLE S23-5-7: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-S23-C-0

Capital Improvements	Size/Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)
Replace diversion structure: DC060A001	0 OF/yr Each	$0.36	$0.36
Add screening to diversion structure: DC060A001	27.0 mgd overflow rate	$0.45	$0.46
Conveyance Piping	24-in diameter	$1.84	$1.89
Conveyance Piping	30-in diameter	$0.15	$0.15

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

S-23 is not a multi-municipal POC and therefore has no upstream tributary municipalities. As a result, an Inter-Municipal O&M Agreement is not required.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the S-23 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving waters and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC S-23 overflow is intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the "Selected Plan" to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the "Recommended Plan". This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the "Selected Plan" is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it's important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

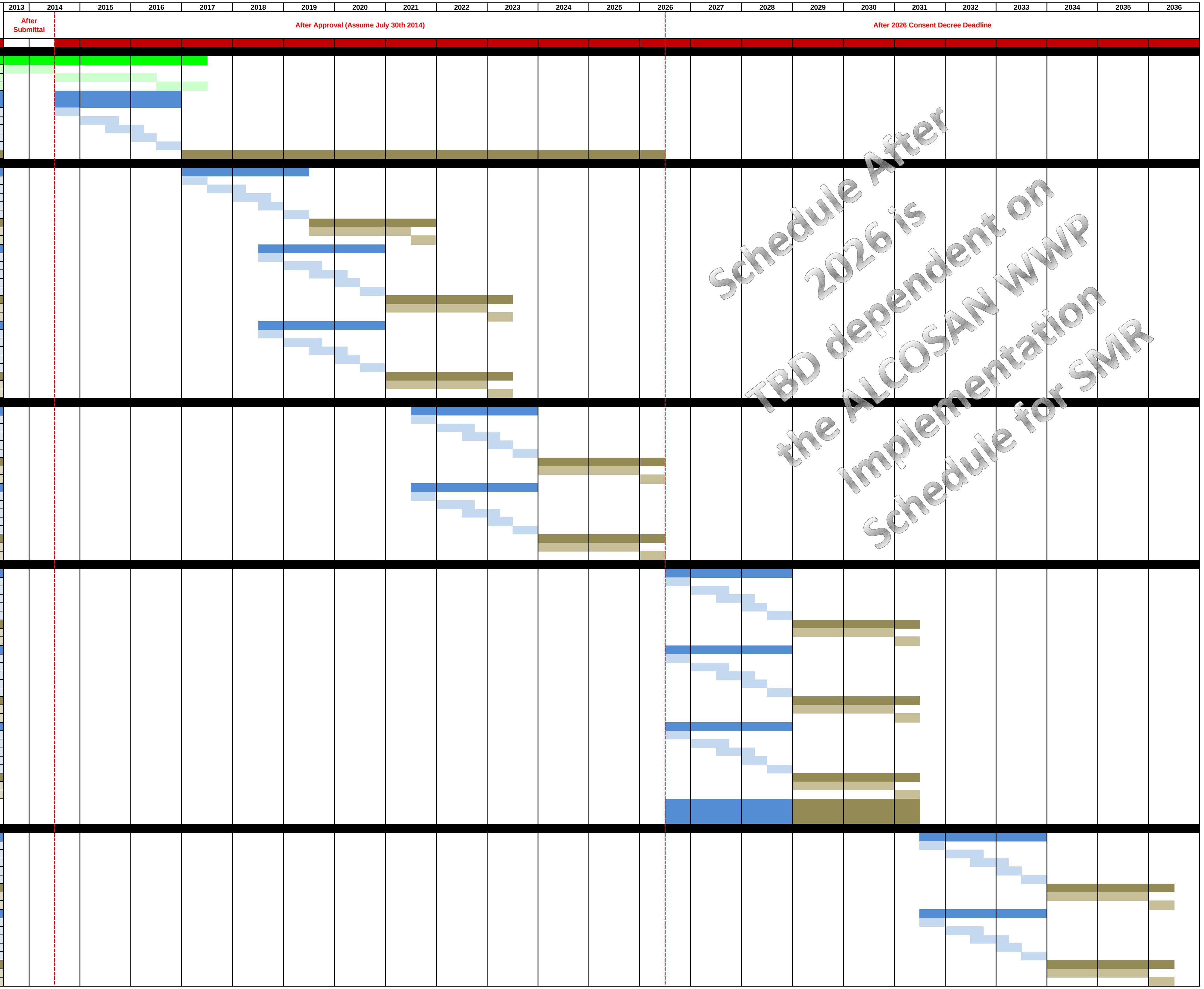
According to the ALCOSAN WWP, the SMR portion of the regional plan is not being implemented by 2026, and an implementation date is not specified in the plan. Therefore, an implementation schedule for S-23 improvements cannot be specified at this time as it depends on the ALCOSAN WWP' SMR implementation schedule.

The deadline shown in the schedule for S-23, which is shown in Figure MH18-5-5, is for reference purposes only.

ATTACHMENT B

FIGURE S23-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
	Phase 1		54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
	Phase 2		27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
	Phase 3		21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
	Phase 4		31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
	Phase 5		25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the S-23 sewershed. The PWSA is the only stakeholder municipality/ authority in this sewershed. Therefore, Inter-Municipal Agreements are not applicable. The considerations regarding the S-23 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

There are no cost allocation needs for the improvements in this sewershed.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

There are no inter-municipal agreements needed for the improvements in this sewershed.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this subsection, PWSA provides the plan and schedule for implementing the recommended S-23 system improvements and the plan to meet regulatory reporting obligations during and after S-23 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

Phase I	2013 through 2017
Phase II	2017 through 2023
Phase III	2021 through 2026
Phase IV	TBD
Phase V	TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/Integrated Watershed Planning activities

that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure S23-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

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[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

6.3.2 Joint Municipal Planning and Implementation

There are no Joint Municipal Planning and Implementation needs for the improvements in this sewershed.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$2,803,000.
- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance
- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA collection systems that are not directly attributed to the recommended alternative.

For the purpose of submitting the Feasibility Study, inter-municipal agreements regarding O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative is not needed for the improvements in this sewershed.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table S23-6-1. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE S23-6-1: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure S23-6-1.

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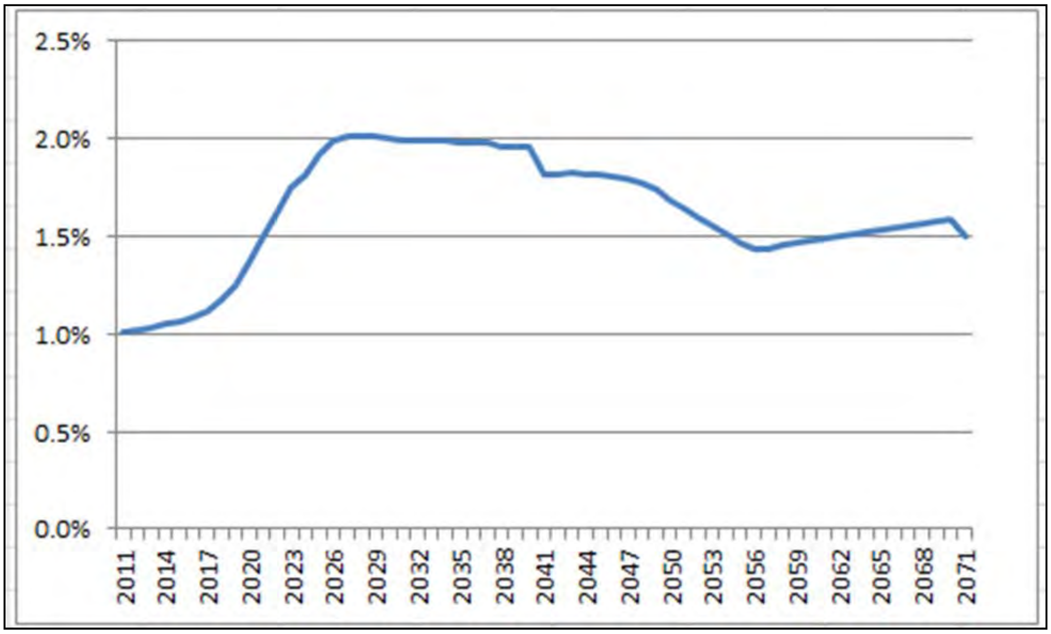
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

FIGURE S23-6-1 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.

7.0 STAKEHOLDER INVOLVEMENT

For the purpose of developing the PWSA Feasibility Study and this POC-based feasibility study, the PWSA is the sole contributor of flow to the Brook Street sewershed. Due to the absence of flow from neighboring municipalities, the PWSA did not lead a Wet Weather Feasibility Study Coordination Meeting to facilitate stakeholder participation. Additionally, stakeholder meetings facilitated by 3RWW, titled POC Sewershed Coordination Meetings, were not held for POC S-23. Other PWSA stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

ATTACHMENT B

WET WEATHER FEASIBILITY STUDY
APPENDIX A

POINT OF CONNECTION
SMRE-40: PLUMMERS RUN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

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1.0 INTRODUCTION

The Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act (CWA) establishes criteria governing communities' sewage conveyance and treatment systems. Specifically, the Pennsylvania Clean Streams Law prohibits overflows from separate sanitary sewers, and the Federal CWA (through the Combined Sewer Policy) requires certain controls be applied to reduce pollutants from combined sewer systems. In early 2004, Administrative Consent Orders (ACOs) and Consent Order and Agreements (COAs) were issued to the City of Pittsburgh and the other 82 communities tributary to the Allegheny County Sanitary Authority (ALCOSAN) Conveyance and Collection system, directing compliance with these two laws. The ACOs were issued to separate sewer communities by the Allegheny County Health Department (ACHD), and the COAs were issued to combined sewer communities by the Pennsylvania Department of Environmental Protection (PADEP). The initial COA between the Pittsburgh Water and Sewer Authority (PWSA), the City of Pittsburgh, the PADEP and the ACHD was entered into on January 29, 2004 and later amended in July 2007. Subsequent to that, in January 2008, ALCOSAN entered into a Consent Decree (CD) with the United States of America (represented by the US Department of Justice and the US Environmental Protection Agency), the Commonwealth of Pennsylvania (PADEP) and the ACHD. ALCOSAN's CD required them to prepare and submit an approvable Wet Weather Plan (WWP) by January 2013.

These ACOs/COAs (collectively known as the Orders) and the ALCOSAN CD require the respective entities to gather data and information, characterize their respective systems, develop and analyze alternatives, and submit feasibility studies addressing work required to bring their systems into compliance with the Pennsylvania Clean Streams Law and the CWA, eliminate sanitary sewer overflows (SSOs), and fulfill the Pennsylvania and USEPA combined sewer overflow (CSO) Policy obligations. ALCOSAN's CD not only requires ALCOSAN to submit a plan to the regulators by January 2013 outlining a program to comply with these laws, but also requires the facilities, including the municipal facilities, be constructed and in operation by 2026. Municipalities tributary to ALCOSAN, including the PWSA, are required to submit their feasibility studies to the regulators within six months of ALCOSAN's submission. Barring any extensions to ALCOSAN's submission date, this would be no later than July 30, 2013. The PWSA, ALCOSAN and other municipal sewer systems are physically and hydraulically interconnected and

interrelated, making it necessary to closely coordinate planning activities to facilitate the development of comprehensive regional solutions.

As part of the coordination process, ALCOSAN requested that they be provided with municipal draft feasibility study information by July 2012 so that such information could be considered as they prepared their Final Wet Weather Plan. PWSA complied with that request and provided ALCOSAN with a document entitled *Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System*, dated July 31, 2012. This document provided ALCOSAN with an overview of the current planning for the control of PWSA's permitted CSO facilities as of July 2012. The preliminary information describes the currently identified highest ranked system improvements, approximate locations and general arrangements of facilities, estimated costs of facilities, anticipated performance in terms of CSO discharges, and the anticipated flows to be conveyed through the PWSA system to ALCOSAN interceptor facilities. The information in the report is organized by the name of the ALCOSAN Point of Connection (POC) at which the PWSA system connects to the ALCOSAN system.

It is understood that the PWSA Feasibility Study, (of which this POC report is a part) and those of other municipalities, will serve as the basis for the next round of regulatory compliance orders that will mandate the implementation of the selected/approved alternatives. To that end, the PWSA Feasibility Study addresses both the internal PWSA alternatives that were evaluated for POC sewersheds in which the PWSA is the sole contributor of flow, and for POC sewersheds in which both PWSA and tributary municipalities are flow contributors. Consequently, the PWSA Feasibility Study is being submitted on behalf of the PWSA and their tributary municipalities.

Those POC sewersheds for which no control facilities are required or that will include facilities that will be the responsibility of ALCOSAN or of municipalities tributary to the PWSA are described within the body of the PWSA Feasibility Study. Those POC sewersheds that include facilities that will be the responsibility of the PWSA are described in detail using this format, and have been included as appendices to the PWSA report.

1.1 BACKGROUND

This Feasibility Study is the culmination of numerous studies and activities and is intended to fulfill the requirements of the City of Pittsburgh/ PWSA COA. The most relevant of those prior studies are the *PWSA Feasibility Study Report* (October 2008) and the *Report On The Current Status Of The Development Of The Wet Weather Feasibility Study For The City Of Pittsburgh Sewerage System* (July 31, 2012).

PWSA Feasibility Study Report (October 2008). The objective of this report was to identify and present technology, cost, and non-cost analyses that would allow the PWSA to select appropriate CSO control alternatives that best meet the environmental requirements set forth in the Commonwealth of Pennsylvania, Department of Environmental Protection's (PaDEP) Consent Order Agreement (COA) issued January 29, 2004. The technology screening process and analysis used to identify and select CSO control alternatives for the October 2008 plan were summarized and presented in the report. Those processes and analyses are still valid and form the foundation upon which this report is based.

In addition, the intent of the October 2008 report was to place the PWSA in a position to work with the ALCOSAN Basin Planners in an effort to mutually develop the best regional plan as their work proceeded. The October 2008 report built upon the information presented in a series of CSO abatement reports prepared for the PWSA, which include the following:

- Closed-Circuit Television Report (February, 2006)
- Receiving Water Quality Assessment Program Technical Memorandum (December, 2006)
- PWSA Combined Sewer Overflow Report (January, 2007)
- CSO Quality Assessment Technical Memo (June, 2007)
- Collection System Inventory and Characterization Report (August, 2008)
- Hydraulic and Hydrologic Characterization Report (September, 2008)

Report on the Current Status of the Development of the Wet Weather Feasibility Study for the City of Pittsburgh Sewerage System (July 31, 2012). The July, 2012 report was prepared in response to a request by ALCOSAN, made to all of

ALCOSAN's customer municipalities, for DRAFT Wet Weather Feasibility Study information.

The July 2012 report reviewed the current status of the development of the Wet Weather Feasibility Study for the City of Pittsburgh sewerage system. It also provided an overview of the current status of Wet Weather Feasibility Study planning for the control of PWSA's permitted CSO facilities. The July 2012 report was also submitted on behalf of affected municipalities tributary to PWSA.

This POC FS Report is intended to present a description of the work tasks performed, as well as the results of the tasks that culminated in recommended wet weather control alternatives. This report also contains existing sewer system CSO statistical data, hydraulic performance assessment, feasibility study recommendations, flow rate and cost estimate data presented by PWSA on behalf of the City of Pittsburgh and Dormont Borough. This POC FS Report was prepared according to guidelines provided in the 3 Rivers Wet Weather (3RWW) Feasibility Study Working Group (FSWG) Documents that were developed for such purpose, in cooperation with the participating municipalities.

This report is divided into seven sections. Details on the information contained in each section are described below:

- Section 1.0 provides the background for this POC FS Report and a description of the existing system.

- Section 2.0 describes the sewer system capacity analysis. Information on the development and calibration of hydrologic and hydraulic (H&H) tools that were used to evaluate the existing system and model future conditions are discussed including preliminary flow estimates (PFEs), 2008 Flow Monitoring Data, dry weather flow and baseline conditions. Capacity deficient sewers are identified.

- Section 3.0 discusses water quality criteria that are applicable to the receiving streams and what CSO and SSO control levels were selected.

- Section 4.0 presents the alternative development process for alternatives that would be implemented for the POC including the technology screening and site screening processes, alternative development,

alternative evaluation criteria, cost estimating, green infrastructure, and alternative selection process and evaluation results.

- Section 5.0 provides a detailed description of the recommended alternative, stream removals that will be done, and how the recommended alternative will be integrated into the ALCOSAN regional alternative.

- Section 6.0 provides a discussion of how costs will be allocated for the implementation of the recommended alternative including details on financial responsibility agreements, affordability analyses, and funding alternatives.

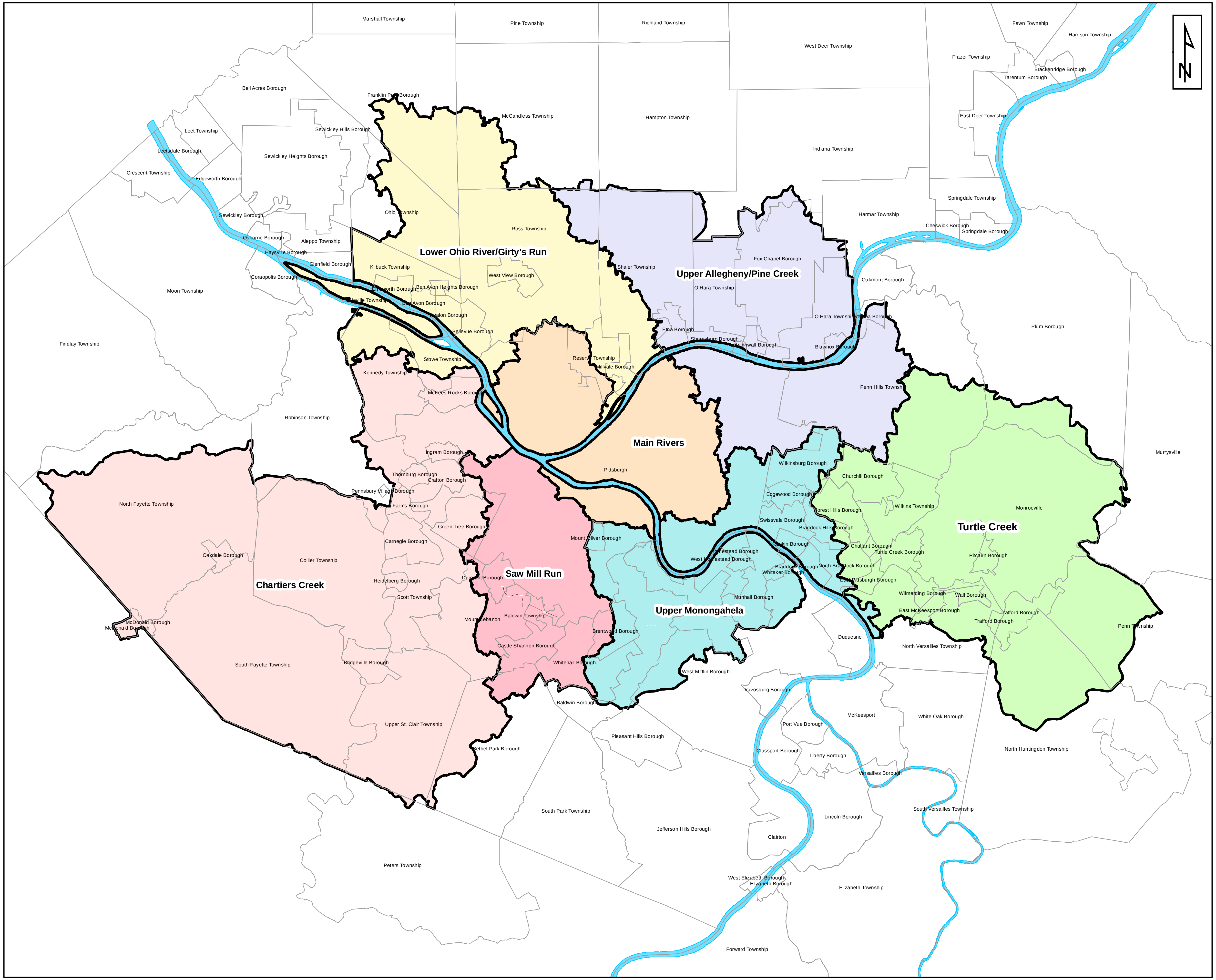
- Section 7.0 describes how stakeholders were included in the development of the plan.

1.2 EXISTING SYSTEM DESCRIPTION

This POC FS Report addresses POC SMRE-40, also known as Plummers Run. The SMRE-40 sewershed is located in the Saw Mill Run Planning Basin. The Saw Mill Run basin is one of seven planning basins delineated by ALCOSAN in their wet weather planning efforts. These seven basins are indicated in *Figure 1-1: ALCOSAN Planning Basins*.

The existing sewerage facilities in this sewershed are illustrated in *Figure 1-2: SMRE-40 Plummers Run Existing Facilities Map*. The SMRE-40 sewershed system is served by one main trunk sewer system that is directly connected to ALCOSAN's Saw Mill Run Interceptor at MH 40. The trunk sewer consists of two parallel pipes that extend from MH 40 in a southwesterly direction along West Liberty Avenue. One line is the primary overflow/storm sewer and the other is the main trunk sewer. The main trunk sewer ranges in size from 12 inches to 24 inches in diameter at its connection point and is constructed mainly of concrete. The primary overflow/storm sewer portion of the trunk sewer varies in size from 30 inches to 66 by 120 inches in diameter and is constructed primarily of reinforced concrete, brick, vitrified clay and ductile iron.

There are eleven PWSA CSO diversion chambers in the sewershed that overflow to Saw Mill Run at one permitted CSO. The SMRE-40 sewershed encompasses approximately 611. The sewershed is made up of 576 acres of the City of Pittsburgh and 35 acres of Dormont Borough. Refer to *Table 1-1: Sewershed Characteristics for Area Tributary to SMRE-40* for specific information on this POC.



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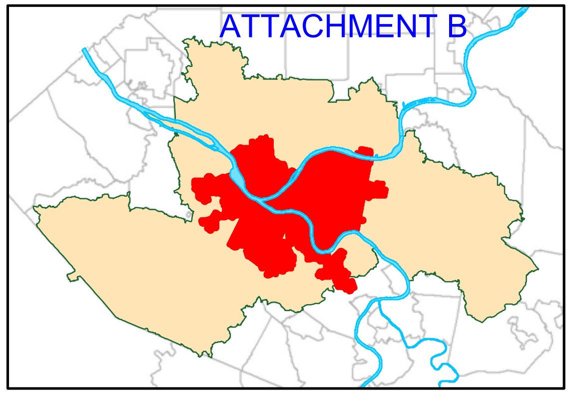

ALCOSAN Service Area Overview

Legend

☐ Municipal Boundary
▨ Chartiers Creek
▨ Lower Ohio River / Girty's Run
▨ Main Rivers
▨ Saw Mill Run
▨ Turtle Creek
▨ Upper Allegheny / Pine Creek
▨ Upper Monongahela
▨ River

14,000 7,000 0 14,000 Feet

Figure 1 - 1: ALCOSAN Planning Basins Feasibility Study Report

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Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\FIGURE 1-1_ALCOSAN PLANNING BASIN.mxd

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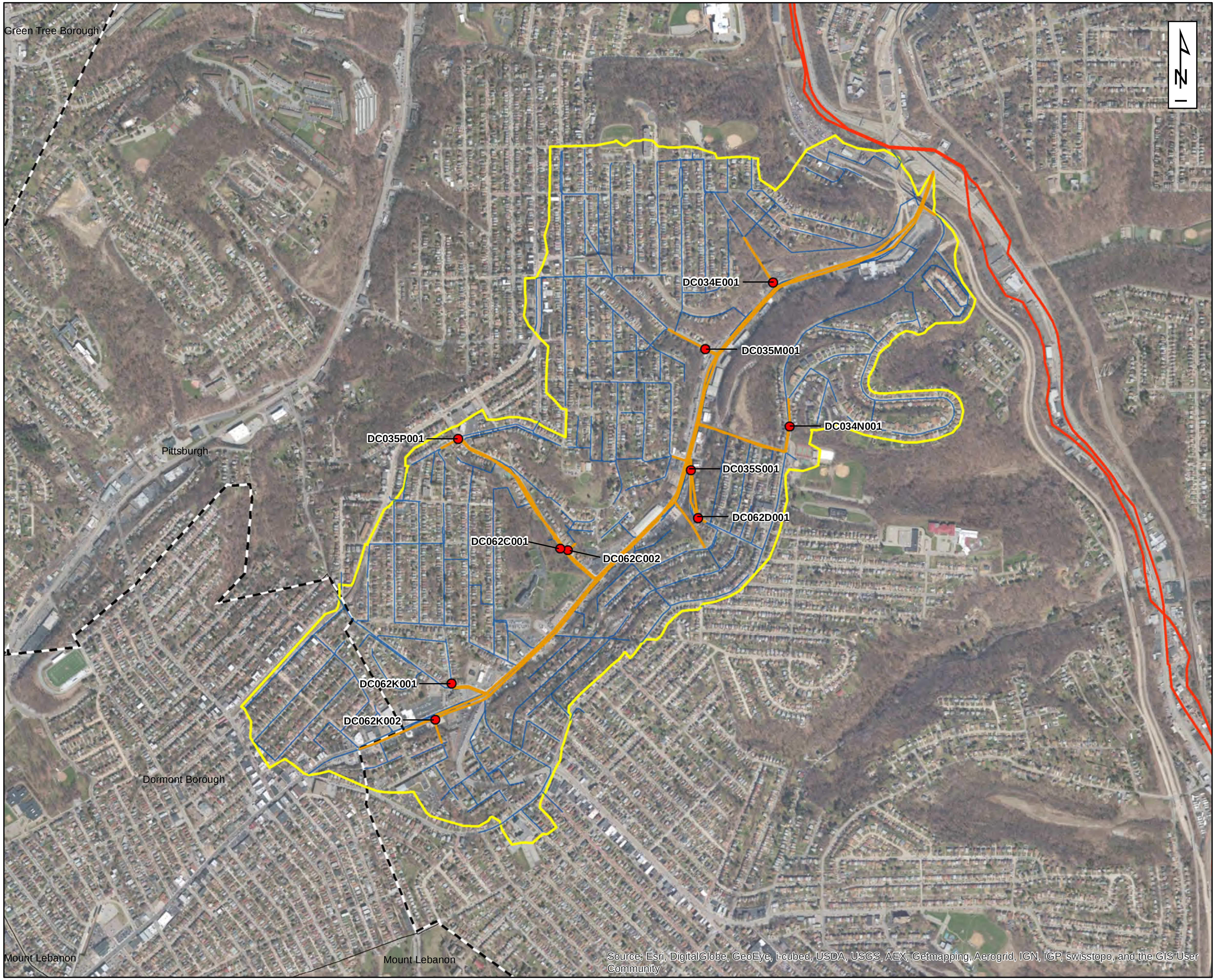
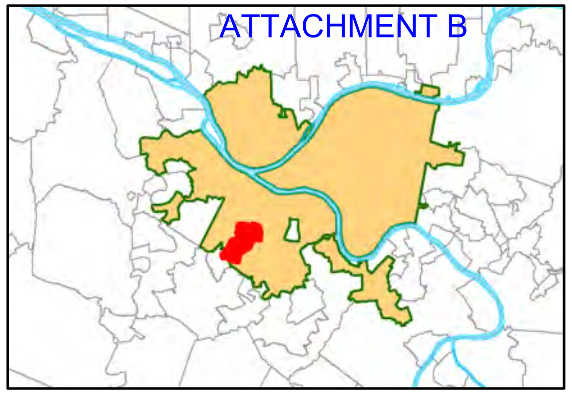


Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



PWSA Service Area Overview

Legend

● PWSA CSO Diversion Structure

Trunk Sewer

Collector Sewer

SMRE-40 Sewershed Boundary

PWSA Service Area Boundary

Municipal Boundary

River

Existing ALCOSAN Interceptor

Deep Tunnel

Shallow Cut

1,000 500 0 1,000 Feet

Figure 1 - 2: SMRE-40 Plummers Run Existing Facilities

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Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\PLUMMERS RUN (SMRE-40)\FIGURE 1-2_SMRE_40Existing Overflows.mxd

TABLE 1-1: SEWERSHED CHARACTERISTICS FOR MUNICIPALITIES TRIBUTARY TO SMRE-40

COMPLEX SHED CHARACTERISTICS	MUNICIPALITY	
	City of Pittsburgh	Dormont Borough
Tributary Area (Acres)	576	35
Population	5,645	792
Combined		
Inch-Miles	120	0
Linear Feet	47,800	0
Inch-Miles/Acre	0.21	0
Separate		
Inch-Miles	145	12
Linear Feet	76,700	7,000
Inch-Miles/Acre	0.25	0.34

*Inch-Mile and Linear Feet data obtained from 3RWW Municipal Data Support web-map.

Combined flows from the upstream PWSA diversion structures tie directly into the Saw Mill Run interceptor with no overflow structure. The Saw Mill Run interceptor conveys those flows to ALCOSAN diversion structure O-14.

A brief description of each permitted overflow is provided below in *Table 1-2: Known Constructed Discharge Locations Tributary to SMRE-40*. Detailed descriptions of these discharge locations may be found in Section 6 of the *PWSA System Inventory & Characterization Report (August 2008)*.

TABLE 1-2: KNOWN CONSTRUCTED DISCHARGE LOCATIONS TRIBUTARY TO SMRE-40

NPDES#	Upstream Regulator Name	Common Name	Location	Receiving Waters
015P001	DC034E001 DC034N001 DC035M001 DC035P001 DC035S001 DC062C001 DC062C002 DC062D001 DC062K001 DC062K002	CSO015P001	West Liberty Avenue and Saw Mill Run Boulevard	Saw Mill Run

As shown in *Table 1-3: SMRE-40 Sewershed Typical Year Overflow Statistics*, during the typical year these eleven structures overflow between zero and 46 times. Overflow volumes range from zero gallons to 1.0 million gallons per event, and from zero gallons to 4.9 million gallons annually, on a structure by structure basis. Annual overflow volume for this sewershed is 5.63 million gallons.

TABLE 1-3: SMRE-40 SEWERSHED TYPICAL YEAR OVERFLOW STATISTICS

Diversion Structure Identification	Number of Overflows	Peak Flow Rates (mgd)			Overflow Volume (mg)			Annual Overflow Volume (mg)
		Largest	5th Largest	11th Largest	Largest	5th Largest	11th Largest	
DC034E001	6	12.34	0.21	N/A	0.27	0.01	N/A	0.32
DC034N001	6	2.46	0.05	N/A	0.06	0.01	N/A	0.08
DC035M001	46	44.27	11.50	5.02	1.00	0.29	0.17	4.90
DC035P001	35	3.1	0.68	0.23	0.05	0.01	0.01	0.19
DC035S001	1	0.01	N/A	N/A	0.01	N/A	N/A	0.01
DC062C001	3	3.27	N/A	N/A	0.05	N/A	N/A	0.06
DC062C002	0	N/A	N/A	N/A	N/A	N/A	N/A	0.00
DC062D001	2	0.57	N/A	N/A	0.01	N/A	N/A	0.01
DC062K001	3	0.72	N/A	N/A	0.01	N/A	N/A	0.02
DC062K002	7	0.83	0.36	N/A	0.01	0.01	N/A	0.04
Total Annual Volume								**5.63**

1.2.1 Diversion Structure Sketches

The following sketches of the SMRE-40 diversion structures were taken from Appendix A.2 of the PWSA SICR, August 2008.

Diversion Chamber ID: DC 034E001
NPDES #: 015P001
Type: Sluice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size:	24	NA	NA	inches
Material:	RC	NA	NA	
Invert:	910.16	NA	NA	ft
Slope:	12.89	NA	NA	%

Weir

Crest:	909.24	ft
Length:	3	ft

Effluent Sewers (non-overflow)

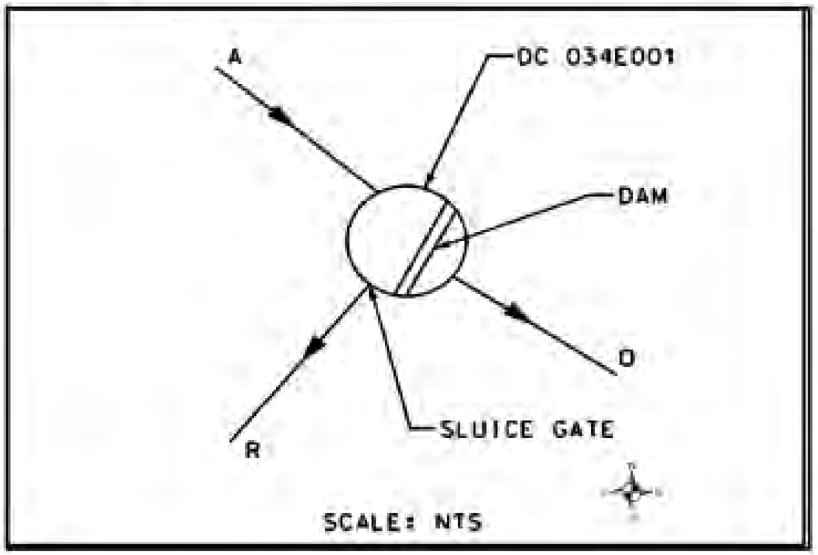
	R	S	T	
Size:	8	NA	NA	inches
Material:	PVC	NA	NA	
Invert:	908.49	NA	NA	ft
Slope:	11.31	NA	NA	%

Overflow Sewer

	O	
Size:	36	inches
Material:	Brick	
Invert:	909.24	ft
Slope:	7.71	%

Orifice

	U	V	W	
Invert:	908.49	NA	NA	ft
Shape:	NA	NA	NA	
Opening Height:	0.58	NA	NA	ft
Opening Width:	NA	NA	NA	ft



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Diversion Chamber ID: DC 034E001

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Diversion Chamber ID: DC 034N001
NPDES #: 015P001
Type: Sluice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1138.24	NA	NA	ft
Slope:	1.95	NA	NA	%

Weir

Crest:	1138.58	ft
Length:	2.17	ft

Effluent Sewers (non-overflow)

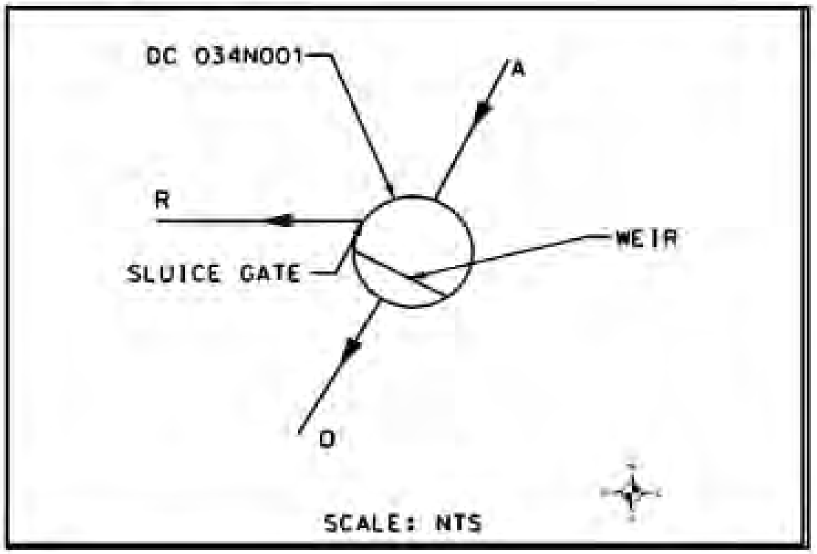
	R	S	T	
Size:	8	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1138.11	NA	NA	ft
Slope:	49.3	NA	NA	%

Overflow Sewer

	O	
Size:	8	inches
Material:	TC	
Invert:	1138.1	ft
Slope:	27.02	%

Orifice

	U	V	W	
Invert:	1138.11	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.33	NA	NA	ft
Opening Width:	NA	NA	NA	ft



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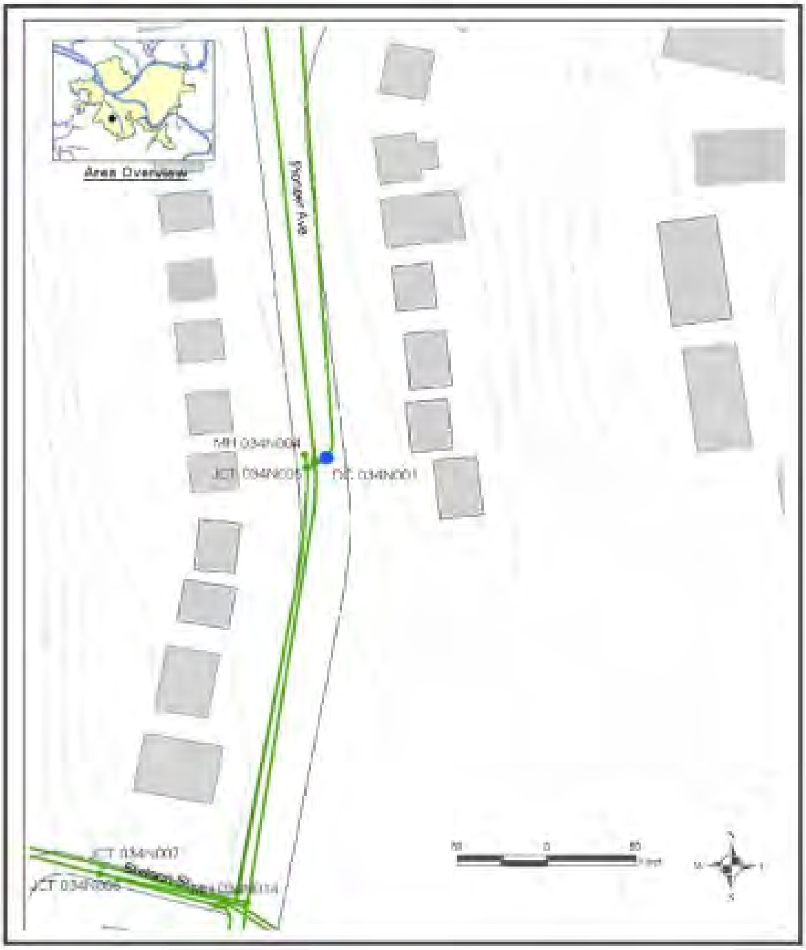
Diversion Chamber ID: DC 034N001



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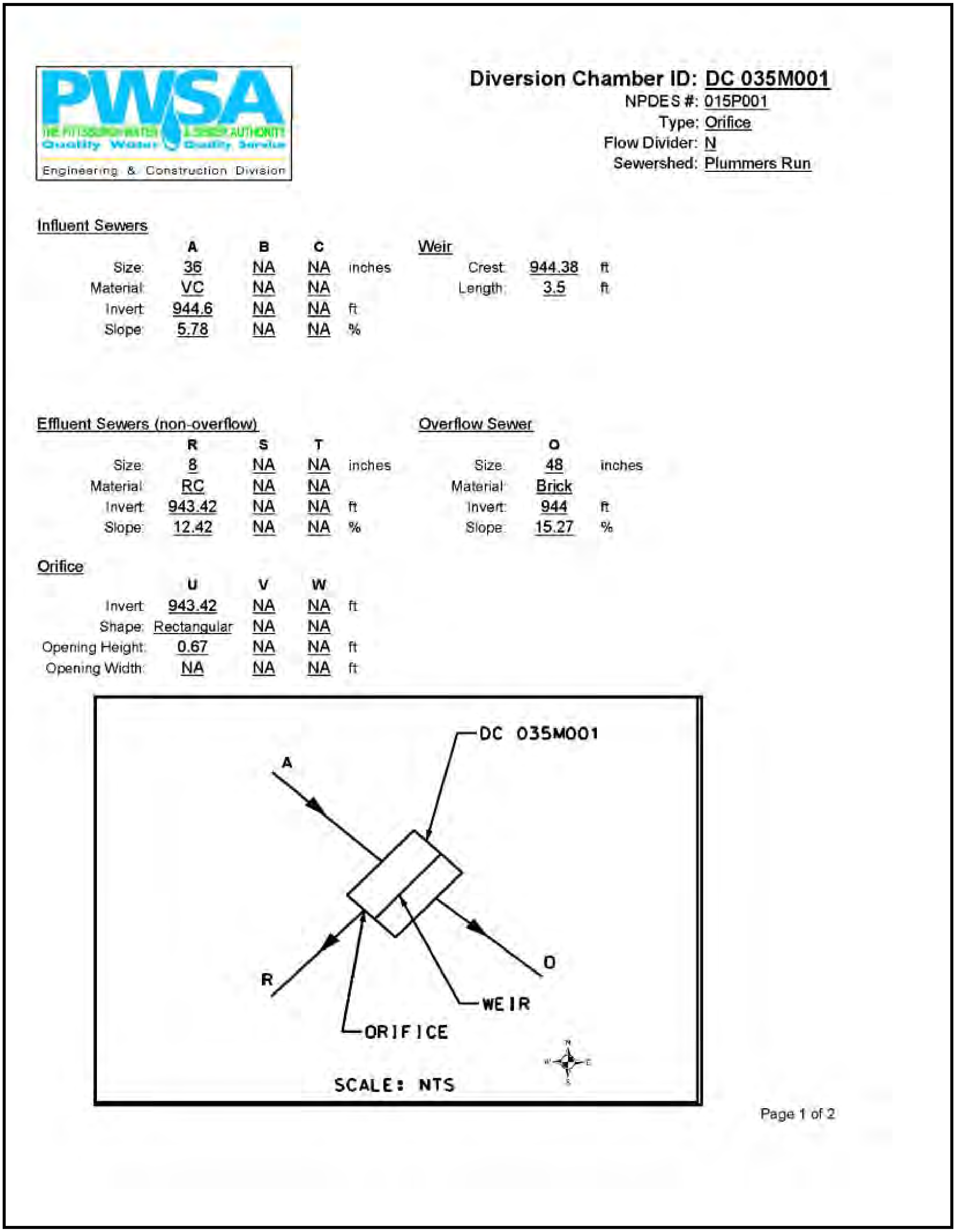

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Diversion Chamber ID: DC 035M001
NPDES #: 015P001
Type: Orifice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size:	36	NA	NA	inches
Material:	VC	NA	NA	
Invert:	944.6	NA	NA	ft
Slope:	5.78	NA	NA	%

Weir

Crest:	944.38	ft
Length:	3.5	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	RC	NA	NA	
Invert:	943.42	NA	NA	ft
Slope:	12.42	NA	NA	%

Overflow Sewer

	O	
Size:	48	inches
Material:	Brick	
Invert:	944	ft
Slope:	15.27	%

Orifice

	U	V	W	
Invert:	943.42	NA	NA	ft
Shape:	Rectangular	NA	NA	
Opening Height:	0.67	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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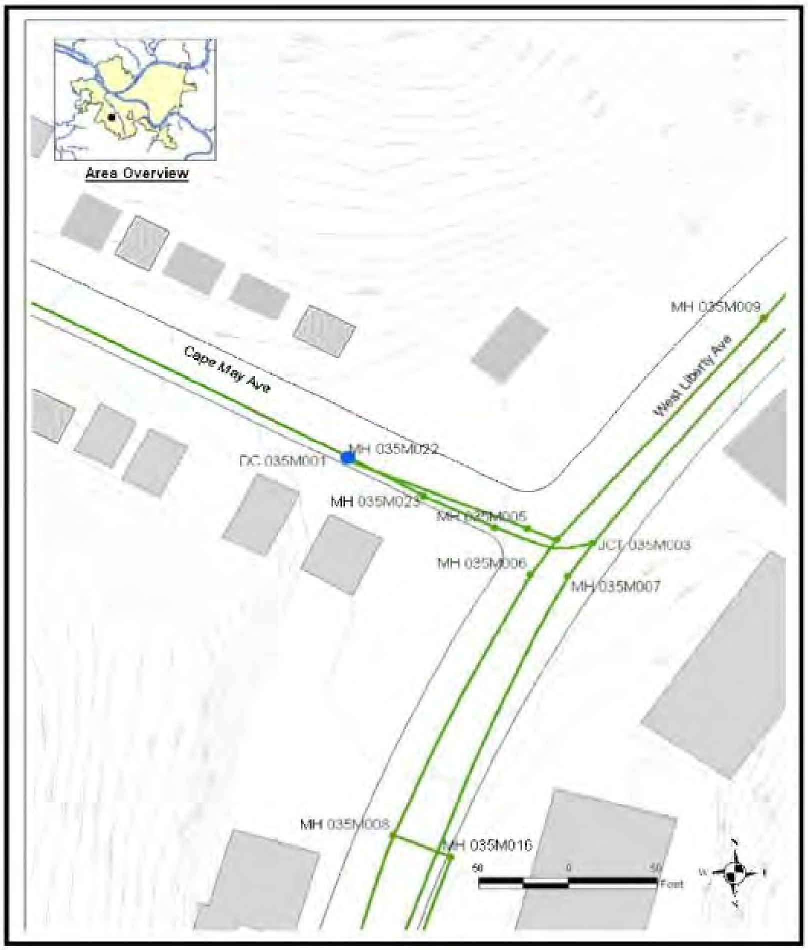
Diversion Chamber ID: DC 035M001



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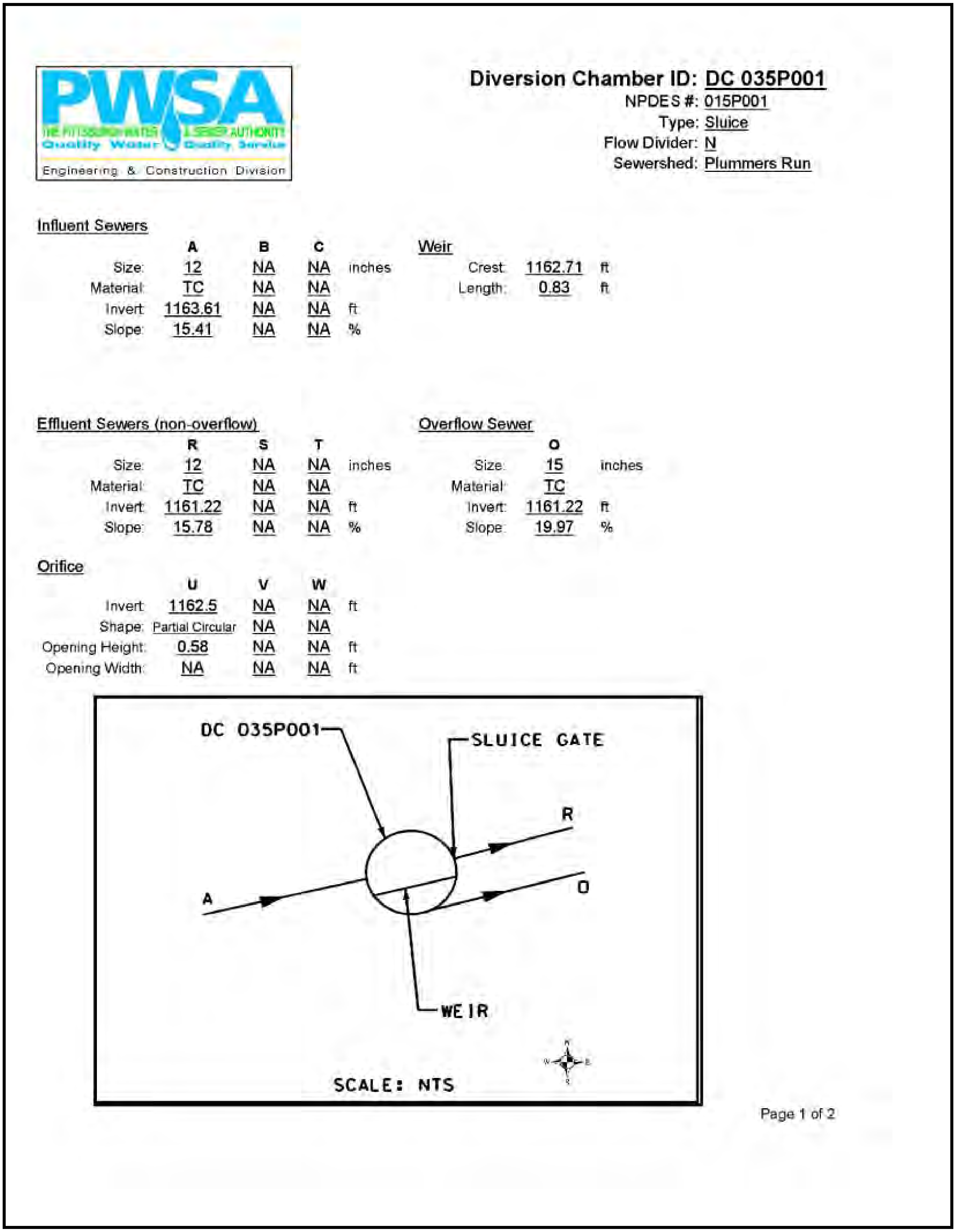

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Engineering & Construction Division

Diversion Chamber ID: DC 035P001

NPDES #: 015P001
Type: Sluice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1163.61	NA	NA	ft
Slope:	15.41	NA	NA	%

Weir

Crest:	1162.71	ft
Length:	0.83	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1161.22	NA	NA	ft
Slope:	15.78	NA	NA	%

Overflow Sewer

	O	
Size:	15	inches
Material:	TC	
Invert:	1161.22	ft
Slope:	19.97	%

Orifice

	U	V	W	
Invert:	1162.5	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.58	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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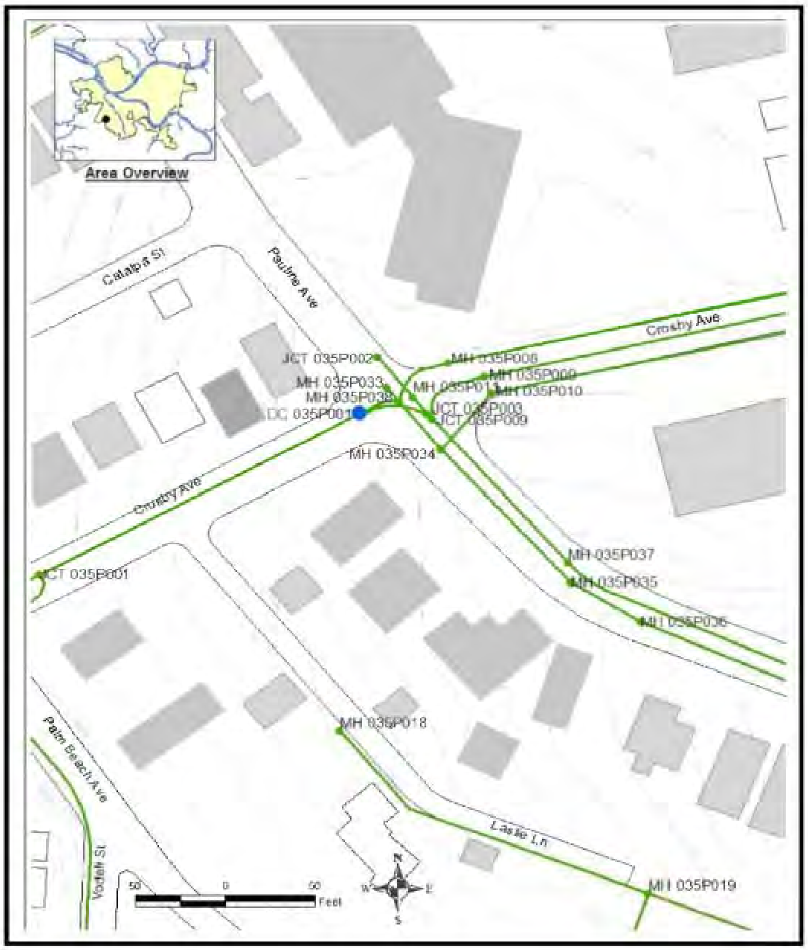
Diversion Chamber ID: DC 035P001



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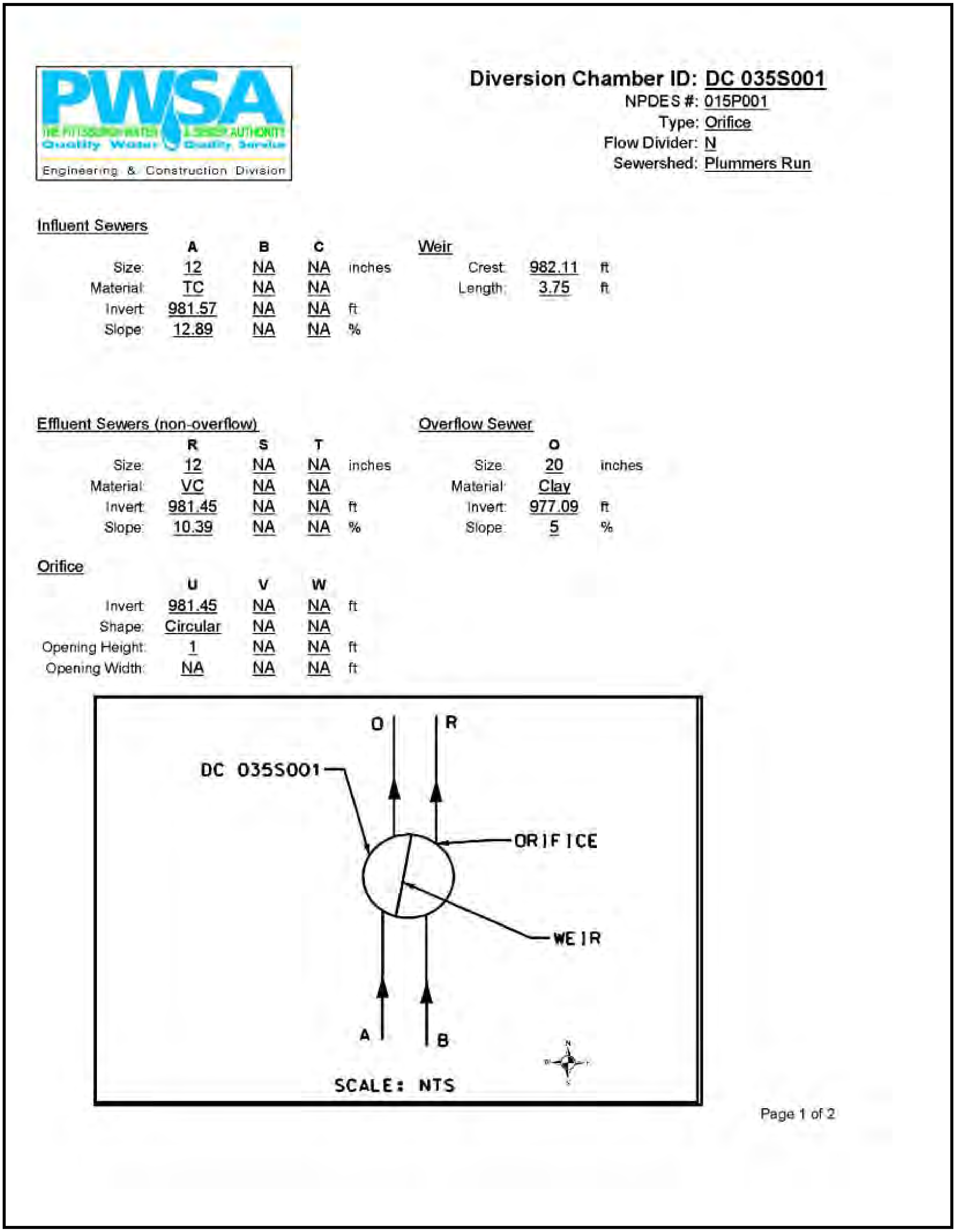

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Diversion Chamber ID: DC 035S001
NPDES #: 015P001
Type: Orifice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	981.57	NA	NA	ft
Slope:	12.89	NA	NA	%

Weir

Crest:	982.11	ft
Length:	3.75	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	12	NA	NA	inches
Material:	VC	NA	NA	
Invert:	981.45	NA	NA	ft
Slope:	10.39	NA	NA	%

Overflow Sewer

	O	
Size:	20	inches
Material:	Clay	
Invert:	977.09	ft
Slope:	5	%

Orifice

	U	V	W	
Invert:	981.45	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	1	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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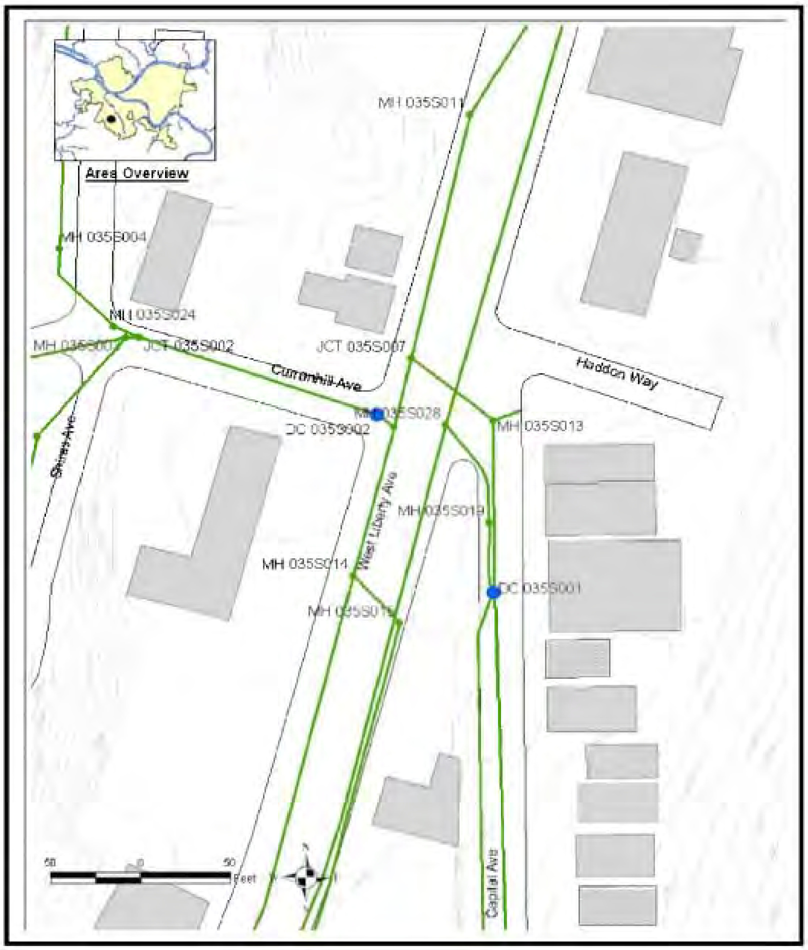
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 035S001



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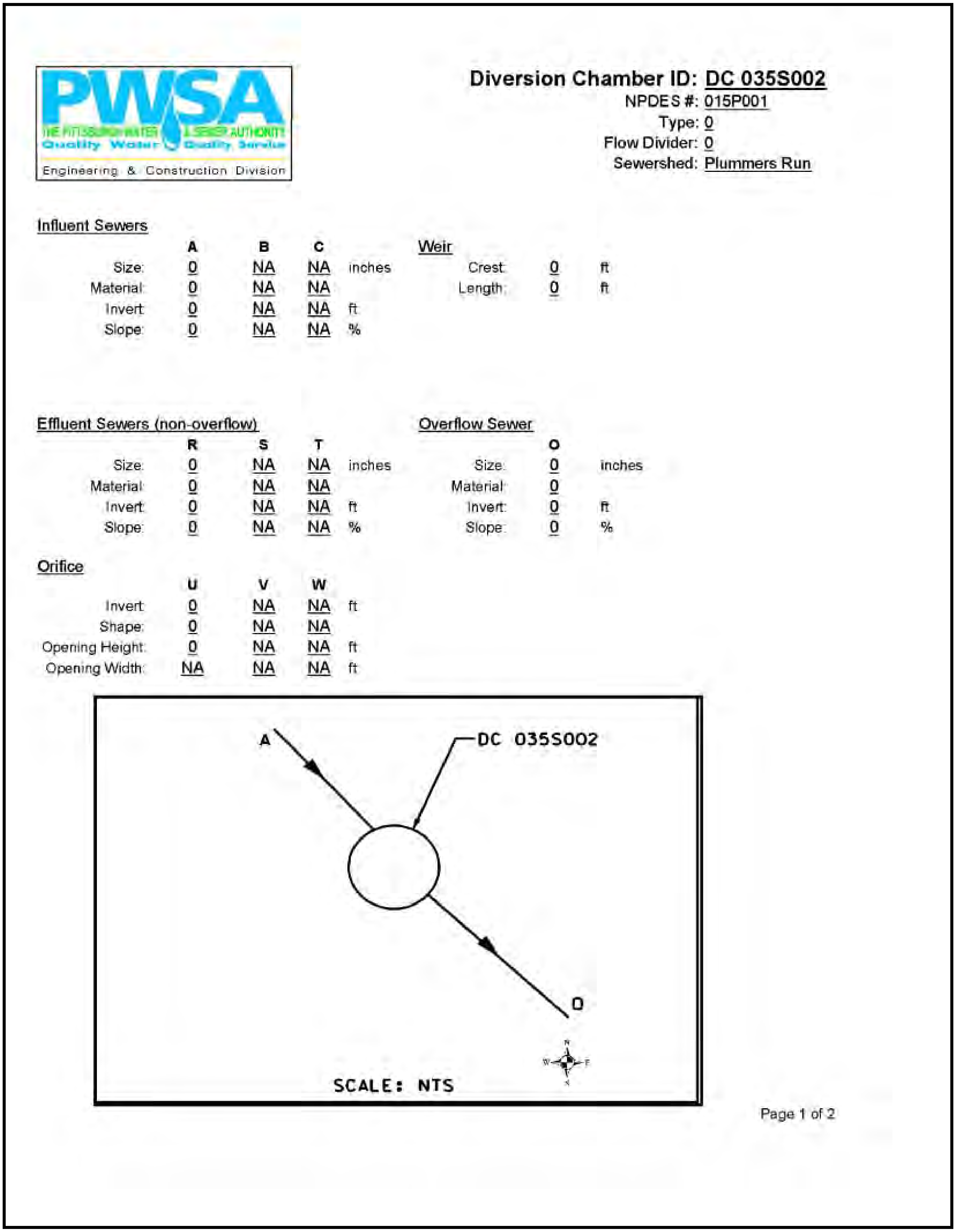

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Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 035S002
NPDES #: 015P001
Type: 0
Flow Divider: 0
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size:	0	NA	NA	inches
Material:	0	NA	NA	
Invert:	0	NA	NA	ft
Slope:	0	NA	NA	%

Weir

Crest:	0	ft
Length:	0	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	0	NA	NA	inches
Material:	0	NA	NA	
Invert:	0	NA	NA	ft
Slope:	0	NA	NA	%

Overflow Sewer

	O	
Size:	0	inches
Material:	0	
Invert:	0	ft
Slope:	0	%

Orifice

	U	V	W	
Invert:	0	NA	NA	ft
Shape:	0	NA	NA	
Opening Height:	0	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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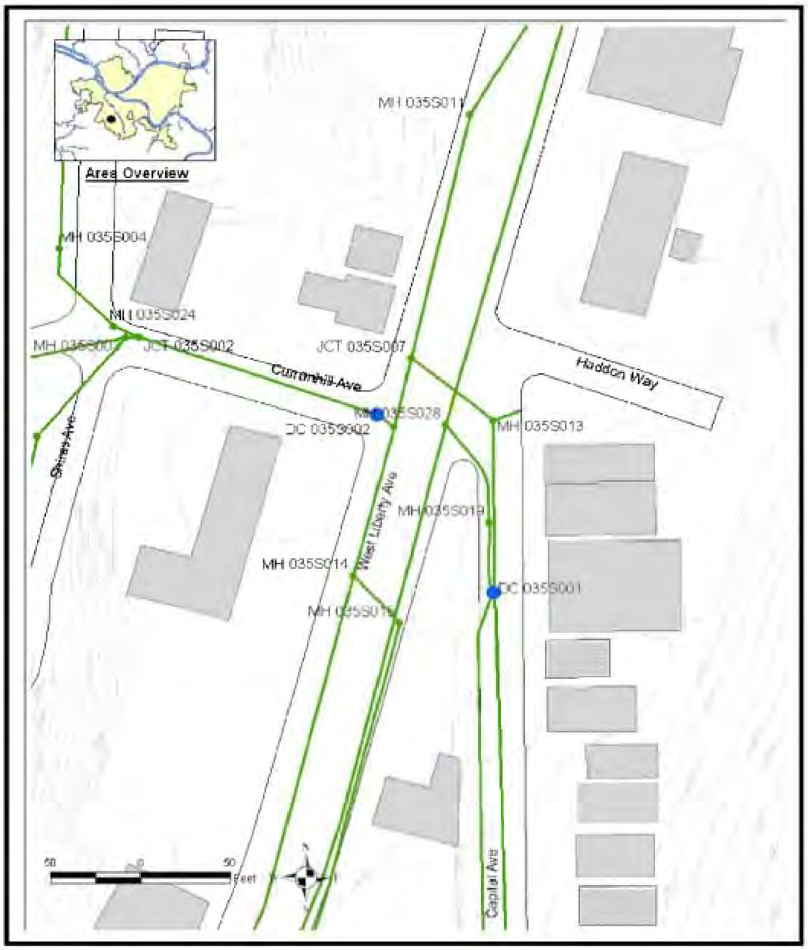
Diversion Chamber ID: DC 035S002



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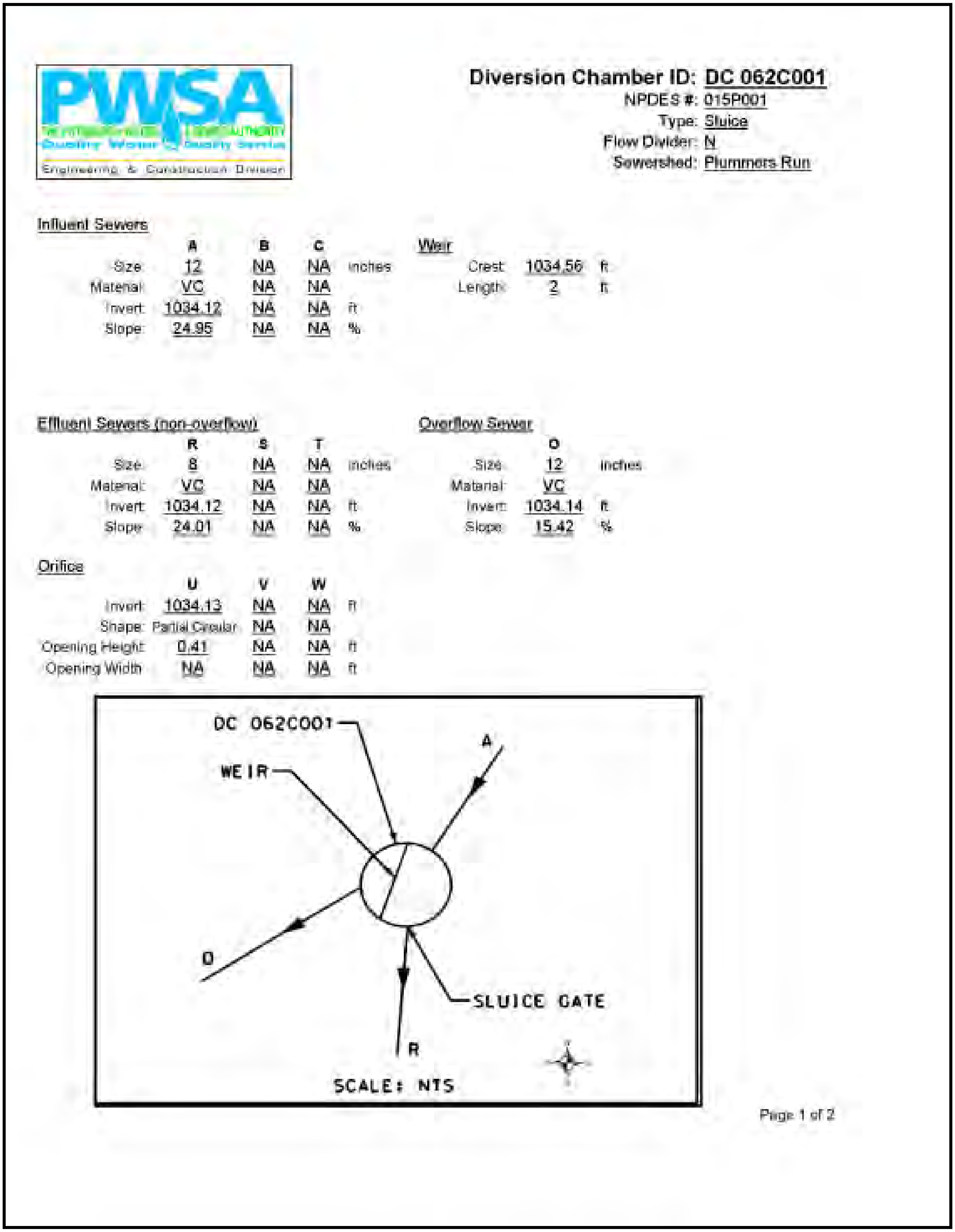

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Engineering & Construction Division

Diversion Chamber ID: DC 062C001
NPDES #: 015P001
Type: Sluice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	VC	NA	NA	
Invert:	1034.12	NA	NA	ft
Slope:	24.95	NA	NA	%

Weir

Crest:	1034.56	ft
Length:	2	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	8	NA	NA	inches
Material:	VC	NA	NA	
Invert:	1034.12	NA	NA	ft
Slope:	24.01	NA	NA	%

Overflow Sewer

	O	
Size:	12	inches
Material:	VC	
Invert:	1034.14	ft
Slope:	15.42	%

Orifice

	U	V	W	
Invert:	1034.13	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.41	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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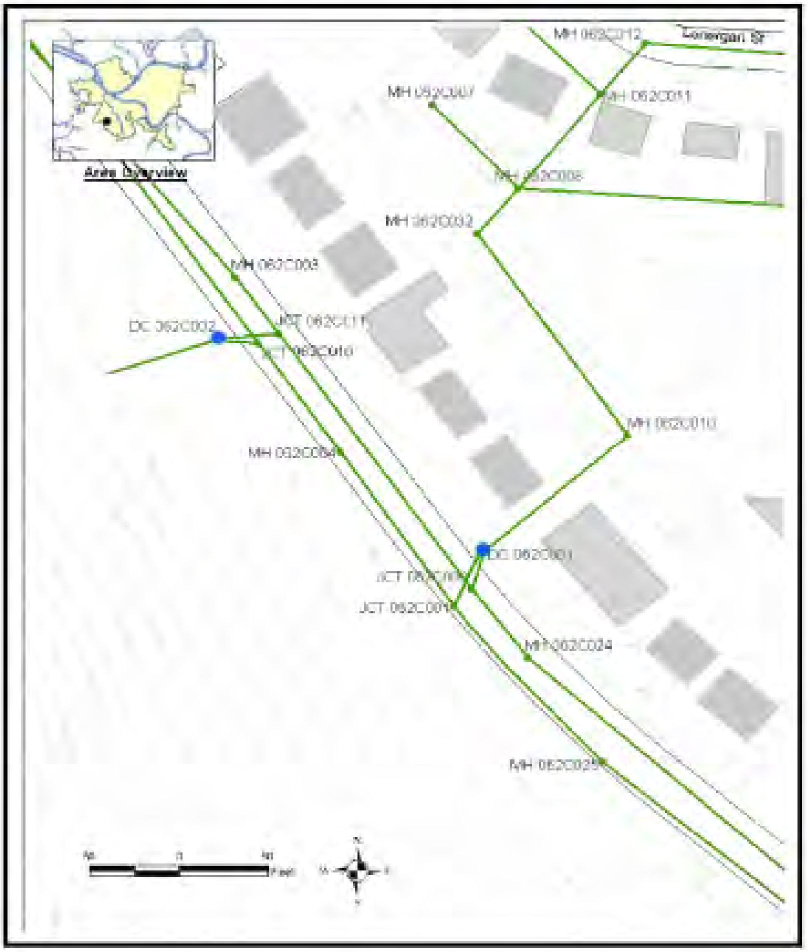
PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 062C001



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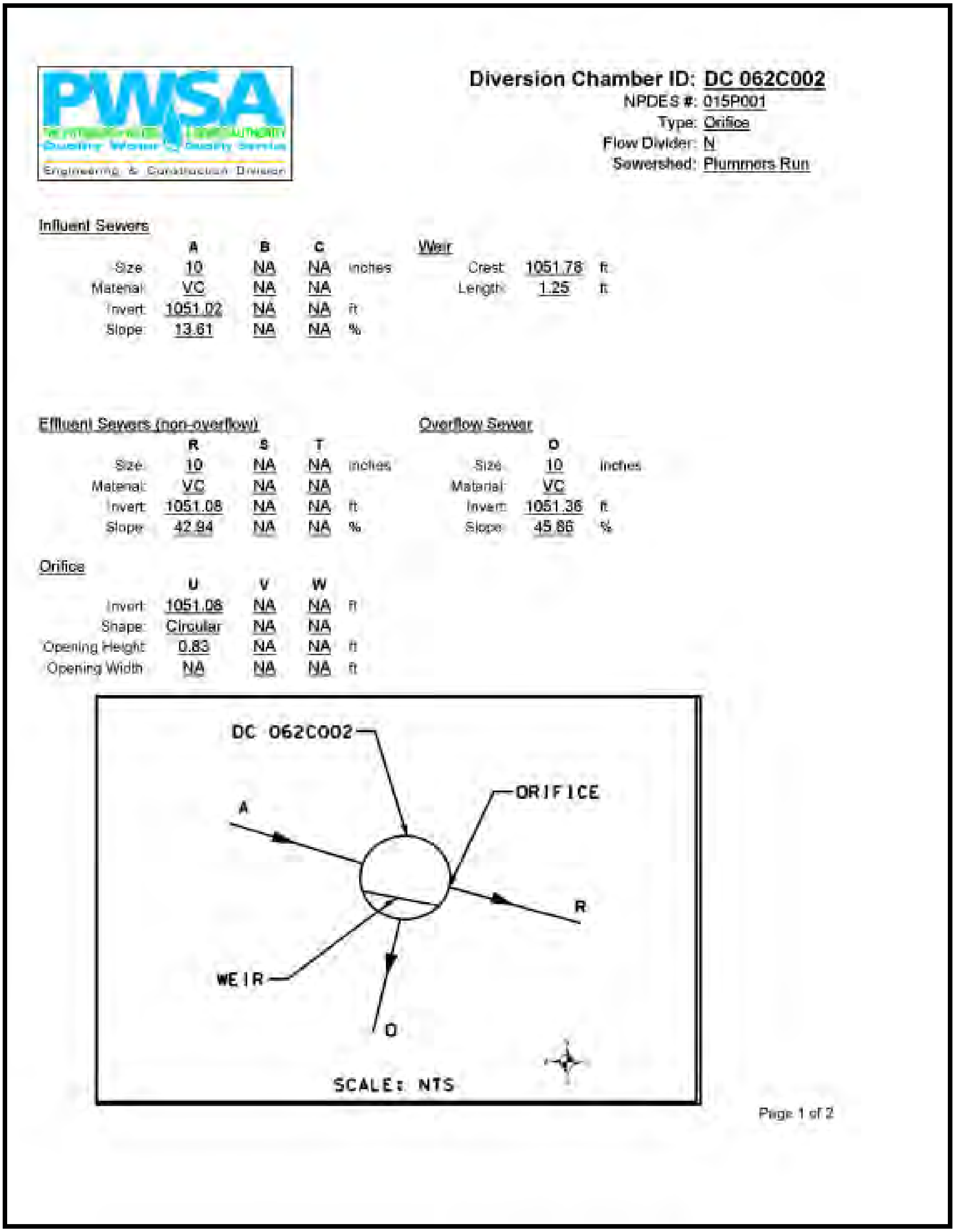

PWSA
The Pittsburgh Water & Sewer Authority
Quality Water & Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 062C002
NPDES #: 015P001
Type: Orifice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size:	10	NA	NA	inches
Material:	VC	NA	NA	
Invert:	1051.02	NA	NA	ft
Slope:	13.61	NA	NA	%

Weir

Crest:	1051.78	ft
Length:	1.25	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	10	NA	NA	inches
Material:	VC	NA	NA	
Invert:	1051.08	NA	NA	ft
Slope:	42.94	NA	NA	%

Overflow Sewer

	O	
Size:	10	inches
Material:	VC	
Invert:	1051.36	ft
Slope:	45.86	%

Orifice

	U	V	W	
Invert:	1051.08	NA	NA	ft
Shape:	Circular	NA	NA	
Opening Height:	0.83	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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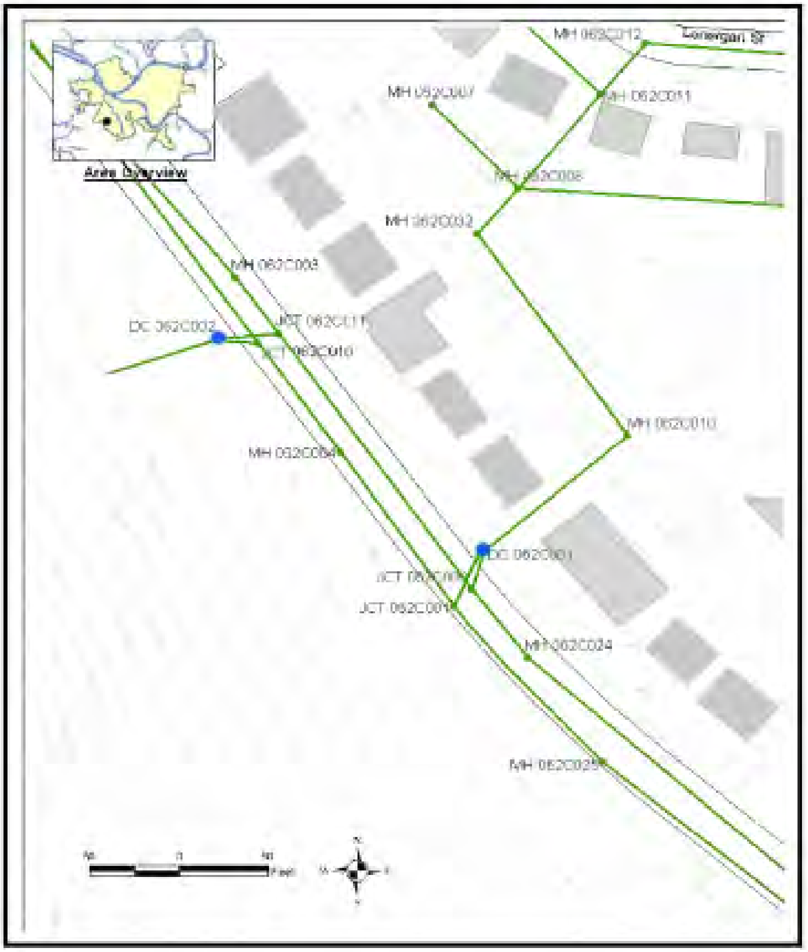
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 062C002



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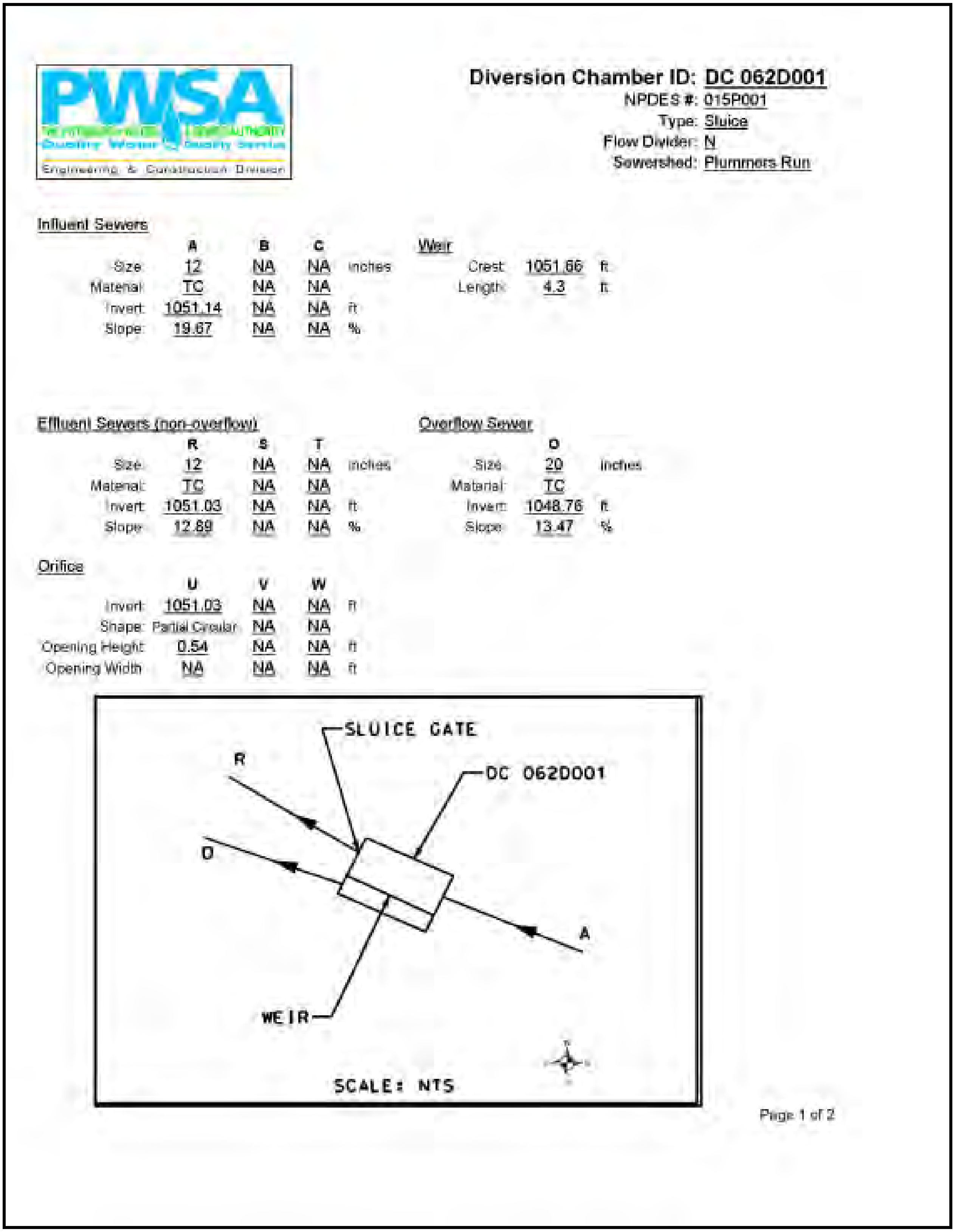

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 062D001
NPDES #: 015P001
Type: Sluice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1051.14	NA	NA	ft
Slope:	19.67	NA	NA	%

Weir

Crest:	1051.66	ft
Length:	4.3	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size:	12	NA	NA	inches
Material:	TC	NA	NA	
Invert:	1051.03	NA	NA	ft
Slope:	12.89	NA	NA	%

Overflow Sewer

	O	
Size:	20	inches
Material:	TC	
Invert:	1048.76	ft
Slope:	13.47	%

Orifice

	U	V	W	
Invert:	1051.03	NA	NA	ft
Shape:	Partial Circular	NA	NA	
Opening Height:	0.54	NA	NA	ft
Opening Width:	NA	NA	NA	ft

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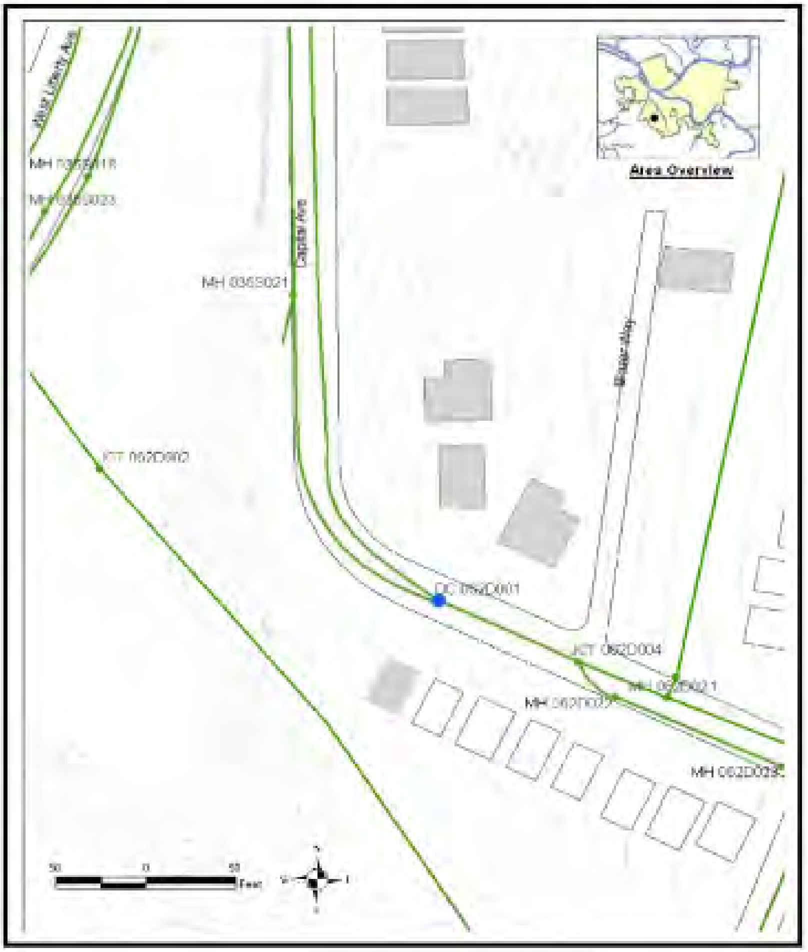
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 062D001



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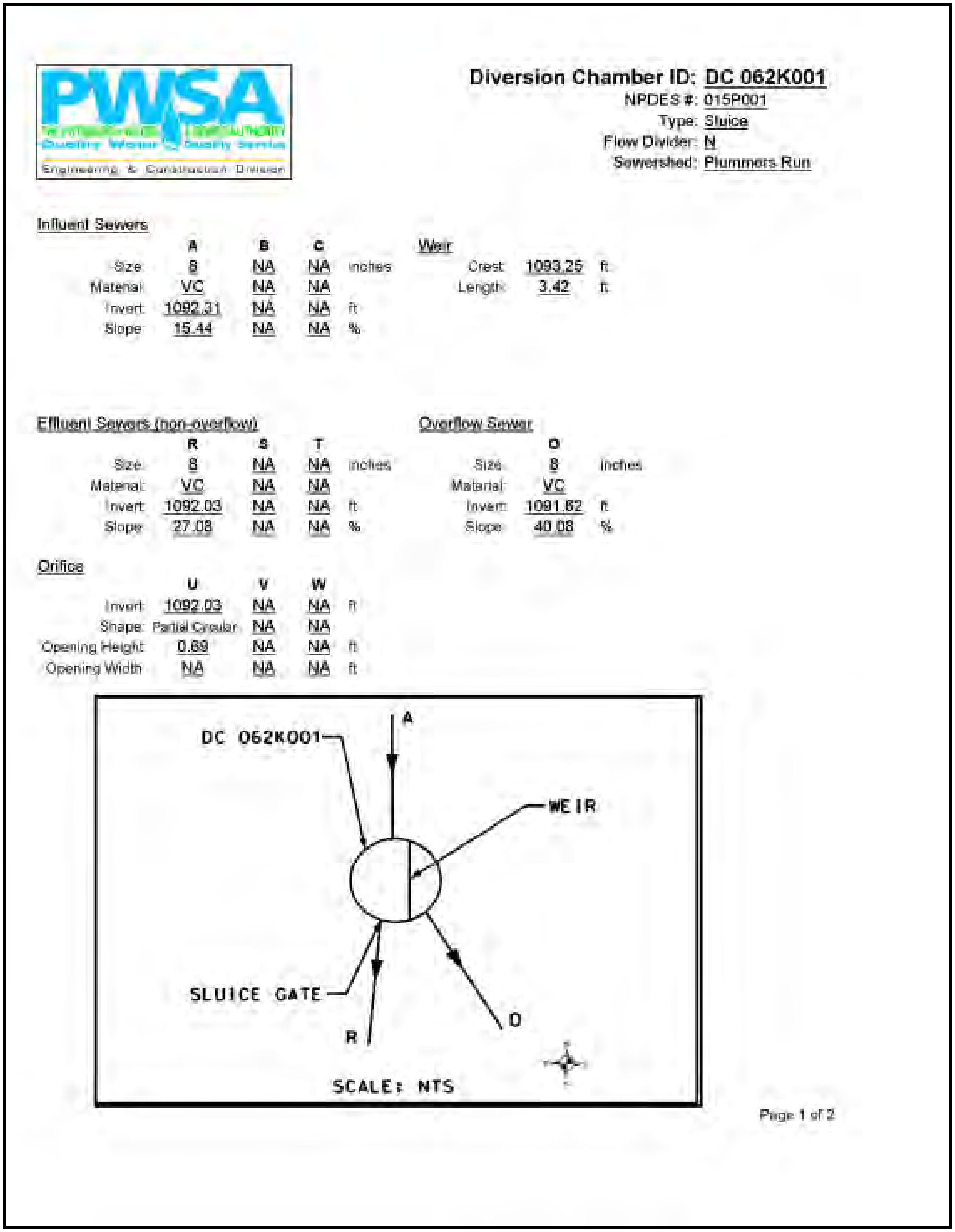

PWSA
The Pittsburgh Water & Sewer Authority
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 062K001
NPDES #: 015P001
Type: Sluice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size	8	NA	NA	inches
Material	VC	NA	NA	
Invert	1092.31	NA	NA	ft
Slope	15.44	NA	NA	%

Weir

Crest	1093.25	ft
Length	3.42	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	8	NA	NA	inches
Material	VC	NA	NA	
Invert	1092.03	NA	NA	ft
Slope	27.08	NA	NA	%

Overflow Sewer

	O	
Size	8	inches
Material	VC	
Invert	1091.62	ft
Slope	40.08	%

Orifice

	U	V	W	
Invert	1092.03	NA	NA	ft
Shape	Partial Circular	NA	NA	
Opening Height	0.69	NA	NA	ft
Opening Width	NA	NA	NA	ft

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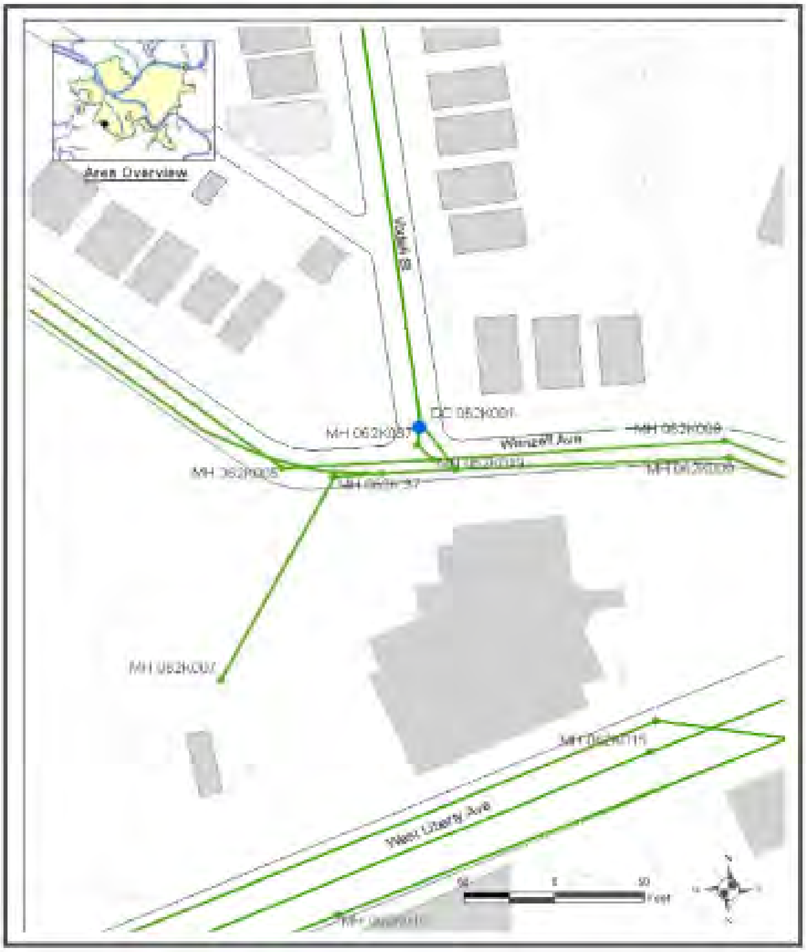
Engineering & Construction Division

Diversion Chamber ID: DC 062K001



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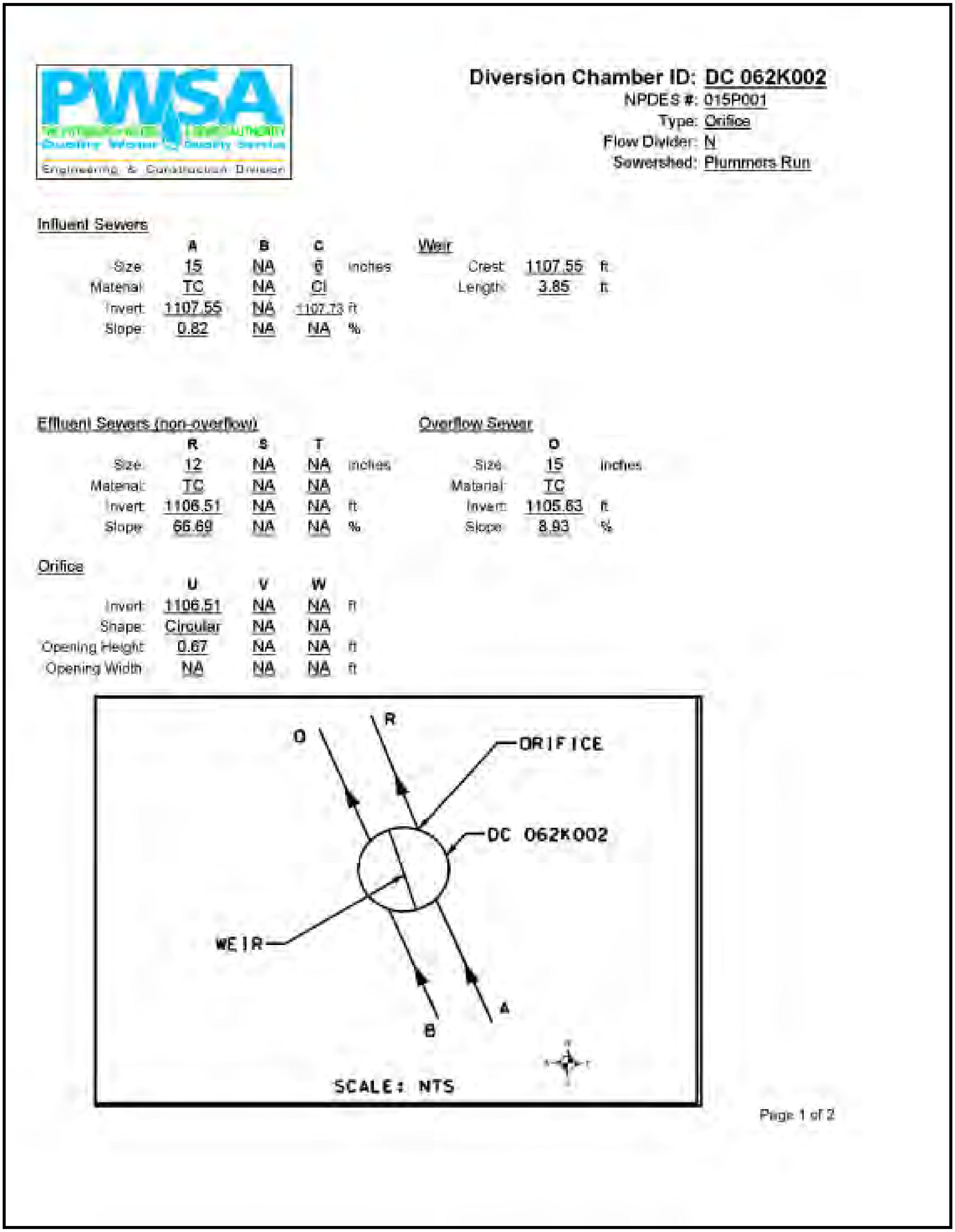

Engineering & Construction Division

Diversion Chamber ID: DC 062K002
NPDES #: 015P001
Type: Orifice
Flow Divider: N
Sewershed: Plummers Run

Influent Sewers

	A	B	C	
Size	15	NA	6	inches
Material	TC	NA	CI	
Invert	1107.55	NA	1107.73	ft
Slope	0.82	NA	NA	%

Weir

Crest	1107.55	ft
Length	3.85	ft

Effluent Sewers (non-overflow)

	R	S	T	
Size	12	NA	NA	inches
Material	TC	NA	NA	
Invert	1106.51	NA	NA	ft
Slope	66.69	NA	NA	%

Overflow Sewer

	O	
Size	15	inches
Material	TC	
Invert	1105.63	ft
Slope	8.93	%

Orifice

	U	V	W	
Invert	1106.51	NA	NA	ft
Shape	Circular	NA	NA	
Opening Height	0.67	NA	NA	ft
Opening Width	NA	NA	NA	ft

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THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service
Engineering & Construction Division

Diversion Chamber ID: DC 062K002

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2.0 SEWER SYSTEM CHARACTERIZATION AND CAPACITY ANALYSIS

This portion of the report presents the approach utilized to determine existing and future baseline flows in the sewer system tributary to POC SMRE-40: Plummers Run through both PWSA and regional flow monitoring efforts. It outlines the review and acceptance of the calibration of the ALCOSAN H&H model (referred to as the Regional Model) developed by the Saw Mill Run Basin Planners (SMR_BP), locations of the flow monitors, the development of the Baseline Conditions, the capacity limitations currently existing in the sewer system, and the Future Baseline overflow frequency and volumes for SMRE-40.

2.1 DEVELOPMENT AND CALIBRATION/VERIFICATION OF H&H TOOLS

For the 2012 Feasibility Study, the Preliminary Draft Feasibility Study was updated utilizing the regional computer H&H model developed by ALCOSAN. ALCOSAN's wet weather planning process included the development of a regional sewer system hydrologic and hydraulic (H&H) model that built upon and expanded the initial PWSA H&H model. The Regional Model extends deeper into the municipal systems tributary to the PWSA system, and provides more detailed information about the performance and impacts of those tributary systems on the existing PWSA system. ALCOSAN offered their H&H model to their customer municipalities. The PWSA agreed to use the Regional H&H model in its planning process as a means of improving modeling resolution throughout the regional system and achieving consistency with the basis of planning throughout the region. No additional calibration or verification of the model was performed during utilization of the model for this FS.

2.1.1 Flow Monitoring Data Evaluation and Background

PWSA flow monitoring efforts (mainly in 2004), the Regional Flow Monitoring Program (RFMP), and ALCOSAN's Regional Collection System Flow Monitoring Plan (RCS-FMP) used in the PWSA efforts are explained in Section 4.0 of the Wet Weather Feasibility Study. In support of both the Hydraulic and Hydrologic Characterization Report (September, 2008) and the October 2008 Draft Feasibility Study, PWSA embarked on a comprehensive sewer flow monitoring program in 2004. A total of 418 monitors were installed. Data were collected from March 2004 to July 2004 for all 418 monitors when 397 of the monitors were removed. The remaining 21 flow monitors continued to collect data through October of 2004. The

flow monitoring data were used to help develop and calibrate the H&H model upon which this Feasibility Study is based. This includes data from PWSA flow monitoring efforts in 2004, updated with supplementary data added to the model by the ALCOSAN basin planners. Details regarding the ALCOSAN H&H model updates are described in the ALCOSAN WWP.

On June 1, 2006, a Regional Flow Monitoring Plan (RFMP) was assembled by 3RWW and the 3RWW/PM Team with direct input from ALCOSAN and the Flow Monitoring Working Group (FMWG). The FMWG was composed of approximately 50 engineers and technical representatives from ALCOSAN, regulatory agencies and approximately 50 municipalities within the ALCOSAN service area. Concurrently, ALCOSAN was developing a flow monitoring plan to meet the requirements of their draft CD. Their plan was called the Regional Collection System Flow Monitoring Plan (RCS-FMP).

The ALCOSAN H&H model, which PWSA adopted in developing the July 2012 draft Feasibility Study, was validated using the RCS-FMP and additional data through selected municipal flow monitoring efforts and supplemental sites.

The RCS-FMP includes most of the provisions of the June 2006 RFMP. As part of the development of the June 2006 RFMP and the selection of recommended flow monitoring points within municipal collection systems, the availability of prior data and its utility to amend these locations was evaluated. Seven (7) flow meters located within the SMRE-40 sewershed were used in the RCS-FMP. Details on the seven (7) RCS-FMP flow monitors installed within the Plummers Run sewershed are found in Table SMRE40-2-1.

TABLE SMRE-2-1: SMRE-40 SUMMARY OF RCS-FMP FLOW METERS[1]

Meter Name	Municipality	Monitor Term[1]
SMRE40_-MM_-L-02_	City of Pittsburgh	L
SMRE40_-OSC-M-03_	City of Pittsburgh	M
SMRE40_-OSC-M-03O	City of Pittsburgh	M
SMRE40_-OSC-M-03OB	City of Pittsburgh	M
SMRE40_-OSC-M-04_	City of Pittsburgh	M
SMRE40_-OSC-M-04O	City of Pittsburgh	M
SMRE40_-POC-L-01_	City of Pittsburgh	L

[1] M=Medium Term: 6 months to 9 months, Long Term: 1-year minimum to 21-month maximum.

2.2 EXISTING CONDITIONS AND FUTURE BASELINE CONDITION DEVELOPMENT

PWSA has been coordinating with ALCOSAN by providing them planning level information throughout their Basin Planning process. PWSA's information helped ALCOSAN and their basin planners determine a number of "conditions" on which the Regional H&H model could be built:

- Existing Condition - the state of the system and service area in 2008, with an ALCOSAN plant capacity of 250 MGD (as of the first quarter of 2009).

- Baseline Condition - the state of the system and service area in the near future, including any planned ALCOSAN and municipal projects which are certain to be implemented.

- Future Baseline Condition - the state of the system and service area in 2046, including changes due to planned development/re-development but without implementation of the wet weather plan improvements.

---

[1] The flow monitor information in this table is from a file titled "Summary of Program Monitors by Name, Type and Dates.xls". This was downloaded from the 3RWW Regional Flow Monitoring Data webpage from a folder labeled "Summary and Report of Flow Monitoring June 2009".

- Future Conditions (2046) - the state of the system and service area 20 years after implementation of the wet weather plan, including changes due to planned development/re-development.

The planning horizon date for the Regional model is September 2046.

This section describes the development of the Baseline Condition and Future Baseline Condition H&H models for predicting wastewater flow within the SMRE-40 Sewershed without implementing the recommended wet weather plan alternative.

PWSA's original H&H model is discussed in detail in the *Collection System Hydraulic and Hydrologic Characterization Report* (September 2008) and is summarized in Section 5.2 of the Wet Weather Feasibility Study.

The impacts on expected dry weather and wet weather flow were derived for the SMRE-40 sewershed from the Regional Baseline Conditions and Future Baseline Conditions H&H models which were used as the basis for the evaluation of system performance and the development of solutions.

2.2.1 Dry Weather Flows (Existing and Future)

PWSA adopted the Regional H&H Model with the existing and future Dry Weather Flow (DWF) and Wet Weather Flow (WWF) estimates.

The DWF estimates includes two major components: Ground Water Infiltration (GWI) and Base Wastewater Flow (BWWF). BWWF and GWF are defined as:

- BWWF - the residential, industrial, and commercial flow discharged to the sewer system for collection and treatment.

- GWI - groundwater that enters the collection system through defective pipes, pipe joints, and leaking manhole walls. GWI may also be attributed to direct stream inflow.

The process representing the two major DWF components is described in Section 5.2.1 of the Wet Weather Feasibility Study.

The average daily flows, GWI ratio, and GWI per inch-mile of sewer for each flow monitor within the Plummers Run sewershed are listed in Table SMRE40-2-2. The

GWI ratio is an estimated amount of the DWF that can be associated with GWI compared to the DWF peaking factor (i.e. Average Daily Maximum Flow vs. Average Daily Minimum Flow). Relatively high GWI ratios, up to 0.9, can be seen at some of the meters.

TABLE SMRE40-2-2: SMRE-40 DRY WEATHER FLOW STATISTICS DURING BASELINE CONDITIONS[2]

Flow Monitor[1]	**Average Daily Flow (ADF)**		**DWF Peaking Factor (ADF Max/ ADF Min)**	**GWI Ratio (min/avg)**
	(mgd)	**(gpcpd)**		
SMRE40_-MM_-L-02_	0.8	215	1.3	0.9
SMRE40_-OSC-M-03_	0.2	673	1.2	0.9
SMRE40_-OSC-M-04_	0.4	508	1.6	0.8
SMRE40_-POC-L-01_	1.0	144	1.4	0.8

[1] Not all flow monitors from Table SMRE40-2-1 were included in the source document for this table. No explanation was given.

The Future Baseline Conditions represents the service area with near-term municipal or ALCOSAN projects added and with projected 2046 population. Future DWF was determined by applying the per capita proportional rates that corresponds to the population projections. The percent difference in DWF between existing and future baseline conditions are shown in Table SMRE40-2-3.

TABLE SMRE40-2-3: SMRE-40 EXISTING AND FUTURE BASELINE CONDITIONS FOR DRY WEATHER FLOWS[3]

POC Sewershed	**Total Average Dry Weather Flow**		
	Baseline Conditions (mgd)	**Future Baseline Conditions (mgd)**	**Percent Difference**
SMRE-40	1.27	1.29	1.6%

---

[2] ALCOSAN Wet Weather Program, H&H Model Validation and Characterization Report, Saw Mill Run Planning Basin – Table 2.3.

[3] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.4

2.2.2 Wet Weather Flows (Existing and Future)

Rainfall derived infiltration and inflow (RDII) represents the wet weather contribution that enters a sewer system during a wet weather event. RDII can be defined as the increased portion of water flow in a sewer system that occurs during a rainfall or snowmelt event.

RDII is the third significant component of the total observed wastewater flow. The process for accurately representing the RDII component of the wet weather events is described in Section 5.2.2 of the Wet Weather Feasibility Study.

The Regional Model with typical year precipitation and the projected 2046 population were used to estimate the Future Baseline WWFs. The peak WWFs for existing and future Baseline Conditions for Plummers Run are presented in Table SMRE40-2-4.

TABLE SMRE40-2-4: SMRE-40 EXISTING AND FUTURE BASELINE CONDITIONS FOR WET WEATHER FLOWS[4]

POC Sewershed	Total Average Wet Weather Flow		
	Existing Conditions (mgd)	Future Baseline Conditions (mgd)	Percent Difference
SMRE-40	22.2	22.2	0.0%

2.2.3 Estimation Process for Unmonitored Areas

The process for accounting for unmonitored areas and gaps in flow monitoring readings are explained in Section 5.0 of the Wet Weather Feasibility Study.

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[4] ALCOSAN Wet Weather Program, Basin Facility Plan, Saw Mill Run Planning Basin – Table 2.5

2.3 CAPACITY DEFICIENT SEWERS

The performance of the existing sewerage facilities was evaluated under the Future Baseline Conditions, current diversion structure settings and 2-year, 5-year and 10-year design storm conditions. Performance was evaluated in terms of the basic criteria that no flooding or overflows from sanitary sewers or significant manhole surcharging should occur. Locations where the performance standards were not attained were noted for further analyses. Modeling was also performed for typical year conditions. Statistics were generated for each PWSA diversion chamber that documented flow rates into the diversion structures and overflow statistics were expressed in terms of number of overflow events, peak overflow rates and total overflow volumes for each event. Annual overflow volumes were also calculated.

Figure SMRE40-2-1 presents the computed hydraulic profiles of the existing SMRE-40 main trunk sewer system under projected 2-year design storm peak flow conditions. As is indicated in the figures, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along a significant portion of the trunk sewer.

Figure SMRE40-2-2 presents the computed hydraulic profiles of the existing SMRE-40 main trunk sewer system under projected 5-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along a significant portion of the trunk sewer.

Figure SMRE40-2-3 present the computed hydraulic profiles of the existing SMRE-40 main trunk sewer system under projected 10-year design storm peak flow conditions. These figures illustrate that, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along a significant portion of the trunk sewer.

Computed flow hydrographs for each of the design storms at the SMRE-40 POC are presented in Figure 2-4. It is noted that the peak flows reaching the POC are truncated due to extensive manhole surcharging and manhole flooding.

FIGURE SMRE40-2-1: SMRE-40 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

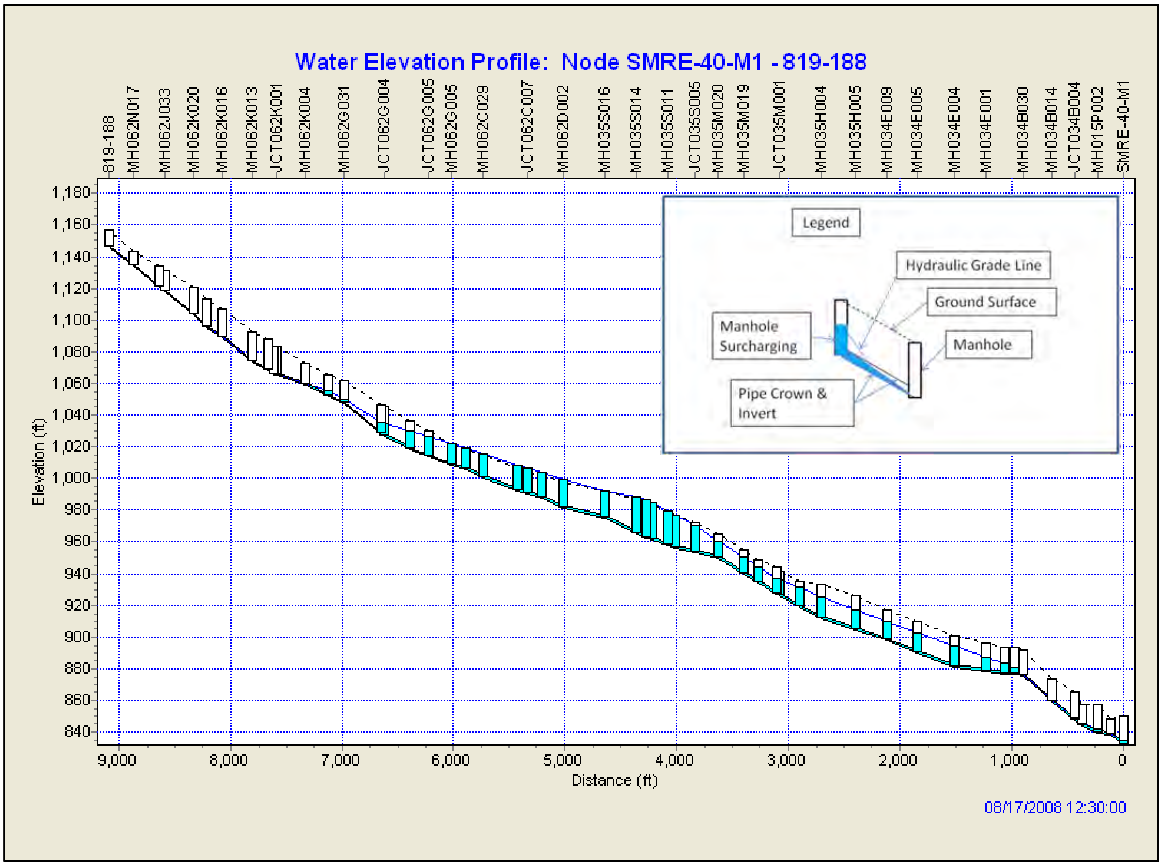


FIGURE SMRE40-2-2: SMRE-40 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

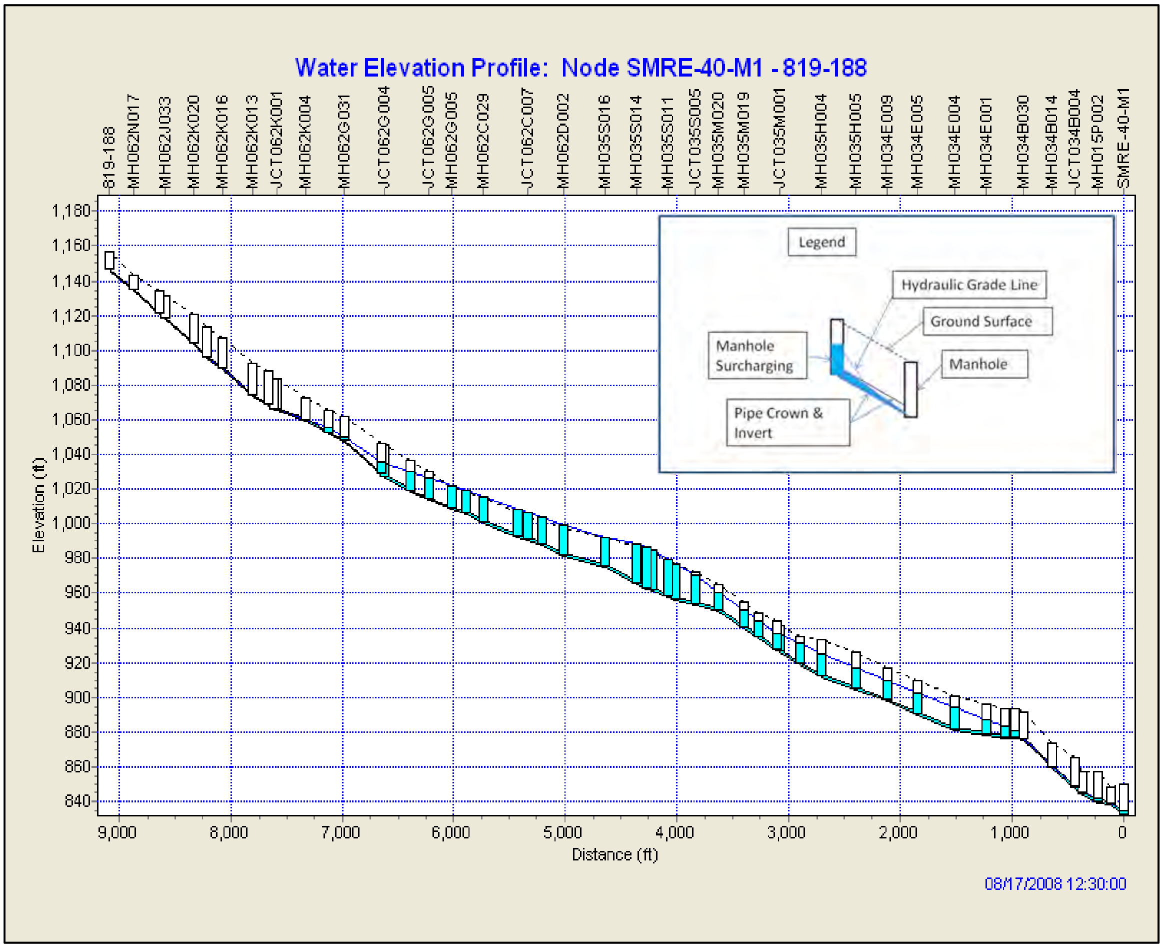


FIGURE SMRE40-2-3: SMRE-40 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing System Configuration and Mode of Operation Under Peak 2-Year Design Storm and Future Baseline Conditions

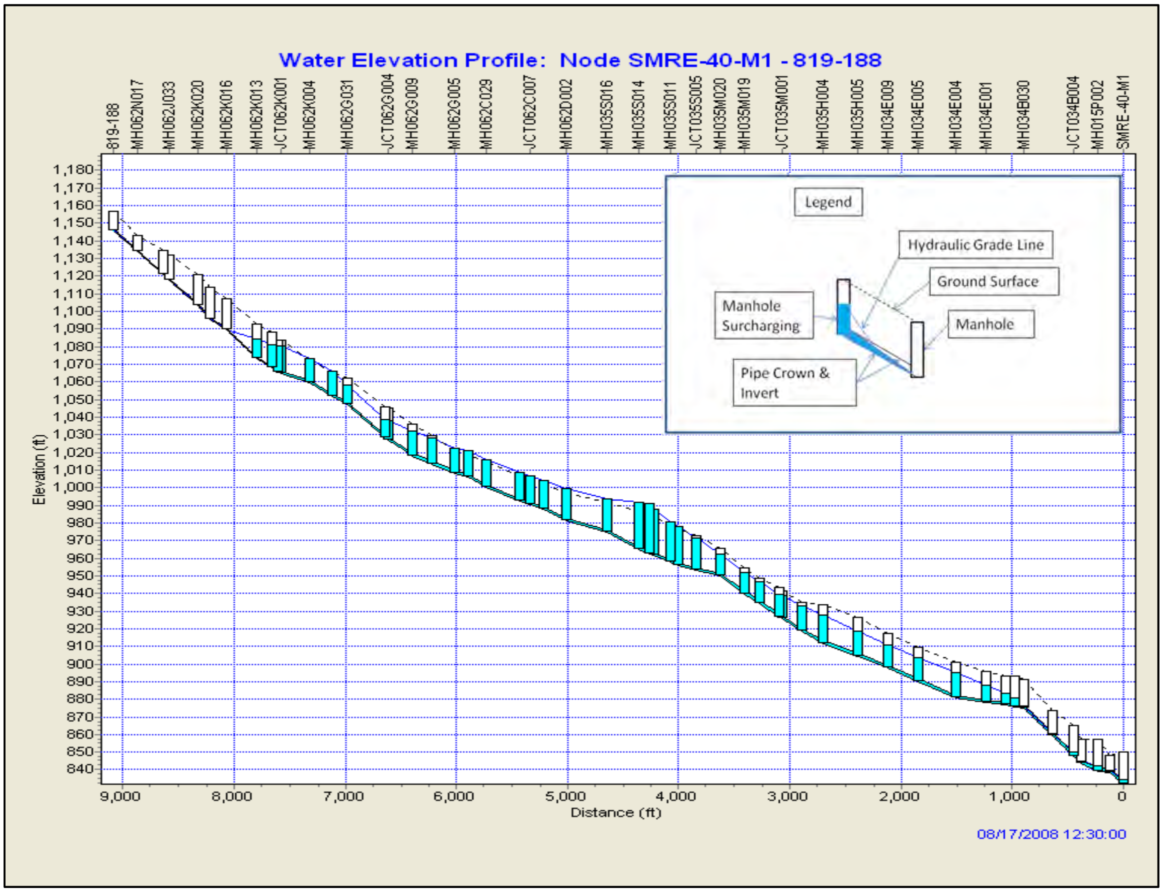
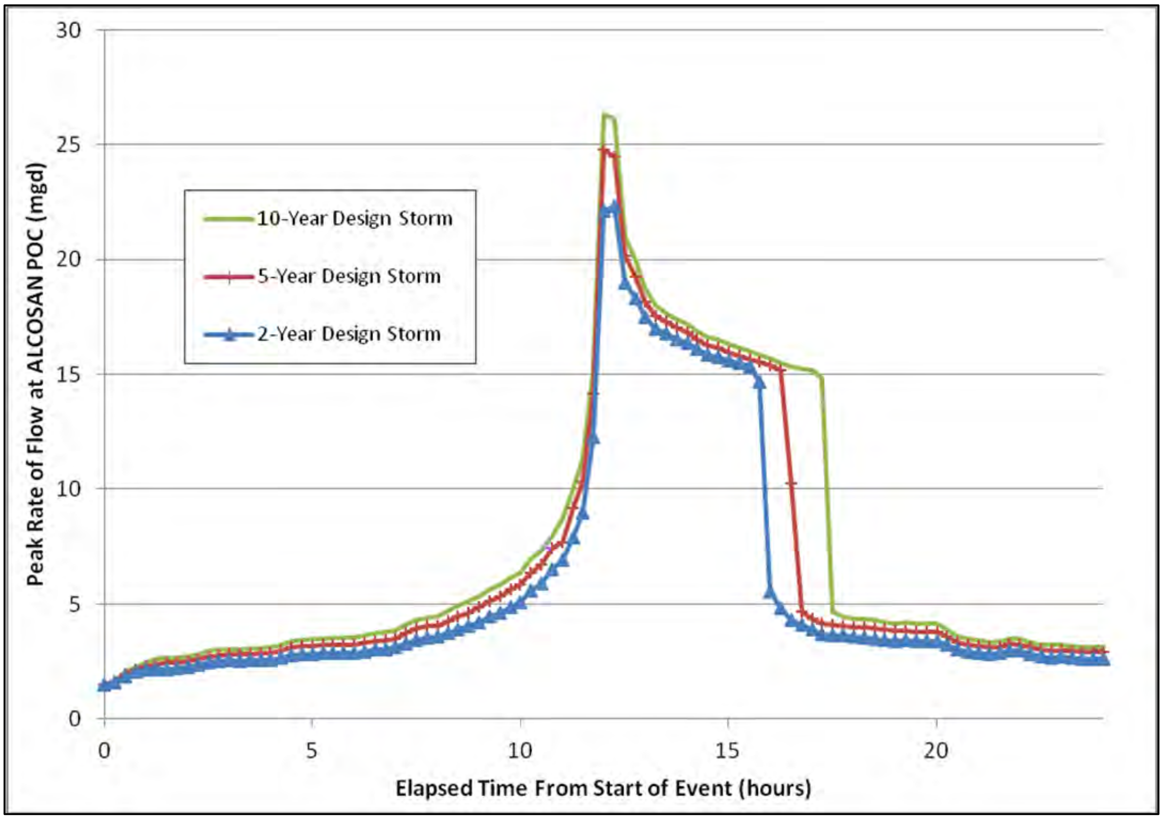


FIGURE SMRE40-2-4: SMRE-40 SEWERSHED PEAK FLOW RATES TO ALCOSAN POC

Existing System Configuration and Mode of Operation Under 2-, 5- and 10-Year Design Storm and Future Baseline Conditions



2.3.1 Existing Basement Flooding Areas–History and Locations

Table SMRE40-2-5 presents a summary of the identified chronic basement flooding locations within the PWSA portion of the Plummers Run sewershed. The neighboring municipalities that contribute wastewater flow to the PWSA system have not provided information identifying basement backup locations within their collector sewer systems. The data presented in Table 2-5 is based upon an analysis of customer complaints that were received by and logged into PWSA's SAP system by PWSA personnel. Data was obtained for the period 2004 through 2012. This dataset was incorporated into the GIS system and was analyzed to identify customer complaints that can be considered chronic complaints that may be indicative of sewer capacity problem locations. The analysis was performed by doing the following:

- Eliminating complaints for which the identified causes are unrelated to insufficient capacity in the public sewer system. This dataset includes a brief description of the responses by PWSA operations staff to each report and often identifies the apparent cause of the reported problem. Typical types of such unrelated causes included: problems with the customer's lateral, the need for cleaning of the public sewer, and the need for cleaning of nearby catch basins. In many cases, the causes of the reported problems were not evident to the field personnel. In these cases, the incidents were considered to potentially be caused by public sewer capacity problems.

- Eliminating repeat complaints from the same address for the same incident.

- Identifying the remaining complaint reports to identify addresses for which more than one incident is reported. Single reports of flooding problems over a nine year period were not considered indicative of "chronic" problems that are potentially attributable to public sewer capacity limitations.

TABLE SMRE40-2-5: SMRE-40 CHRONIC BASEMENT BACKUP LOCATIONS (PWSA SYSTEM)[5]

Address	Number of Occurrences Since 2004	Most Recent Occurrence
2736 Amman St	2	2007
2411 Bazore St	2	2004
747 Linda Dr	2	2010
1501 Westfield St	2	2007

2.3.2 Capacity Requirements for Various Design Storms and Levels of Protection

Modeling was performed to assess the ability of the existing trunk sewer system to convey the flows to the SMRE-40 ALCOSAN point of connection at 0, 4, and 10 overflows per typical year and the 2-year, 5-year, and 10-year storms. This was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 overflow frequency levels of CSO control for each design storm.

---

[5] Information from analysis of PWSA SAP system

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, are presented in Figures SMRE40-2-5 and SMRE40-2-6. These figures present the computed hydraulic grade line under peak flow conditions for the 10 overflows per typical year, 2-year design storm level of control condition and the 0 overflows per typical year, 10-year design storm. These are the least and most stringent levels of control, respectively and it produces the smallest and largest peak flows that require conveyance to the point of connection.

The figure shows that under this range of operating conditions, the existing trunk sewer system does not have sufficient capacity to convey the required flows to the ALCOSAN point of connection without significant manhole surcharging and flooding. These results validate the findings and recommendations of the Draft Feasibility Study that anticipated the need to construct a consolidation/relief sewer to supplement the capacity of the existing trunk sewer system.

FIGURE SMRE40-2-5: SMRE-40 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 2-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 10 OF/ Typ. Year

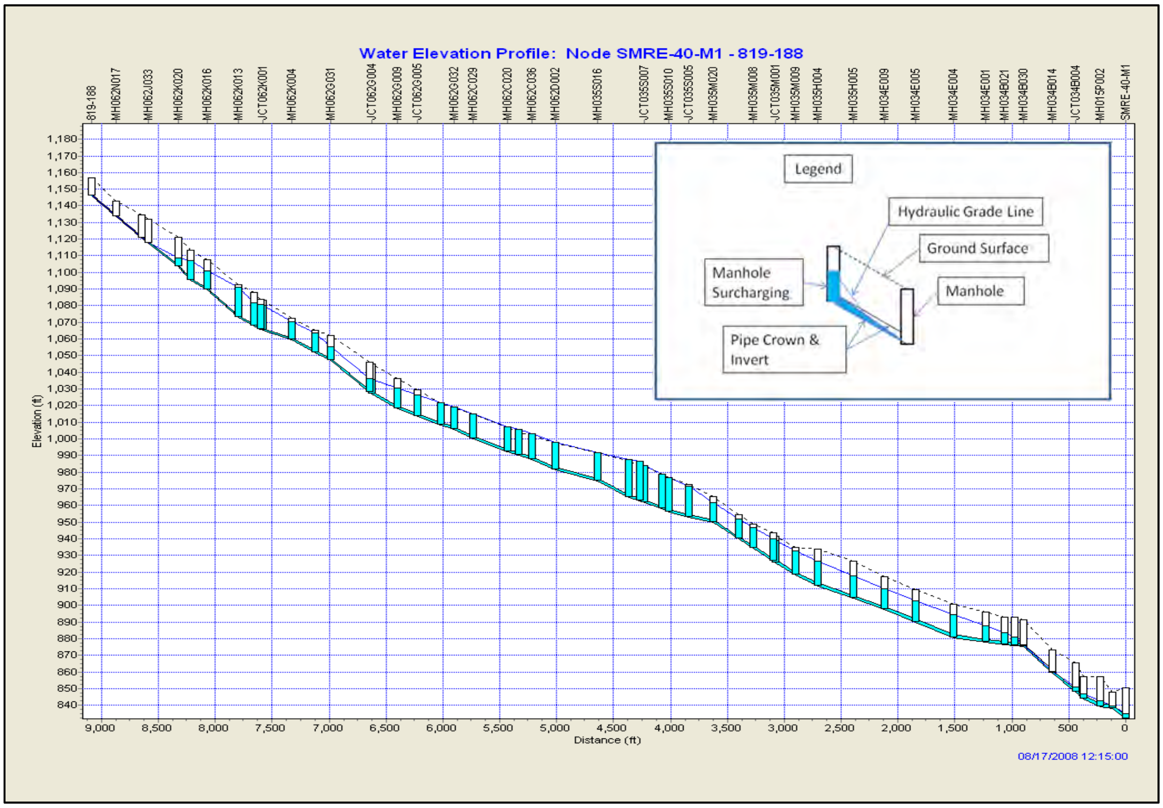
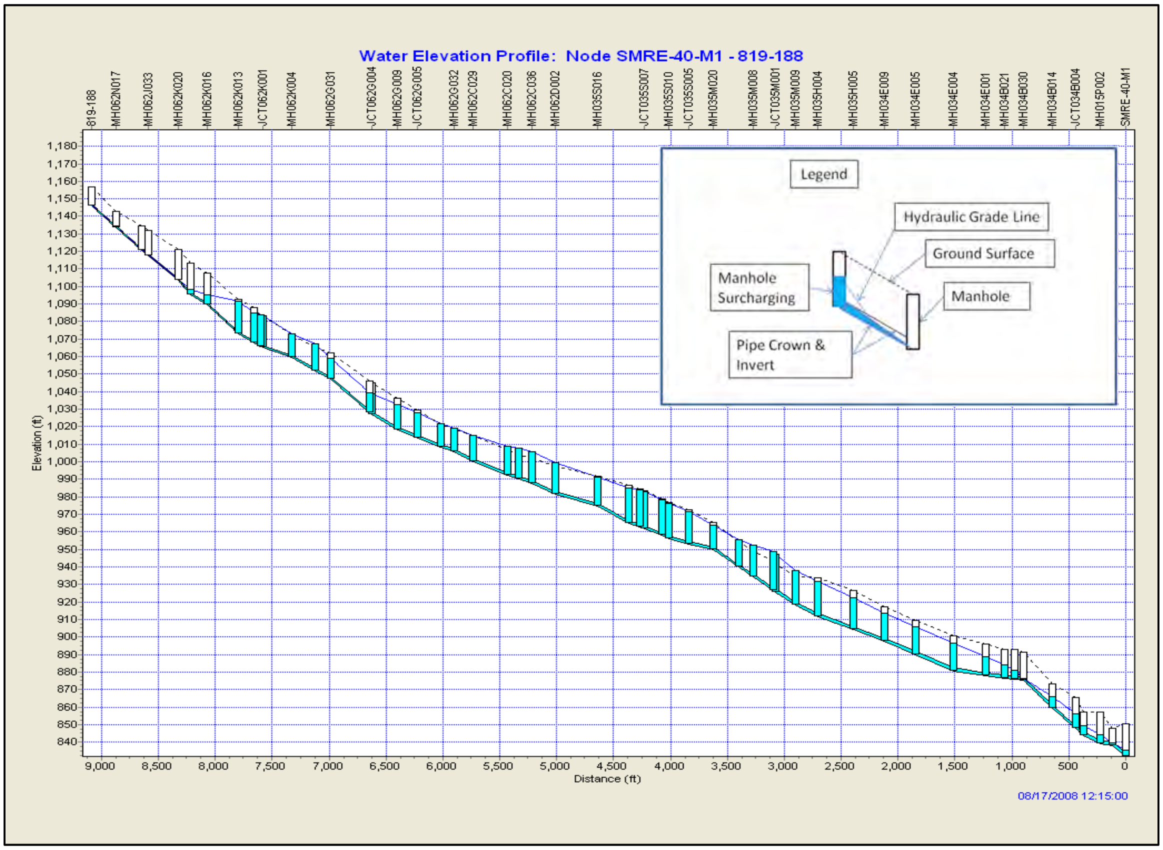


FIGURE SMRE40-2-6: SMRE-40 SEWERSHED MAIN TRUNK SEWER PROFILE

Existing Piping System Under 10-Yr Design Storm and Future Baseline Conditions with Diversions Structures Modified to Achieve 0 OF/ Typ. Year



The potential system improvements to convey the flow at the different control levels under future baseline conditions are identified in Section 5.0 of this POC report.

2.4 OVERFLOW FREQUENCY AND VOLUME

SWMM modeling of the SMRE-40 sewer system performed by PWSA produced computed typical year CSO statistics for each diversion chamber in terms of event peak overflow rate expressed in million gallons per day (mgd) and event overflow volume (mg). The statistics are shown in Table SMRE40-1-3.

3.0 CSO/SSO CONTROL GOALS

Water quality issues are the driving force behind the PWSA's and other municipal COA and ACO requirements, as well as the ALCOSAN CD. These requirements stem from the existing water quality criteria in the local streams that are not being met, some as a result of combined and separate overflows. CSO and SSO control goals need to be developed by the PWSA so that water quality criteria will be met after implementation of the regional wet weather plan that includes municipal alternatives.

This section presents the requirements and goals for CSO control by the PaDEP and the USEPA as they apply to the SMRE-40: Plummers Run sewershed.

3.1 BACKGROUND

Section 6.2 of the Wet Weather Feasibility Study summarizes the wet weather (CSO and SSO) regulatory "climate" and requirements associated with the USEPA, the PaDEP, and the NPDES Permit.

3.2 WATER QUALITY ISSUES

As described in Section 6.0 of the Wet Weather Feasibility Study, to develop a "water-quality based" LTCP for PWSA, initial water quality objectives must be established. The objectives should be aligned with known existing water quality issues impacting the rivers and streams into which PWSA's CSOs discharge. The objectives can be summarized as follows:

- Receiving water quality must meet the requirements corresponding to its designated use.
- If the requirements that correspond to its designated use are not being met, PWSA must understand where and why they are not being met, and the corresponding impairment(s) to "designated use."
- Remaining CSO discharges must not contribute to the impairment of "designated use" – i.e., "neither cause nor contribute to a violation of WQS."
- If "designated uses" are still not met, discussions should be initiated with PaDEP regarding the development of a Use Attainability Analysis (UAA)

which is a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors.

In general, Pennsylvania requires that the following parameters be protected for all receiving waters:

Aquatic Life. This includes cold water fishes, warm water fishes, migratory fishes, and trout stocking. The major parameters of concern are water temperature, dissolved oxygen (DO) concentration, and total residual chlorine (TRC) in the receiving stream.

Water Supply. This covers potable water supply points, industrial water supply points, livestock water supply, wildlife water supply, and irrigation. The most applicable issue for the receiving waters is the possible contamination of potable water supply points with pathogens introduced to the waters by CSOs. From a water quality perspective, most controls instituted as part of the LTCP will generally be seen as an improvement over the current conditions in which untreated discharges are entering the receiving streams. Care must be taken when introducing any new chemicals to the treated CSO discharges, as they may negatively impact downstream potable water treatment facilities.

Recreation and Fish Consumption. This covers boating, fishing, water contact sports, and aesthetics. The major CSO pollutant parameters affecting these issues are floatables and bacteria (pathogens).

Special Protection. Designated “high quality” and “exceptional quality” waters.

Other. Navigation.

Wherever a “designated use” is not being met due to water quality issues, the stream is said to be impaired. “Use impairments” are normally documented in the USEPA’s 303(d) list. The USEPA website states: “The term, '303(d) list’, is the list of impaired waters (stream segments, lakes) that the Clean Water Act requires all states to submit for USEPA approval every two years (even-numbered years). The states identify all waters where pollution controls are not sufficient to attain or maintain applicable water quality standards and rank the waters taking into account the uses of the water and severity of the pollution problem. The federal regulations at 40 CFR 130.7 directs the states to:

- Identify the waters that require Total Maximum Daily Loads (TMDLs);
- Rank, or prioritize, those waters taking into consideration the water uses and severity of the pollution problem;
- Identify the pollutant(s) causing or expected to cause violations of the applicable water quality standards; and
- Identify the waters targeted for TMDL development in the next two years."

PWSA owns the permits for several outfalls. One (1) of these outfalls is found within the SMRE-40 or Plummers Run Sewershed, as shown in Table SMRE40-3-1.

TABLE SMRE40-3-1: WATER QUALITY STATUS OF PWSA OWNED OUTFALLS WITHIN THE SMRE-40: PLUMMERS RUN SEWERSHED

Outfall Structure ID	ALCOSAN Planning Basin	POC ID	Receiving Waters	Designated Use	WQ Attainment (Y/N)	TMDL (Y/N)
OF015P001	SMR	SMRE-40	Saw Mill Run	WWF[1]	N	Y

As shown in the table, the one (1) PWSA owned outfall discharges into Saw Mill Run. This receiving water is classified as warm water fishery (WWF) and currently does not meet its assigned water quality standards.

Applicable PaDEP water quality standards, i.e. those parameters most likely to be impacted by CSO discharges, are as follows:

Bacteria. Section 93.7 of 25 PA Code has established exposure limits for Water Contact Sports. Measurements are made of Fecal Coliform bacteria in units of Colony Forming Units (CFU) /100ml.

- From May 1 through September 30, during the recreational season, a 30 day geometric mean fecal coliform must not exceed 200CFU/100ml. This mean is calculated on a minimum of five consecutive samples, with each sample being collected on different days, throughout a 30 day period.

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[1] Warm Water Fishery

- From May 1 through September 30, during the recreational season, no more than 10% of the total samples can exceed 400CFU/100ml., over a 30 day period.

For the remainder of the year, the 30 day geometric mean Fecal Coliform must not exceed 2,000CFU/100ml. This mean is calculated on a minimum of five consecutive samples collected on different days, throughout a 30 day period.

Dissolved Oxygen. Section 93.7 of 25 PA Code includes the minimum concentration levels of dissolved oxygen for surface waters. Surface waters designated as WWF, must meet a minimum allowable level of 4.0 mg/l, with a minimum daily average of 5.0 mg/l. Surface waters designated as TSF, must meet a minimum of 5.0mg/l., with a minimum daily average of 6.0 mg/l, between February 15 to July 31 each year; for the remainder of the year, a minimum allowable of 4.0mg/l, minimum daily average of 5.0 mg/l shall be met.

pH. Section 93.7 of 25 PA Code has set the range of allowable concentration for pH to be from 6.0 to 9.0 inclusive. This standard is for both WWF and TSF designated water sources.

In addition to the preceding numerical standards, narrative standards for aesthetics and public health protection are also outlined in £ 93.6. General water quality criteria:

a. Water may not contain substances attributable to point or non-point source discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant or aquatic life

b. In addition to other substances listed with or addressed by this chapter, specific substances to be controlled include, but are not limited to, floating materials, oil, grease, scum and substances which produce color, tastes, odors, turbidity or settle to form deposits.

3.2.1 PWSA and ALCOSAN Water Quality Assessment

CSO control alternatives are typically developed and evaluated based on their effectiveness in providing water quality benefits in the receiving waters after implementation. It is therefore important to define the existing water quality issues and understand the extent these issues could be attributed to CSO discharges to form the baseline for quantifying the benefits of implementing control alternatives.

This subsection summarizes PWSA's approach to water quality assessment and relates it to the ALCOSAN water quality assessment which was utilized in the selection of ALCOSAN's control level and their selected plan.

PWSA Program. A PWSA water quality sampling program was implemented in 2005. In the overall sampling program, review of available water quality data from the respective receiving waters during both dry and wet weather conditions was performed. Available receiving water quality data for the Allegheny, Monongahela, and Ohio rivers and tributaries was obtained primarily from the USGS, 3R2N, ORSANCO, and USACE (Pittsburgh District). Additional data was indirectly obtained from ALCOSAN from the report on the Third Party Review of the ALCOSAN Regional Long Term Wet Weather Control Concept Plan. After this review of the available data, it was concluded that the fecal coliform level for the three main rivers is often within the established limits during dry weather conditions, except at some selected sites that are just downstream of major tributaries. Other water quality parameters, such as DO and pH, are often within acceptable limits during both dry and wet weather conditions. The CSO outfall water quality assessment consisted of monitoring CSOs during storm events in 2006 at six monitoring locations within the PWSA Service Area.

The presence of consistently high fecal coliform counts across all sites at all time-intervals was sufficient to conclude that significant levels of bacteria exist in overflows from all six sites.

The receiving water characterization field program began on June 1, 2006 and ended October 1, 2006 and incorporated seven monitoring sites. Monitoring sites were either downstream from most of the outfalls within a stream or at the upstream boundaries of the service area within a stream, including Saw Mill Run.

Pollutants typically found in CSOs include floatables, TSS, BOD, metals, bacteria, Phosphorus, Ammonia, oil & grease, etc. Impacts from these pollutants include dissolved oxygen depletion, public health impacts, and impairment of physical characteristics standards that include aesthetics. Evaluation of these pollutants by the project team led to the selection of dissolved oxygen (DO), pH, temperature, and specific conductance as the pollutants to be monitored in this program. DO was the primary interest because aquatic organisms cannot survive without oxygen. DO depletion during wet weather likely indicates the impact of high organic loads which sewer overflows can affect.

The receiving water characterization field program resulted in certain findings within Saw Mill Run. In general, the DO concentrations for Saw Mill Run did not meet regulatory limits during wet weather which is likely related to CSO discharges during the storm events and/or wet weather discharges from upstream municipalities. Saw Mill Run also showed DO concentrations not meeting standards during dry weather indicating that CSO discharges are not likely causing the condition.

ALCOSAN Program.[2] The ALCOSAN CD required extensive CSO outfall and receiving water quality monitoring. It was envisioned that PWSA would use the ALCOSAN data to aid in its analysis because the monitoring by ALCOSAN included parameters for which PWSA had not monitored and encompass a much larger area (i.e., ALCOSAN's Service Area) than PWSA's program.

ALCOSAN implemented a series of sampling programs which included sampling of CSO outfalls and receiving waters for a range of parameters.

Water quality sampling was conducted at 51 locations along the three main rivers (Allegheny River, Monongahela River, and Ohio River) and select tributaries in and around the service area and also where receiving waters enter the service area. Each location was sampled for three (3) wet and three (3) dry weather events. Samples were collected between 2006 and 2011. Monitoring was conducted in the Three Rivers and selected tributaries during wet and dry weather conditions beginning in 2006 and extending through the fall of 2011. Receptors, transects and tributaries were sampled during the recreational season from April 1 through October 31.

According to ALCOSAN, the results indicate that under existing conditions, water quality standards are not being met for all the monitored receiving waters, including Saw Mill Run and its tributaries within the PWSA limits, with fecal coliform being the primary concern. Attainment with fecal coliform criteria was assessed by comparing each sample result collected during the recreational season to 200 cfu/100mL and 400 cfu/100mL concentration thresholds, and each sample collected during the non-recreational season compared to 2,000 cfu/100mL. For Saw Mill Run, the concentration during the recreational season exceeded the 200 cfu/100mL limit in 100% of the samples and exceeded the 400 cfu/100mL limit in 80% of the samples.

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[2] *ALCOSAN Draft Wet Weather Plan; January 2013; Section 5*

Saw Mill Run has an in-stream target concentration of 0.035 mg/L for total phosphorus (TP) which was exceeded by 75% of the samples. TP appears to be a concern throughout Saw Mill Run, with CSO discharges being a potentially significant source in wet weather.

Other results can be seen in the *ALCOSAN Draft Wet Weather Plan, January 2013*.

ALCOSAN's receiving water characterization effort also included the development of water quality models. Fecal coliform loadings to receiving waters were simulated from wet weather discharges to predict receiving water quality under existing conditions. The pollutant loading estimates were produced using the ALCOSAN hydrologic and hydraulic simulation models along with data available from existing national stormwater quality databases, locally-collected sanitary sewage data, locally-collected industrial discharge data, and a number of locally collected CSO/stormwater discharge samples. The receiving water quality monitoring results were used to validate the predictive models.

During ALCOSAN's development and evaluation of alternatives to comply with the ALCOSAN CD, it was determined that an alternative sized to the 4-6 overflow per year control level effectively reduces CSOs to not preclude the attainment of the WQS. However for Saw Mill Run, it is judged that a higher level of control is needed due to the need to reduce phosphorus levels (see next section).

3.2.2 Saw Mill Run TMDL Report

A TMDL report was completed for Saw Mill Run and its tributaries which showed phosphorus TMDL results are shown below in Table SMRE40-3-2.

TABLE SMRE40-3-2: SAW MILL RUN PHOSPHORUS TMDL RESULTS

Total Phosphorus Load	CSO Load	SSO Load
Existing Load (Ib/Growing Season)	7,161.9	1,950.4
Allocated Load (Ib/ Growing Season)	177.5	0.0
Percent Reduction (%)	98%	100%

The implication of this is that substantial reductions of CSOs and complete elimination of SSOs is necessary for compliance. For CSOs, it is judged that a control level of 0 overflows per year will be required.

3.3 CSO CONTROL LEVELS

The USEPA CSO Control LTCP Guidance Manual allows for the evaluation of the effectiveness of CSO control alternatives at various levels of control, based upon a "typical year" of rainfall or other rainfall design conditions. The CSO control level should contribute to achievement of WQS for each receiving water body. However, the CSO control levels address only CSO-related conditions that contribute to non-attainment of beneficial uses. They do not address control of other sources such as stormwater and upstream loads. In certain receiving water segments, such as Saw Mill Run, pollution contributed by CSOs is a portion of the total pollutant loads from all sources. Although complete elimination of CSO discharges would not result in the attainment of WQS, since other sources of pollution alone are enough to prevent the attainment of beneficial uses, CSO pollution must be reduced so that CSOs will not prevent the attainment of WQS, despite the existence of other pollution sources.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated. This provided a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach conditions (see Section 6.5 of the Wet Weather Feasibility Study).

3.4 IMPACT OF THE ALCOSAN CONSENT DECREE

ALCOSAN's WWP was finalized during the preparation of the FS for PWSA. The background section provided a brief summary of the status. This section briefly summarizes the potential impacts of ALCOSAN's WWP on PWSA's FS.

The CD requires that ALCOSAN handle all flows that its "customer municipalities", one of which is PWSA, can deliver through connection points to the ALCOSAN interceptor. Flows delivered to the connection points would then be handled by ALCOSAN per its WWP. This requirement allows PWSA the option of controlling CSOs via PWSA-owned facilities, or the option of transferring the overflow volumes to the nearest ALCOSAN connection point. If transferred, the flows become the responsibility of ALCOSAN.

ALCOSAN has selected an alternative in their draft WWP. Under the selected alternative, larger CSOs served by the new regional tunnel are controlled to 4 to 6

overflows per year per facility. CSOs discharging to sensitive areas are controlled to zero overflows per year or re-located downstream of the sensitive areas. CSOs discharging to the existing tunnel vary by outfall and depend on the existing drop shaft capacity. A two year design storm level of control was used for ALCOSAN SSOs. At this control level (4 to 6 OF/yr), it was demonstrated that the alternative would meet water quality standards in the main rivers (Ohio, Monongahela, and Allegheny) and the main tributaries (Chartiers Creek, Turtle Creek, and Saw Mill Run). Thus, ALCOSAN has prepared their WWP using the demonstration approach.

For PWSA's Feasibility Study, a range of CSO Control Levels were assessed for the SMRE-40 sewershed. For the typical year, 0, 4 and 10 overflows per year (OF/yr) were calculated providing a range of conditions which bracketed the presumptive criterion of 4 OF/yr. The 4 OF/yr also aligned with the criterion of 4-6 OF/yr used by ALCOSAN, which according to their analysis, met WQS in accordance with the demonstration approach.

3.5 PWSA FEASIBILITY STUDY CSO CONTROL LEVELS

For this FS, the demonstration approach for CSO control levels was used as the method for developing CSO control technology alternatives. ALCOSAN's WWP receiving water modeling and assessment demonstrated that the outfalls with PWSA CSO flows would meet water quality standards by implementing CSO controls that will not allow more than an average of four to six overflow events per year on an annual average basis.

Based on the PWSA the system model, CSO statistics (volume and number of overflows) were generated for every outfall for control levels of zero, four and ten overflow events per year, based on a "typical year" storm. For the SMRE-40 sewershed, Table SMRE40-3-3 lists the untreated CSO statistics that were computed for each control level.

TABLE SMRE40-3-3: CSO STATISTICS FOR DIVERSION STRUCTURES WITHIN THE SMRE-40: PLUMMERS RUN SEWERSHED

CSO Diversion Structure	Levels of CSO Control and Associated Annual Overflow Statistics					
	Max. 0 Overflows/year		Max. 4 Overflows/year		Max. 10 Overflows/year	
	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)	Number of Overflows	Annual Volume (Mgal)
DC034E001	0	0	4	0.31	6	0.31
DC035M001	0	0	3	0.64	9	1.41
DC034N001	0	0	0	0	6	0.08
DC035P001	0	0	0	0	0	0
DC035S001	0	0	0	0	1	0.01
DC062C001	0	0	0	0	3	0.06
DC062C002	0	0	0	0	0	0
DC062D001	0	0	2	0.01	2	0.01
DC062K001	0	0	3	0.02	3	0.02
DC062K002	0	0	0	0	7	0.04
Total Volume		**0**		**0.98**		**1.94**

As will be described later in this report, the SMRE-40 analyses that have been completed to date identify CSO control facilities required to achieve a range of CSO control levels (0, 4, and 10 overflow events per typical year) under a range of design storm conditions (2-year, 5-year and 10-year return frequency events).

Since Saw Mill Run has a TMDL which requires a high level of Phosphorous removal (98%), a higher CSO control level will be required. While 10, 4 and 0 OF/yr are analyzed, it is judged that 0 OF/yr will be necessary for compliance.

A range of design storms (2-yr, 5-yr, and 10-yr) were evaluated for transport of flows. PWSA plans to use the 2-yr storm which is consistent with the proposed regional design storm.

4.0 ALTERNATIVE EVALUATION

The formation, evaluation and selection of wet weather control alternatives is a major component of the overall wet weather planning and feasibility study process. Guidance provided by the FSWG was used to help ensure that the process followed by the PWSA dovetailed with the overall approach used by ALCOSAN. This Section provides background on the PWSA methods used to select the highest ranked alternative for each POC sewershed.

The results of the initial alternatives development, cost estimates, analysis, and selection were developed for the Preliminary PWSA Draft Feasibility Study that was completed in October 2008. At around that time, ALCOSAN began to develop its regional Wet Weather Plan. ALCOSAN's wet weather planning process is generally similar to the PWSA process, but is broader in that it contains the ALCOSAN interceptor and municipalities outside of the PWSA service area. After 2008, due to coordination and consistency issues with regional planning efforts, the PWSA decided to re-evaluate the recommendations of the 2008 Preliminary Draft Feasibility Study. The overall alternative development and evaluation process is described in significant detail in Section 7 of the Wet Weather Feasibility Study, and is summarized in this section.

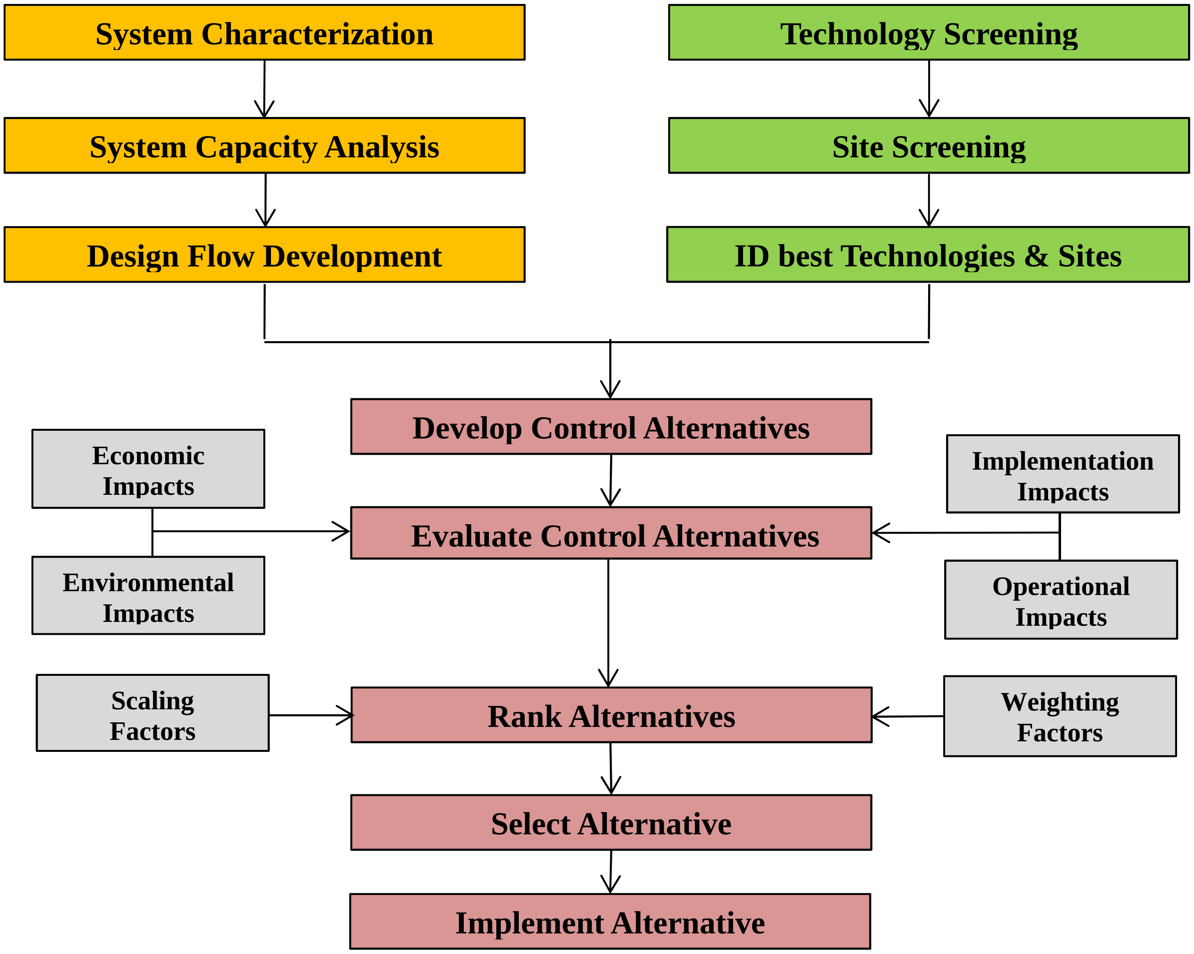
4.1 CONTROL ALTERNATIVE DEVELOPMENT

This section summarizes the process by which CSO control alternatives were developed for this POC sewershed, the methods used to calculate planning level cost estimates and the means by which the control alternatives were evaluated and ranked. Figure 4-1 shows a schematic of various stages of the PWSA process. The orange portion (upper left) of the diagram lists the tasks to be completed to identify the applicable hydrologic and hydraulic (H&H) conditions within each sewershed. The green portion (upper right) of the diagram represents the steps required to identify suitable control technologies and control sites. Each combination of an H&H condition, a control site and a control technology was defined as a control alternative. Each control alternative was then evaluated and ranked, with the highest ranked alternative being selected for implementation.

The PWSA developed control alternatives in a step wise fashion, starting with remote and low flow outfalls, then proceeding through the outfall specific, regional and subsystem analyses. In addition, the PWSA evaluated a "Z Agreement

Alternative" that incorporated the transport of PWSA overflow volumes to the nearest ALCOSAN interceptor system. This alternative is called "Convey All Flows" in this report.

FIGURE 4-1: CONTROL ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS



In order to properly evaluate the relative merit of each of the control alternatives, it was necessary to establish a consistent set of design criteria with which PWSA could estimate the sizes, costs and physical impacts of each alternative. This section addresses the methods used by the PWSA to accomplish those estimates.

4.1.1 Control Technology Screening

More than 70 individual wet-weather management technologies were reviewed for potential use as CSO controls in the PWSA combined sewer system. The review was based on experience with CSO control activities in other communities; technical literature; and information provided by manufacturers, vendors, and other industry sources. Key to the technology screening process were the four functional categories of wet-weather management technologies used in this consideration: Source Control, Collection System Control, Storage and Treatment. From these categories, detailed screening criteria were developed, with the focus being on the impact the technology would have on PWSA costs, the environment, overall implementation and PWSA operations. The criteria were used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

- *Source Control* technologies are designed to minimize flows and/or pollutants entering collection systems. For separate sanitary sewer systems this would include I/I reduction projects. For this discussion, I/I removal projects to be included should be projects that are beyond routine O&M. These controls differ slightly from Green Infrastructure (GI) controls; for details on GI controls, please refer to Section 6 of this POC report.

- *Collection System Control* technologies are introduced into existing sewer systems to enhance their conveyance and/or storage capabilities. Technologies in this category typically increase the system capacity by allowing full utilization of the collection system, or by constructing a parallel relief sewer pipe.

- *Storage* technologies store excess wet weather flows until sufficient conveyance and treatment capacity is available in the system. Storage technologies are often divided into the following sub-categories: Tunnel and Tank Storage.

- *Treatment* technologies are designed to provide pollutant removals from wet weather flows prior to their discharge to receiving waters. Treatment technologies may utilize physical, biological, or chemical processes, or depending on specific treatment goals, these processes may be combined, to achieve the desired level of pollutant removal.

A complete list of the technologies that were identified and categorized for screening is included in Table 8-1 of the *PWSA Feasibility Study Report (October 2008)*.

From the functional categories listed above, detailed screening criteria were developed and used to determine whether a particular CSO control technology should be used to develop short- and long-term control alternatives.

The four main categories, and their specific criteria, included:

- **Economic Impact**: Present worth cost (capital, operations and maintenance).
- **Environmental Impact:** Pollution reduction; impact on habitat, stream flooding, etc.
- **Implementation Impact**: Constructability; permanent land requirements, public acceptance, institutional constraints, siting restrictions.
- **Operational Impact:** Operating complexity, flexibility, reliability; compatibility with other PWSA facilities and operations.

During the technology screening phase, the non-cost criteria were evaluated because it was difficult to assess the impacts of cost prior to the development of control alternatives. Therefore, the economic impact criteria were not used to screen CSO control technologies; however, they were used in later evaluations of control alternatives.

Written summary descriptions of the recommended CSO control technologies were presented in Section 8 of the *PWSA Feasibility Study Report (October 2008)*.

Those technologies that were considered "feasible" for use in the SMRE-40 sewershed are shown below in Table 4-1.

TABLE 4-1: SMRE-40 TECHNOLOGY SCREENING RESULTS

Control Category	Feasible Technologies
Source Controls	N/A
Collection System Controls	Sewer separation
Storage	Surface storage tank Subsurface storage tank Tunnel storage (Regional and Sub-system alternatives only)
Treatment	Screening and disinfection CSO treatment facility High rate end-of-pipe technologies Vortex separation

4.1.2 Best Management Practices – Green Technology Screening

The PWSA is committed to investigating the benefits of green technologies to help control wet weather overflows, and maximizing the amount of green infrastructure where feasible. While Green Infrastructure (GI) wasn't included in the original analysis, its benefits will be fully investigated through a GI program to determine the amount of GI that can be included into the subsequent phases of the plan. For a detailed discussion of regarding the PWSA's plans to implement these technologies, refer to Section 9 of the Wet Weather Feasibility Study.

4.1.3 Site Screening

In order to estimate the required sizes, costs and physical impacts of each CSO control alternative, planning level design criteria were developed for each control technology. These design criteria were detailed in a technical memorandum, *Technical Parameters for CSO Alternatives Analysis, April 2007*. These parameters were used, on a planning level basis, to size technologies (via flow rate or volume), determine available storage capacity (percent of storage volume), set tank side water depths (feet) etc. The application of these design criteria resulted in the production of valuable and consistent planning level information that was used in the alternative evaluation process.

A formal screening process for control sites was not implemented. A control site was considered "feasible" if there appeared to be an adequate amount of space to house the control facilities without infringing upon critical infrastructure[1]. To determine whether adequate space was available, the PWSA used the criteria set forth in the technical memo *Technical Parameters for CSO Alternatives Analysis, April 2007* as follows:

1. Determine the desired level of control.
2. Calculate the required size of each facility component.
3. Calculate the overall facility footprint.
4. Plot the facility footprint on an area map.
5. Note conflicts with critical infrastructure and/or natural barriers to construction.
6. Adjust facility location to avoid conflicts, if possible.
7. Select another location if necessary, and repeat steps 4, 5 and 6.

4.1.4 Formation of Control Alternatives

Once feasible control technologies was identified for the SMRE-40 sewershed, a list of control alternatives to be evaluated was developed. This list provided a unique identification to each control alternative. A list of the control alternatives that were developed by the PWSA for this POC is provided below in Table 4-2.

Contributing flows from the municipalities that are tributary to the SMRE-40 sewershed, which include Dormont Borough were considered when developing control alternatives. If the PWSA had been provided with information regarding municipal control alternatives planned by a tributary municipality, future reductions to contributing flow rates or volumes were also taken into account. If no information had been provided, or the municipality stated that they had no plans to implement CSO controls, the PWSA assumed that no reduction to contributing flow rates or volumes would be realized.

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[1] Critical infrastructure includes items such as local and interstate highways, bridges, railroads, riverfront development, and natural features such as waterways.

4.1.5 Alternative Evaluation Criteria Development

Thirteen economic, environmental, implementation and operational criteria were specifically developed for use in assigning “Objective Scores” to PWSA control alternatives. These criteria are explained in detail in the *PWSA Feasibility Study Report (October 2008)*.

TABLE 4-2: SMRE-40 POTENTIAL CONTROL ALTERNATIVES

CSO(s)	Control Alternative(s)	Description
Outfall-Specific Controls		
Outfall 015P001	CS4 015P001 : Sewer separation	Complete sewer separation of tributary area.
	S2-015P001 : Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-015P001 : Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-015P001 : Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-015P001 : High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-015P001 : CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-015P001 : Screening and Disinfection	A stand-alone screening and disinfection facility.
Regional Controls – SMRE-40: Plummers Run Controls		
Outfall 015P001	CS4-S-31 TO S-36: Sewer Separation	Complete sewer separation of tributary areas.
	S2-S-31 TO S-36: Sub-Surface Storage	A below grade storage tank to temporarily store CSOs.
	S4-S-31 TO S-36: Surface Storage	An above grade storage tank to temporarily store CSOs.
	T1-S-31 TO S-36: Suspended Solids Control	A swirl concentrator / vortex separator, with screening and disinfection.
	T2-S-31 TO S-36: High Rate End of Pipe Treatment	A ballasted flocculation unit, with screening and disinfection.
	T3-S-31 TO S-36: CSO Treatment Facility	A CSOTF unit, with screening and disinfection.
	T4-S-31 TO S-36: Screening and Disinfection	A stand-alone screening and disinfection facility.
Sub-system Controls – Saw Mill Run Controls		
Outfall 015P001	SMR-1a: Tunnel Storage[2]	A 2.8 mile long tunnel O-14 to the S-30 POC. The SMRE-40 CSOs will be controlled using the following outfall-specific and/or regional alternative(s): • 015P001- Sewer Separation, Small Storage Technologies, Direct Connection to Trunk Sewer, or no action
	SMR-1b: Tunnel Storage[2]	
	SMR-2a: Tunnel Storage[2]	A 5.7 mile long tunnel from O-14 to the SMRE-40 POC. The SMRE-40 CSOs will be controlled using the following outfall-specific and/or regional alternative(s): • 015P001 - Sewer Separation, Small Storage Technologies, Direct Connection to Trunk Sewer, or no action
	SMR-2b: Tunnel Storage[2]	

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[2] It is assumed that ALCOSAN will assume responsibility for the construction, ownership and maintenance of the tunnel portion of this control alternative.

As described in later paragraphs, these criteria were used to "score" each control alternative using a defensible and reproducible process that was applicable to all outfall-specific, regional and sub-system alternatives.

4.2 COST ESTIMATES

PWSA chose to utilize ALCOSAN's Alternatives Costing Tool (ACT) to estimate costs contained in the July, 2012 report. The ACT estimated costs in a manner very similar to that used by the PWSA in the *PWSA Feasibility Study Report (October 2008)*. It should be noted that PWSA contributed cost data to ALCOSAN for use in the development of the ACT tool.

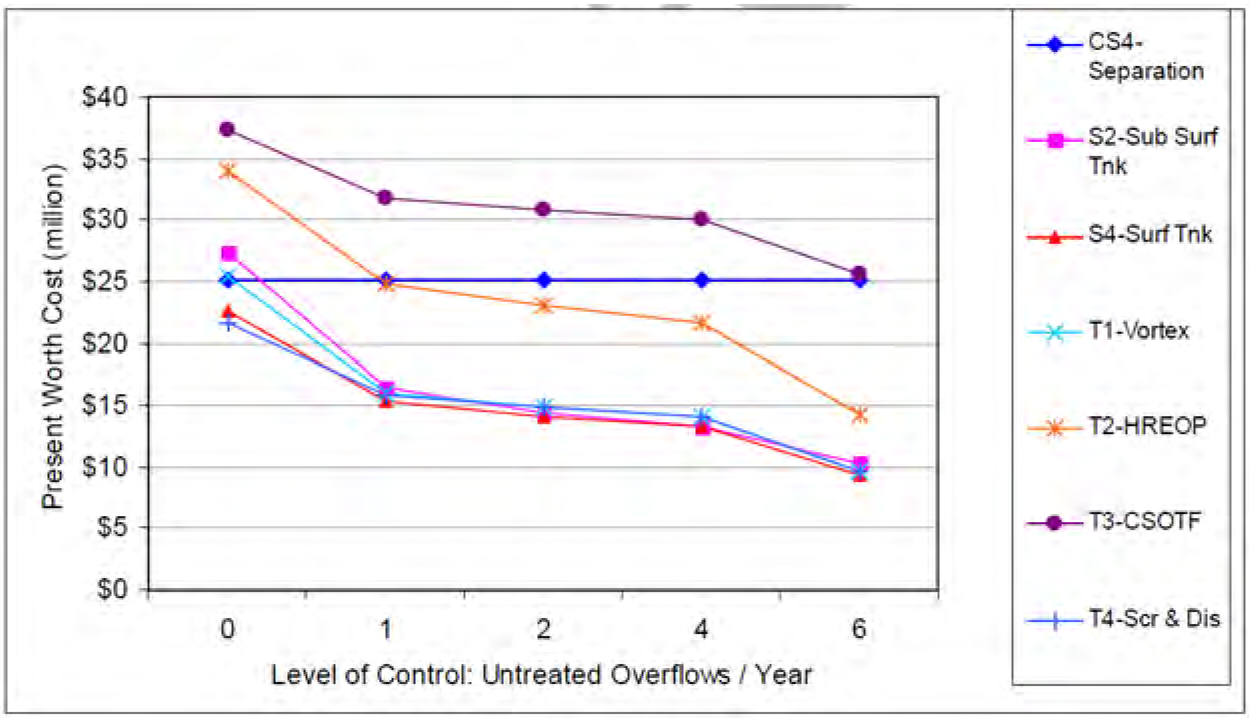
PWSA utilized ACT Version 2.1; a summary of the PWSA's use of the ACT is included in Section 7 of the Wet Weather Feasibility Study, and a more detailed discussion of the ACT may be found in the ALCOSAN WWP.

The results of the PWSA's cost estimating efforts are discussed below. As described in the following paragraphs, the ACT generated Annual O&M and Present Worth costs were important components of the alternative evaluation process.

4.2.1 Outfall-Specific Control Alternatives

Outfall 015P001: Cost estimates were produced for outfall-specific control alternatives CS4 015P001: Sewer separation, S2-015P001: Sub-Surface Storage, S4-015P001: Surface Storage, T1-015P001: Suspended Solids Control, T2-015P001: High Rate End of Pipe Treatment, T3-015P001: CSO Treatment Facility, and T4-015P001: Screening and Disinfection. These estimates were completed for levels of control associated with zero, 1, 2, 4 and 6 untreated overflows per year. Figure 4-2 illustrates the ranges of estimated present worth costs for these alternatives.

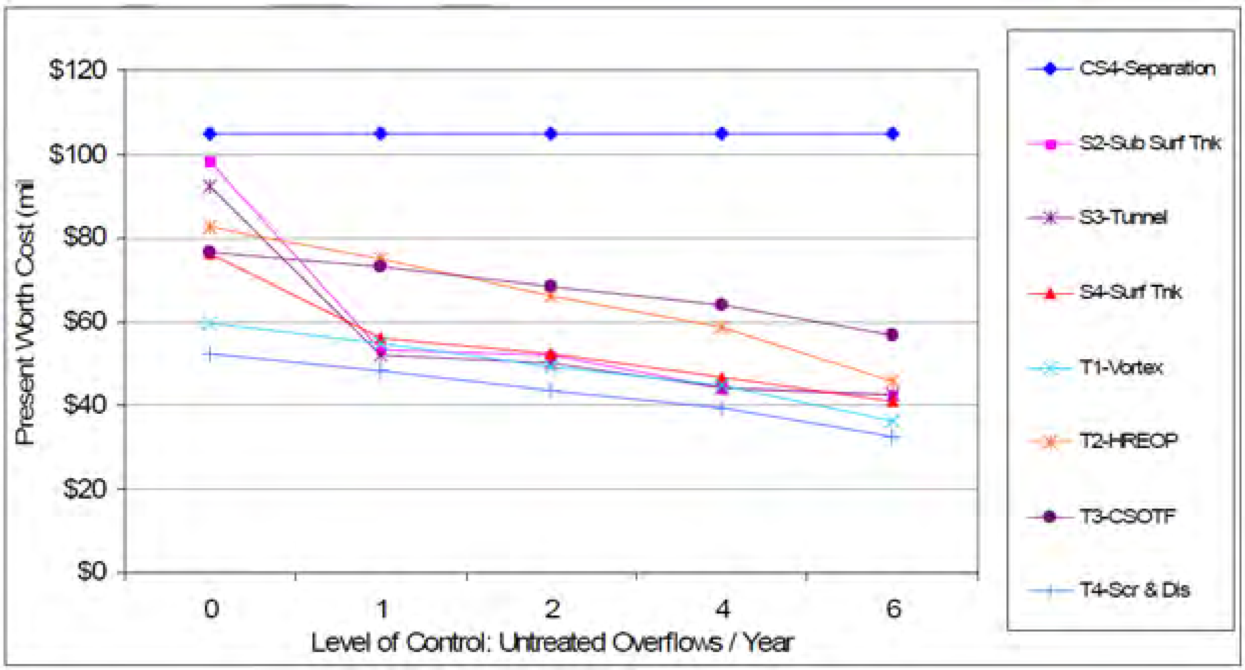
FIGURE 4-2: OUTFALL 015P001 ALTERNATIVE COSTS



4.2.2 Regional Control Alternatives

Cost estimates were produced for regional control alternatives developed for the S-31 TO S-36 region. *Figure* 4-4 illustrates the estimated costs for these alternatives. It is important to note that *Alternative S3-Tunnel* includes the cost of a storage tunnel. If the PWSA were to implement the regional tunnel alternative, it would be sized to control only those overflows that are the responsibility of the PWSA. The cost, construction, ownership and maintenance of the tunnel would then be the responsibility of the PWSA.

FIGURE 4-4: S-31 TO S-36 REGION ALTERNATIVE COSTS



4.2.3 Sub-System Control Alternatives

Cost estimates were produced for sub-system control alternatives developed for the entire Saw Mill Run sub-system. Table 4-3 illustrates the estimated costs for these alternatives, including costs associated with the storage tunnel itself and all other outfall-specific and/or regional controls needed for the Saw Mill Run subsystem. It is important to note that when these cost estimates were produced in 2008, costs associated with the storage tunnel were assumed to be the responsibility of ALCOSAN, but were included to allow comparisons between "complete" sub-system alternatives. It remains PWSA's assumption that ALCOSAN will assume responsibility for the cost, construction, ownership and maintenance of tunnel storage portions of these control alternatives.

TABLE 4-3: SAW MILL RUN SUB-SYSTEM ALTERNATIVE COSTS

Subsystem	Capital Cost (MM$)	Annual O&M Cost (MM$)	PW Cost (MM$)
SMR-1a	249.3	2.1	272.1
SMR-1b	253.3	1.9	274.0
SMR-2a	246.2	1.6	265.1
SMR-2b	251.8	1.5	269.0

4.3 ALTERNATIVE EVALUATION PROCESS

As detailed in the *PWSA Feasibility Study Report (October 2008)*, an evaluation process was performed to select the “highest ranked alternative” for every outfall-specific, regional, and subsystem alternative. The process was initiated for each sewershed at each selected level of control, and was completed in its entirety for the level of control equal to four untreated overflows per year. However, since the completion of the October 2008 report, the issuance of the ALCOSAN Consent Decree has further clarified that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them. Thus, the outfall-specific, regional, and subsystem alternative evaluations contained in the October 2008 report are still valid, but many have since been superseded by the Convey All Flows alternative. The evaluation process consisted of:

- Determining “Objective Scores” relative to each evaluation criteria.
- Applying “scaling” and “weighting” factors.
- Determining “Weighted Objective Scores” relative to each evaluation criteria.
- Ranking each alternative based on the sum of its “Weighted Objective Scores”.

Objective Scoring: Objective scores were determined for each alternative, at each level of control, by developing a set of metrics for each of the 13 criteria by which a score of 1 through 5 could be assigned. For example, the metrics associated with pollution reduction are shown in Table 4-4.

TABLE 4-4: OBJECTIVE SCORING - POLLUTION REDUCTION

Baseline Score	Metric	Example / Explanation
1	Minimal Treatment	Provides minimal pollution reduction, with little or no reduction of TSS, bacteria etc. Applicable for floatables control and large screenings (clogs, debris etc.)
2	Less than Primary Treatment	Some TSS removal or varying effectiveness of sediment removal. Less than sufficient handling of bacteria and/or floatables. Example, screening and disinfection facilities. Net result of sewer separation due to large increases of storm water pollutant loads compared to reduction of CSO.
3	Primary Treatment	Meets EPA minimum treatment guidelines for CSO. Includes primary clarification, floatables/debris control and disinfection, if required. Example: CSOTF, vortex separation or increased primary tankage at WWTP.
4	Primary to Secondary Treatment	Ensures at least minimum treatment per EPA guidelines with up to full secondary treatment at times. Example: deep storage tunnels and storage tanks capture, store and convey flow to WWTP where it receives at least primary and up to secondary treatment, per available capacity. Also, high rate end-of-pipe treatment can show greater than primary treatment levels.
5	Secondary Treatment	Provides full secondary treatment for CSO at all times. For example, regulator modifications which send all flow to the WWTP.

Scaling and Weighting Factors: Scaling factors, defined as the PWSA specific measure of the benefit of each criterion, were determined for each criterion. Scaling factors quantified the numeric relationships between each criterion's "Objective Score" and its "Subjective Score".

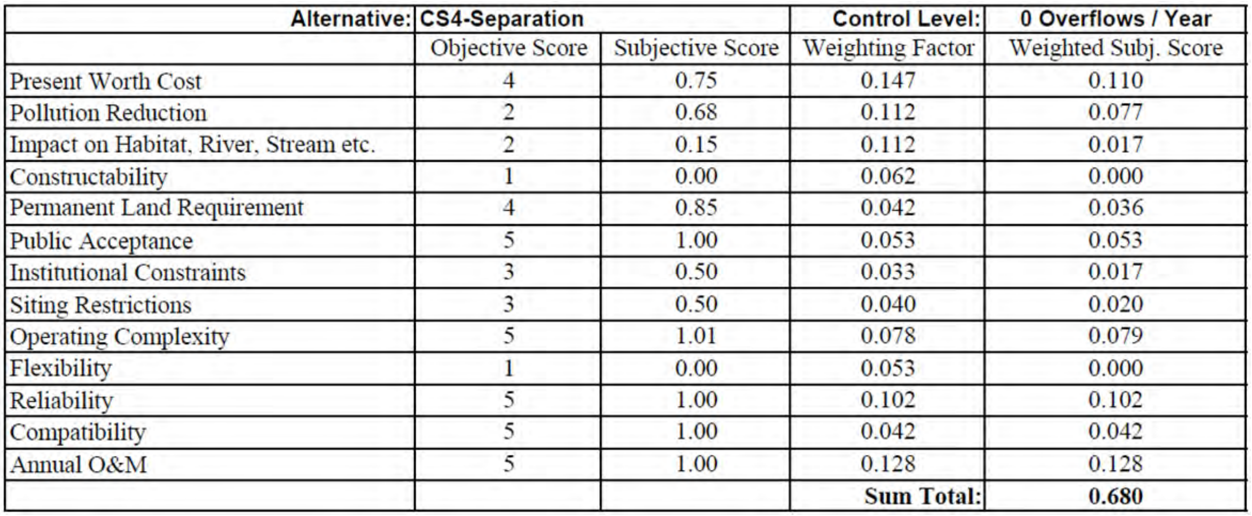
However, the importance of each criterion, relative to all other criteria, varied as well. Some criteria were valued more in the decision making process than others, and were thus "weighted". Weighting factors were determined jointly by PWSA staff and consultant team members in a workshop at which factors for each of the 13 criteria were determined. The results of the workshop are presented in the following Table, taken from Section 7 of the Wet Weather Feasibility Study.

TABLE 4-5: PWSA WEIGHTING FACTORS

Criteria Group	Criterion	Weight Factor
Economic Impact	Present Worth Cost	0.147
	Annual O&M	0.128
Environmental Impact	Pollution Reduction	0.112
	Impact on Stream, River etc.	0.108
Implementation Impact	Constructability	0.062
	Permanent Land Requirements	0.042
	Public Acceptance	0.053
	Institutional Constraints	0.033
	Siting Restrictions	0.040
Operational Impact	Operating Complexity	0.078
	Flexibility	0.053
	Reliability	0.102
	Compatibility w/ Other PWSA Facilities & Operations	0.042
	Total:	**1.00**

Weighted Subjective Scores: Weighted subjective scores were then calculated for each criterion by multiplying subjective scores by weighting factors. The weighted subjective scores that were calculated for outfall-specific control alternative *CS4 015P001: Sewer Separation,* at a level of control equal to 4 overflows per year, is shown below in Table 4-6.

TABLE 4-6: WEIGHTED SUBJECTIVE SCORING - CS4 015P001: SEWER SEPARATION



Alternative:	CS4-Separation		Control Level:	0 Overflows / Year
	Objective Score	Subjective Score	Weighting Factor	Weighted Subj. Score
Present Worth Cost	4	0.75	0.147	0.110
Pollution Reduction	2	0.68	0.112	0.077
Impact on Habitat, River, Stream etc.	2	0.15	0.112	0.017
Constructability	1	0.00	0.062	0.000
Permanent Land Requirement	4	0.85	0.042	0.036
Public Acceptance	5	1.00	0.053	0.053
Institutional Constraints	3	0.50	0.033	0.017
Siting Restrictions	3	0.50	0.040	0.020
Operating Complexity	5	1.01	0.078	0.079
Flexibility	1	0.00	0.053	0.000
Reliability	5	1.00	0.102	0.102
Compatibility	5	1.00	0.042	0.042
Annual O&M	5	1.00	0.128	0.128
			Sum Total:	**0.680**

Weighted subjective scores were calculated in a like manner for each of the outfall-specific, regional and sub-system control alternatives developed for this sewershed.

4.4 ALTERNATIVE EVALUATION RESULTS

The step-wise approach followed in the *PWSA Feasibility Study Report (October 2008)* allowed the PWSA to first develop and evaluate control alternatives for small, individual areas. These outfall-specific alternatives could serve as one component of a larger, regional control alternative. Likewise, both outfall-specific and regional alternatives could serve as one component of a larger, sub-system control alternative. This flexibility allowed the PWSA to develop large scale control alternatives in a modular fashion, utilizing the best combinations of small, medium and large controls to most cost effectively meet their overall wet weather control requirements. For example, implementation of regional controls was found to be more cost-effective than implementation a larger number of outfall-specific control alternatives. Similarly, implementation of sub-system controls was found to be more cost-effective than implementation a larger number of regional control alternatives.

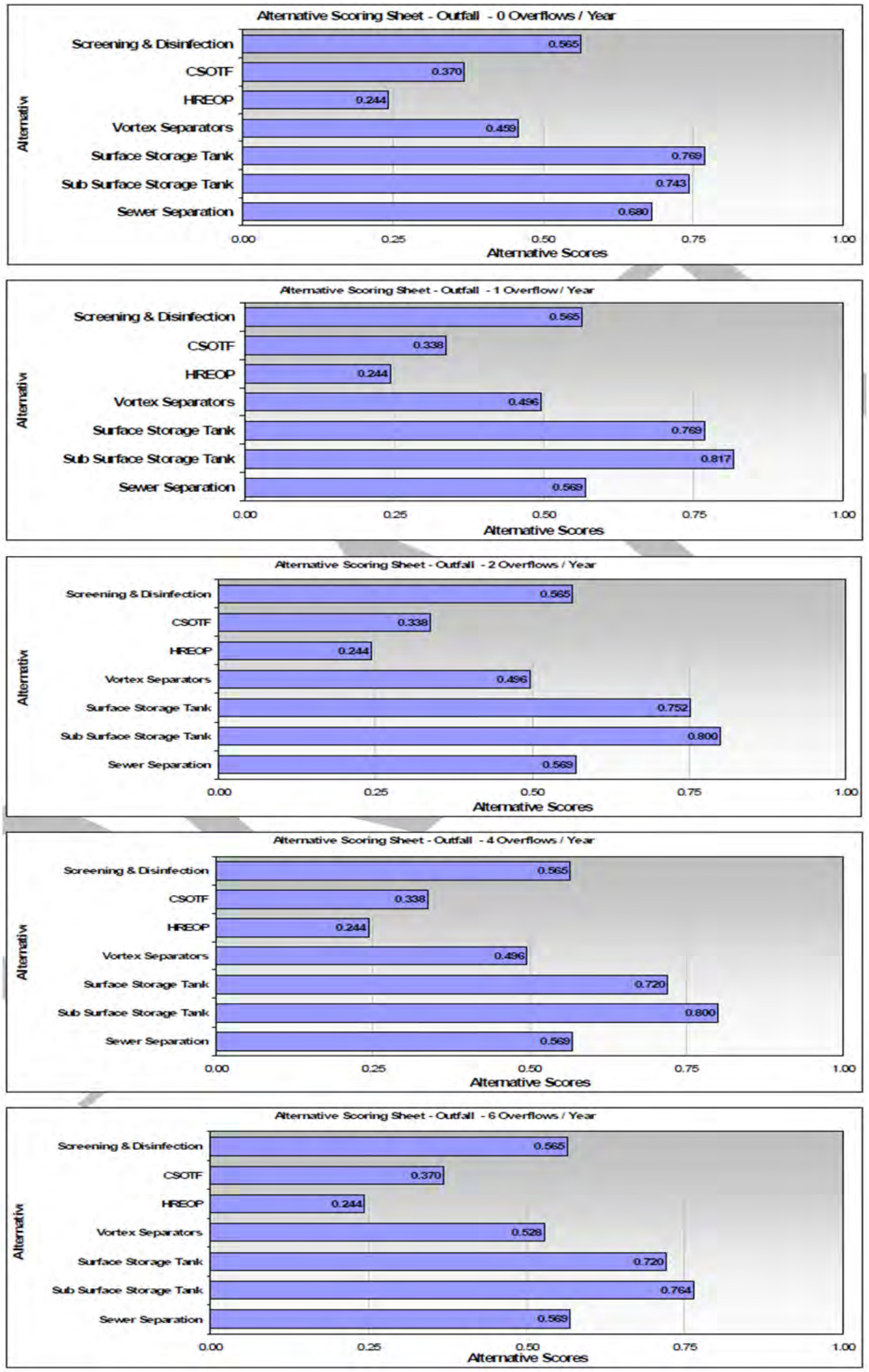
Though completed in 2008, these outfall-specific, regional, and subsystem alternative evaluation results were reviewed and are still valid. However, given the ALCOSAN Consent Decree requirement that ALCOSAN must accept all flows that their tributary municipalities are able to convey to them, the PWSA has re-evaluated those results to determine their compatibility with the Convey All Flows alternative.

The results of the evaluation process are included in their entirety in the *PWSA Feasibility Study Report (October 2008).* Results for a level of control of 4 untreated overflows per year are included below. Also discussed below are the results of re-evaluation of the recommended sub-system control alternative to determine its compatibility with the current Convey All Flows scenario.

4.4.1 Outfall-Specific Control Alternatives

Outfall 015P001: The results of the control alternative evaluation process are shown in Figure 4-5. For control level 0, it is recommended that *Alternative S4-015P001: Surface Storage* be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses. For control levels 1 through 6, it is recommended that *Alternative S2-015P001: Sub-Surface Storage* be carried forward and re-evaluated with the results of the regional and system-wide alternatives analyses.

FIGURE 4-5: ALTERNATIVE SCORING - OUTFALL 015P001



4.4.2 Regional Control Alternatives

S-31 to S-36 Region: The results of the regional control alternative evaluation process are shown below in Figure 4-6. *F*or control level 0, it is recommended that Alternative CS4- S-31 to S-36 Region: Sewer Separation be carried forward and re-evaluated with the results of the system-wide alternatives analysis. For control levels 1 and 4, it is recommended that S3- S-31 to S-36 Region: Tunnel Storage be carried forward and re-evaluated with the results of the system-wide analysis. For control levels 2 and 6, it is recommended that S2- S-31 to S-36 Region: Sub- Surface Storage be carried forward and re-evaluated with the results of the system-wide analysis.

4.4.3 Sub-System Control Alternatives

Saw Mill Run. The results of the sub-system control alternative evaluation process are shown below in Figure 4-7. As previously described, this analysis was only undertaken for a level of control associated with 4 untreated overflows per year.

It was recommended that *Alternative SMR-2b: Tunnel Storage* be carried forward as the Saw Mill Run component of the PWSA's overall wet weather control solution.

Both the July 2012 report and the July 2013 Feasibility Study Report analyzed *Alternative SMR-2b: Tunnel Storage* at the zero, 4 and 10 untreated overflow per year levels of control. It should be noted that in these analyses, the PWSA portion of *Alternative SMR-2b* included only those components required to deliver flows to the SMRE-40 POC. Any wet weather overflows that may subsequently occur at, or downstream of, the SMRE-40 POC would become the responsibility of ALCOSAN.

FIGURE 4-6: ALTERNATIVE SCORING - S-31 TO S-36 REGION

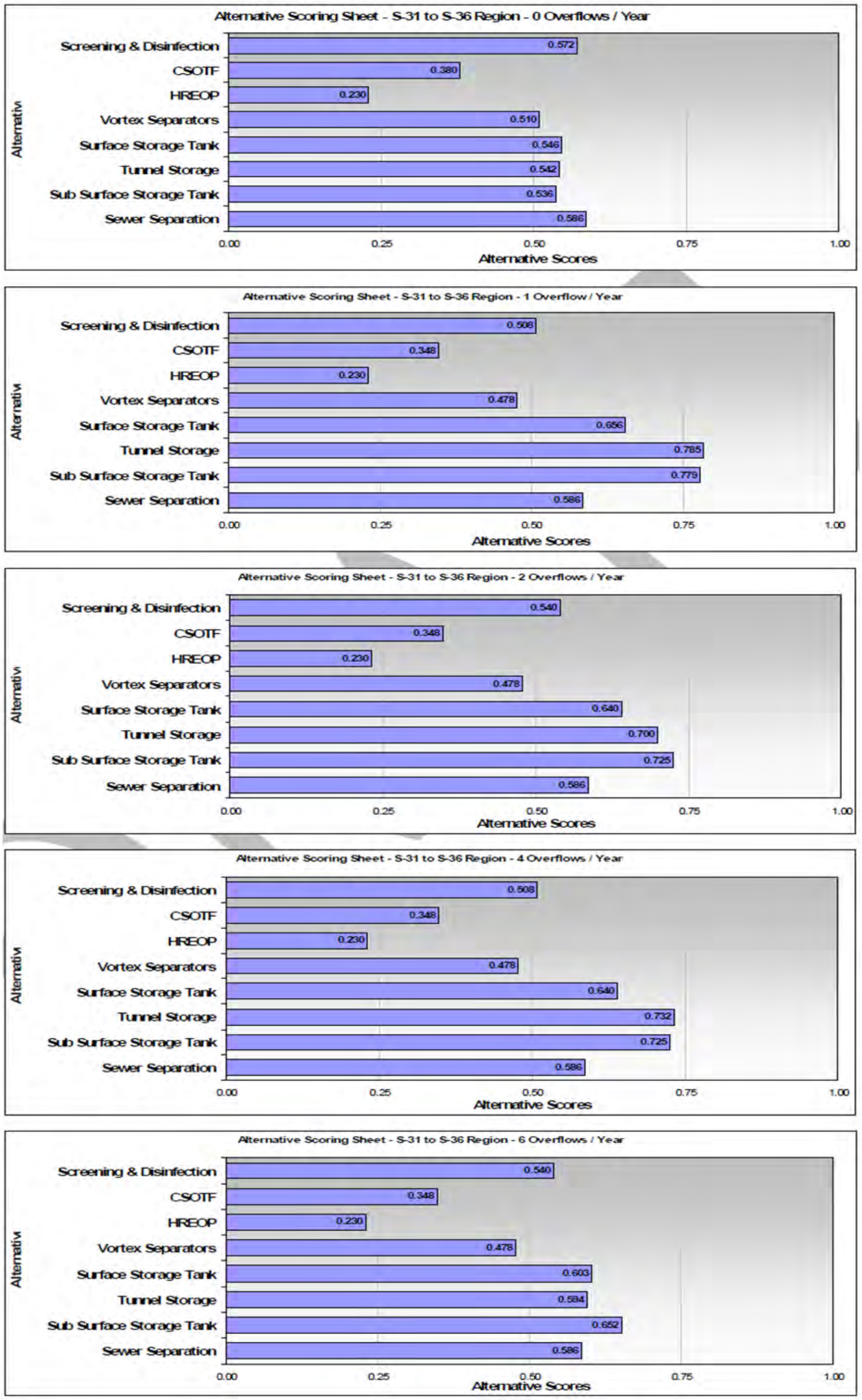
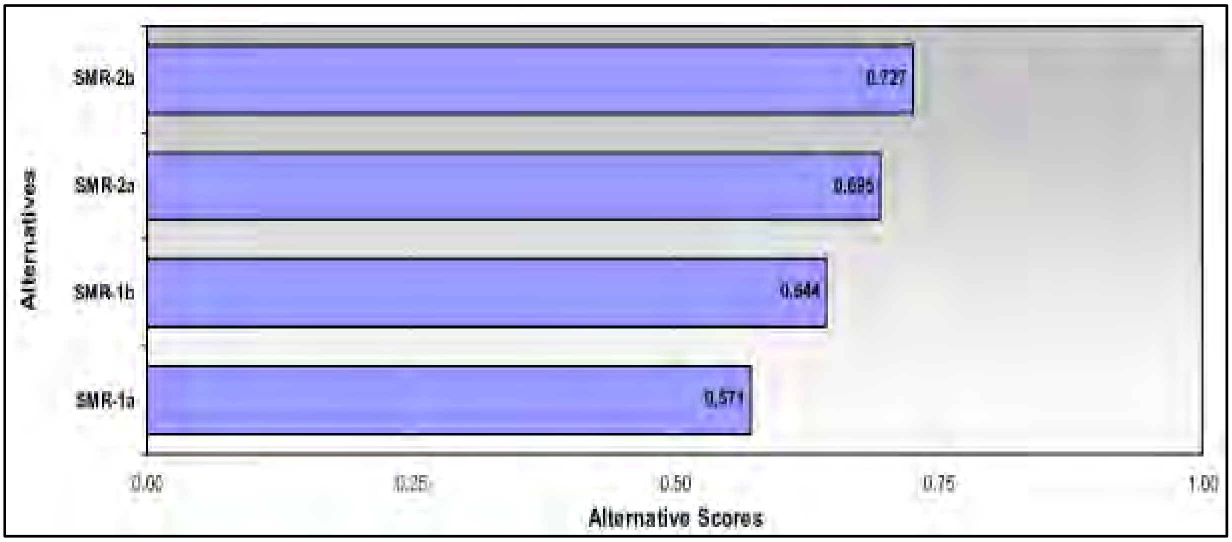


FIGURE 4-7: ALTERNATIVE SCORING – SAW MILL RUN SUB-SYSTEM



4.4.4 Sub-System Control Alternative Re-Evaluation

The *PWSA Feasibility Study Report (October 2008)* recommended that increasing the level of control of CSO overflows in the Plummers Run sewershed would best be accomplished by implementing *Alternative SMR-2b: Tunnel Storage*. Within the SMRE-40 sewershed, implementation of this alternative would equate to the current "Convey All Flows" concept, in that it would necessitate the adjustment of diversion structure controls as required to reduce the frequency of the PWSA permitted CSO to the targeted level of control. Wastewater flows not diverted from the system would be conveyed to the SMRE-40 POC, at which point ALCOSAN would assume responsibility for the flows. As a conservative measure, consolidation sewers would be sized for flow rates corresponding to a control level of zero overflows per year regardless of the targeted level of control.

The current re-evaluation of *Alternative SMR-2b* focused on assessing the existing collection system performance using the more current H&H model, and focused on three control alternatives named *POC-SMRE40-C-0*, *POC-SMRE40-C-4* and *POC-SMRE40-C-10*. These names each contain four designations that indicate the following:

- **POC -** The control alternative services an entire POC sewershed.
- **SMRE40 -** The POC sewershed serviced.
- **C -** Conveyance is the primary control technology; i.e. Convey All Flows.

- **0, 4, 10 -** The desired level of control; i.e. zero, 4 or 10 untreated overflows per year.

Modeling was performed to assess the ability of the existing trunk sewer system to convey flows expected to result from the required regulator modifications. This was accomplished by modifying the future baseline conditions model representation of each of the diversion structures to simulate sewer separation and to reflect the appropriate regulator modifications for levels of control equal to 0, 4, and 10 untreated overflows. The performance of the system was modeled under each level of control under the 2-yr, 5-yr and 10-yr design storm conditions. Under this range of operating conditions, the existing trunk sewer system was shown to have insufficient capacity to convey the required flows to the SMRE-40 POC without significant manhole surcharging and flooding.

It should be noted that the tributary municipalities did not indicate to the PWSA that they had any plans to implement wet weather controls within their tributary sewer systems that would result in reductions to the projected flows.

These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008),* i.e. the need to construct additional consolidation piping to supplement the capacity of the existing trunk sewer system and convey wet weather flows to the ALCOSAN POC.

5.0 RECOMMENDED ALTERNATIVE

As detailed in Section 6 of the Wet Weather Feasibility Study, the selected level of control within the SMRE-40 sewershed is zero untreated overflows per year. The recommended control alternative for the SMRE-40 Plummer's Run sewershed has been designated as POC-SMRE40-C-0. The alternative designation indicates the following:

- **POC** The control alternative services an entire POC sewershed.
- **SMRE40** The SMRE-40 POC sewershed is being serviced.
- **C** Conveyance is the primary control technology.
- **0** The selected level of control is zero untreated overflows/year.

Though the control alternative will be designed to achieve a level of control of zero (0) untreated overflows per year, the required consolidation / conveyance piping will be sized to convey flows under the 2-year design storm without manhole surcharging. The components of alternative POC-SMRE40-C-0 are summarized in Table SMRE40-5-1.

TABLE SMRE40-5-1: ALTERNATIVE POC-SMRE40-C-0 COMPONENT SUMMARY

POC Sewershed	Diversion Structure ID**	Outfall	Required Improvements	Level of Control (OF/yr)
SMRE-40	DC034E001 DC034N001 DC035M001 DC035P001 DC035S001 DC062C001 DC062C002 DC062D001 DC062K001 DC062K002	015P001	C*	0

*To be achieved via additional conveyance piping, regulator modifications and sewer separation in four locations.

A detailed description of the recommended control alternative, including its flow management design rationale, its hydraulic capacity, any anticipated water quality impacts remaining after implementation, its cost-effectiveness, its O&M requirements, any stream removal projects that may be included, its integration with ALCOSAN WWP and its implementation schedule are included in the following paragraphs.

In many cases, information related to POC-SMRE40-C-4 and/or POC-SMRE40-C-10 is also included for comparison.

5.1 FLOW MANAGEMENT DESIGN RATIONALE

As described in Section 4 of this POC report, the results of the analyses undertaken in support of the *PWSA Feasibility Study Report (October 2008)* were validated by the results of the analyses undertaken in support of the July, 2012 report. Both analyses determined that the optimal method of increasing the level of control of CSO overflows in the SMRE-40 sewershed would be to reduce the number of overflows by separating identified sub-sewersheds and reducing overflow at other diversion chambers by modifying the existing diversion chambers to increase the peak rate of flow to the conveyance system, to the extent necessary to reduce the number of typical year overflows to the desired level, conveying the additional wastewater to the ALCOSAN point of connection. To accomplish this, the PWSA and/or their tributary municipalities must:

- Modify existing diversion structures to achieve desired level(s) of control.
- Construct additional consolidation piping to convey remaining CSOs to the POC.
- Conduct sewer separation in four upstream sub-sewersheds to maximize downstream conveyance.
- Determine the future untreated CSO volumes per typical year.
- Determine the anticipated flow rates to the POC.
- Integrate the recommended control alternative into a POC flow management plan.

5.1.1 Diversion Structure Modifications

As stated above, the Draft Feasibility Study determined that the optimal method of increasing the level of control of CSO overflows in the Plummer's Run Sewershed is to separate combined sewers upstream of selected diversion chambers and to adjust the diversion structure controls at other chambers to reduce the amount of wet weather flows that are diverted from the combined system to the existing storm sewer. Wastewater not diverted from the system would be conveyed to the ALCOSAN point of connection. This would be accomplished by separating identified sewersheds and reducing overflow at other diversion chambers by modifying the existing diversion chambers to increase peak rate of flow to the conveyance system to the extent necessary to reduce the number of typical year overflows to the desired level. The required modifications to the flow diversion settings are determined by the current typical year overflow statistics. Under this approach, CSO controls would be implemented at the PWSA diversion structures and only the flow requiring treatment would be delivered to the ALCOSAN facilities.

Table SMRE40-5-2 presents the changes to the maximum flow rates through each diversion structure required to achieve the 0, 4, and 10 untreated overflows per typical year levels of control. The upstream municipality, the Borough of Dormont did not report that they anticipate significant changes to their systems or the flows generated.

TABLE SMRE40-5-2: POC-SMRE40-C-(0, 4, 10) REGULATOR MODIFICATIONS

Diversion Structure ID	Modification Required	Maximum Flow Rate (mgd)		
		0 OF/yr	4 OF/yr	10 OF/yr
DC034E001	Diversion structure replacement*	15.0	1.1	No Change
DC034N001	N/A	Closed	Closed	Closed
DC035M001	Diversion structure replacement*	49.0	14.0	6.5
DC035P001	N/A	Closed	Closed	Closed
DC035S001	Diversion structure replacement*	1.0	No Change	No Change
DC062C001	N/A	Closed	Closed	Closed
DC062C002	No Change*	No Change	No Change	No Change
DC062D001	Diversion structure replacement*	1.1	No Change	No Change
DC062K001	Diversion structure replacement*	2.0	No Change	No Change
DC062K002	N/A	Closed	Closed	Closed

*The installation of screening is planned for all PWSA diversion structures.

As is indicated in Table SMRE40-5-2, some of the diversion structures currently produce fewer than the control level number of overflows during the typical year. In those cases, sewer separation would not be required but changes to the diversion chamber settings would not be made so as not to increase the current frequency of CSO discharges.

5.1.2 Consolidation Piping / Sewer Separation

The H&H model was employed to assess the ability of the existing trunk sewer system to convey the flows to the SMRE-40 POC that will result from the system modifications. The modeling was accomplished by modifying the model representation of each of the diversion structures to reflect the flow settings for the 0, 4, and 10 untreated overflow levels of control, combined with the 2, 5 and 10-year design storm conditions. The hydrologic response parameters for each of subcatchment areas that are designated for separation were modeled to simulate sewer separation. These nine combinations of hydraulic conditions ranged from the least stringent condition of 10 untreated overflows per year at the 2-year design storm level, to the most stringent condition of zero (0) untreated overflows per year at the 10-year design storm level.

Each level of control will be met by 1) combination of sewer separation to be accomplished through the construction of sanitary sewers in the areas identified for separation and 2) modifying the diversion chambers that will be left in operation to adjust overflows and/or provide screening of overflows. It is anticipated that the required increase in sanitary sewer conveyance capacity will be accomplished by constructing an upsized replacement sewer. Due to the depth of the trunk sewers, and the high traffic, highly developed and congested nature of the area, it is anticipated that the new sewer construction will be accomplished using tunneling/directional drilling techniques. Under this approach the required levels of CSO controls will be achieved at the individual diversion chambers and no changes would be made to the existing storm sewer/outfall culvert relative to capacity.

Assessments of the performance of the existing piping systems, expressed in terms of the hydraulic grade line in the main trunk sewer, were completed for each of the nine conditions. Under this range of operating conditions, it was found that the existing trunk sewer system does not have sufficient capacity to convey the increased flows to the SMRE-40 POC without significant manhole surcharging and flooding. These results validated the findings and recommendations of the *PWSA Feasibility Study Report (October 2008).*

Note that the upstream municipalities of Mt. Lebanon, Baldwin Township and the Borough of Dormont have not reported any plans to modify their systems to reduce their tributary flows.

The general arrangement of the consolidation piping, including required pipe sizes, is presented in Table SMRE40-5-3 and in Figure SMRE40-5-1.

TABLE SMRE40-5-3: POC-SMRE40-C-0 CONSOLIDATION PIPING

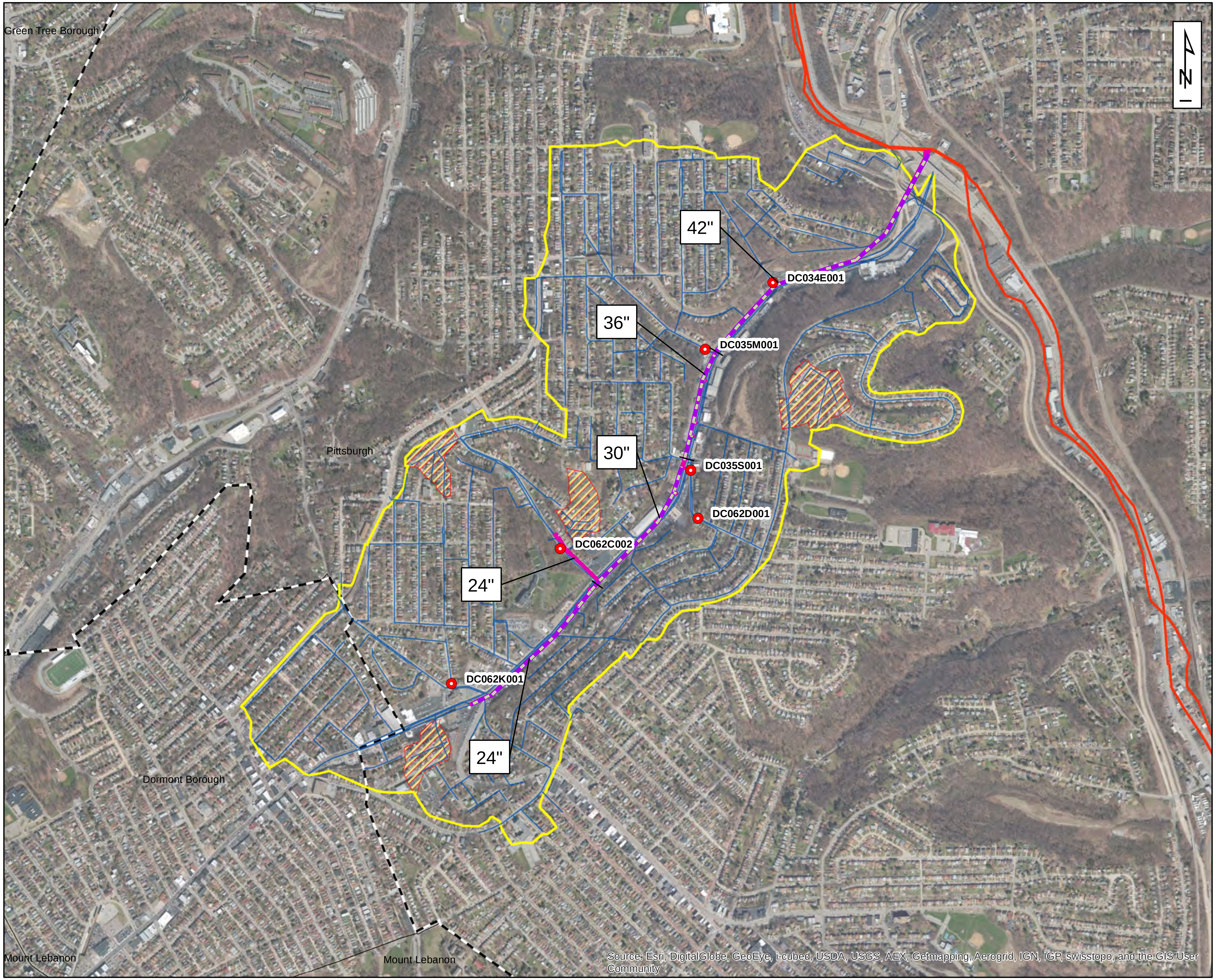
Diameter (in)	Construction Method	Length (ft)
8	Open Cut	6,200
24	Open Cut	660
24	Trenchless	2,189
30	Trenchless	1,650
36	Trenchless	1,179
42	Trenchless	3,250

*Mapping of piping is preliminary; not all pipe diameters/lengths may be included as this time.

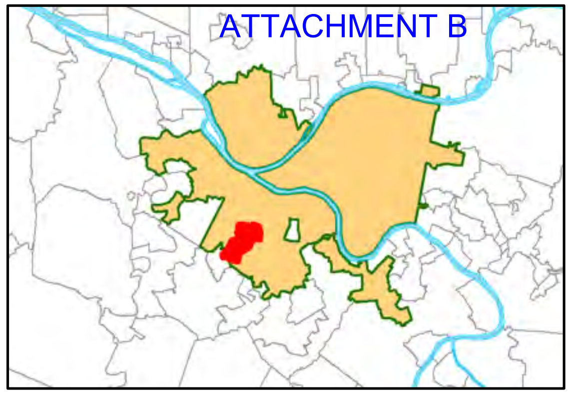
5.1.3 Future Untreated CSO Volumes

Statistics that describe the annual typical year CSO discharge volumes at the zero, 4 and 10 untreated overflow levels of control were developed by modeling the modified system under typical year conditions. Total untreated CSO discharge volumes from each of the PWSA's diversion structures are provided in Table SMRE40-5-4. As a point of reference, the estimated total CSO discharge volume under the existing system configuration is 5.6 MG in the typical year.

ATTACHMENT B



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



PWSA Service Area Overview

Legend

● PWSA Diversion Structure Modification
- - - Relief/Consolidation Sewers (Tunneled)
— Relief/Consolidation Sewers
— Collector Sewer
☐ SMRE-40 Sewershed Boundary
▨ Sewer Separation
- - - PWSA Service Area Boundary
☐ Municipal Boundary
🟦 River

Existing ALCOSAN Interceptor
- - - Deep Tunnel
— Shallow Cut

Figure SMRE40-5-1: POC SMRE40-C-0 Consolidation Piping and Sewer Separation

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\PLUMMERS RUN (SMRE-40)\FIGURE 5-1_SMRE_40_.mxd

TABLE SMRE40-5-4: SMRE-40 SEWERSHED – FUTURE ANNUAL UNTREATED CSO VOLUMES

Diversion Structure ID	Control Alternative Name					
	POC-SMRE40-CS-0		POC-SMRE40-CS-4		POC-SMRE40-CS-10	
	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)	No. of Overflows	Annual Volume (Mgal)
DC034E001	0	0	4	0.3	6	0.3
DC034N001	0	0	0	0	6	0.1
DC035M001	0	0	3	0.6	9	1.4
DC035P001	0	0	0	0	0	0
DC035S001	0	0	0	0	1	0.01
DC062C001	0	0	0	0	3	0.1
DC062C002	0	0	0	0	0	0
DC062D001	0	0	2	0.01	2	0.01
DC062K001	0	0	3	0.02	3	0.02
DC062K002	0	0	0	0	7	0.04
Total Volume		**0**		**0.9**		**1.0**

5.1.4 Anticipated Flow Rates to the ALCOSAN POC

The combination of regulator modifications, additional consolidation piping, and sewer separation will result in increased flow rates and volumes to the SMRE-40 POC. Peak flow rates to the SMRE-40 POC were computed under two scenarios: 1) during the typical year and 2) during the 2-year, 5-year and 10-year design storm conditions.

Typical year peak flow rates associated with alternatives POC-SMRE40-C-0, POC-SMRE40-C-4 and POC-SMRE40-C-10 are presented in Figure SMRE40-5-2. They are presented in terms of the flow rate associated with the number of events that exceed the indicated peak flow rates.

Design storm peak flow rates and volumes conveyed to the SMRE-40 POC during the 2-yr, 5-yr and 10-yr design storm conditions are presented in Table SMRE40-5-5.

FIGURE SMRE40-5-2: TYPICAL YEAR PEAK FLOW RATES TO THE SMRE-40 POC

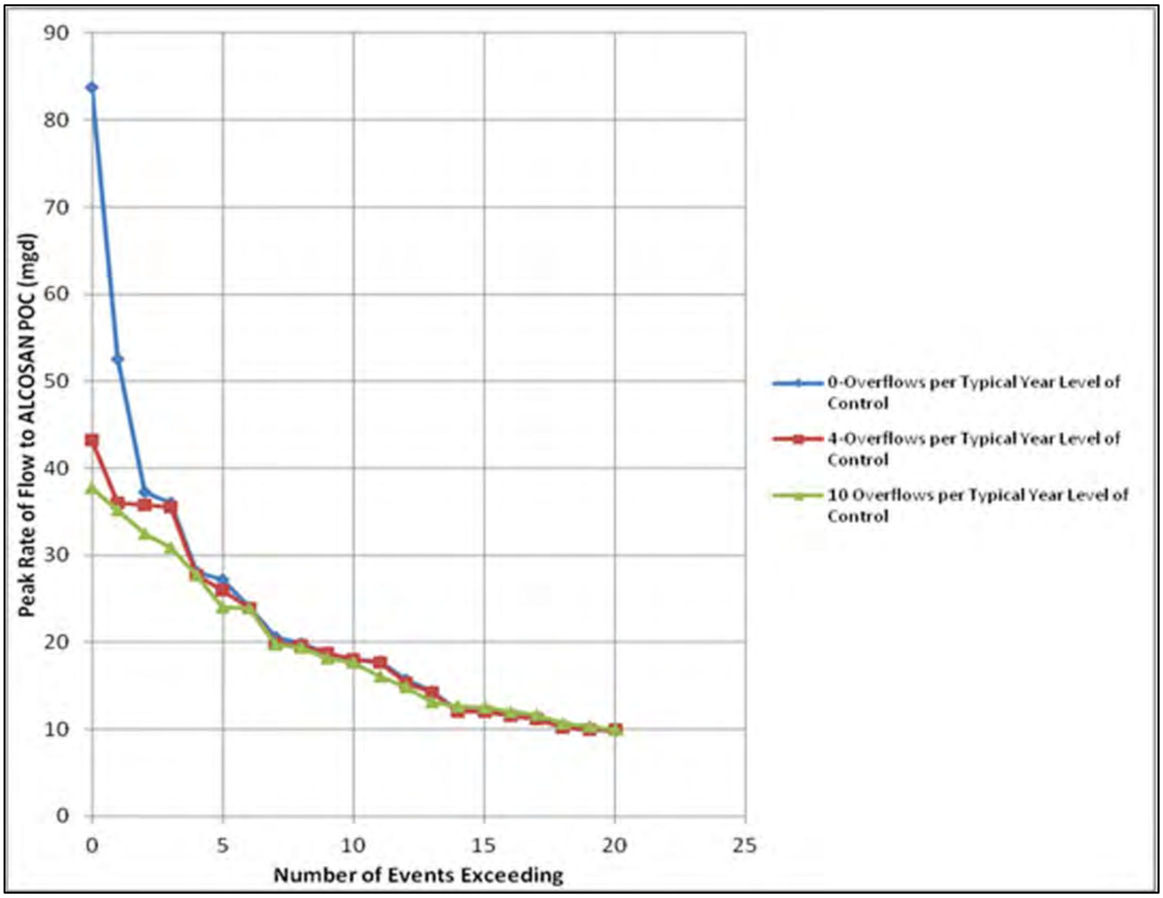


TABLE 5-5: SMRE-40 SEWERSHED DESIGN STORM PEAK FLOWS AND VOLUMES

CSO Control Level	Peak Flow (mgd)			Peak Volume (mg)		
	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm	2-Yr Design Storm	5-Yr Design Storm	10-Yr Design Storm
POC-SMRE40-CS-0	110.3	124.8	134.4	7.4	9.0	10.3
POC-SMRE40-CS-4	67.8	78.4	86.2	6.4	7.5	8.4
POC-SMRE40-CS-10	62.7	75.7	82.9	6.2	7.4	8.2

5.1.5 Recommended Control Alternative Integration

In the spring of 2013, 3 Rivers Wet Weather facilitated a series of meetings between the PWSA and the municipalities tributary to this sewershed. All associated parties in the POC sewershed have participated in these planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements.

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. MOU updates can be found in Addendum SMRE40-6-1.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

5.2 HYDRAULIC CAPACITY OF THE RECOMMENDED ALTERNATIVE

As described above, the existing trunk sewer system does not have sufficient capacity to convey the increased flows resulting from implementation of alternative POC-SMRE40C-0 without significant manhole surcharging and flooding. The PWSA addressed this issue by requiring increases in conveyance capacity to be achieved through the construction of consolidation/relief sewers designed to convey flows associated with zero overflows per typical year, under 2-year design storm conditions (0 OF/yr; 2-yr storm), without manhole surcharging.

The following paragraphs discuss the hydraulic capacity characteristics of the SMRE-40 sewershed, both before and after implementation of the recommended alternative:

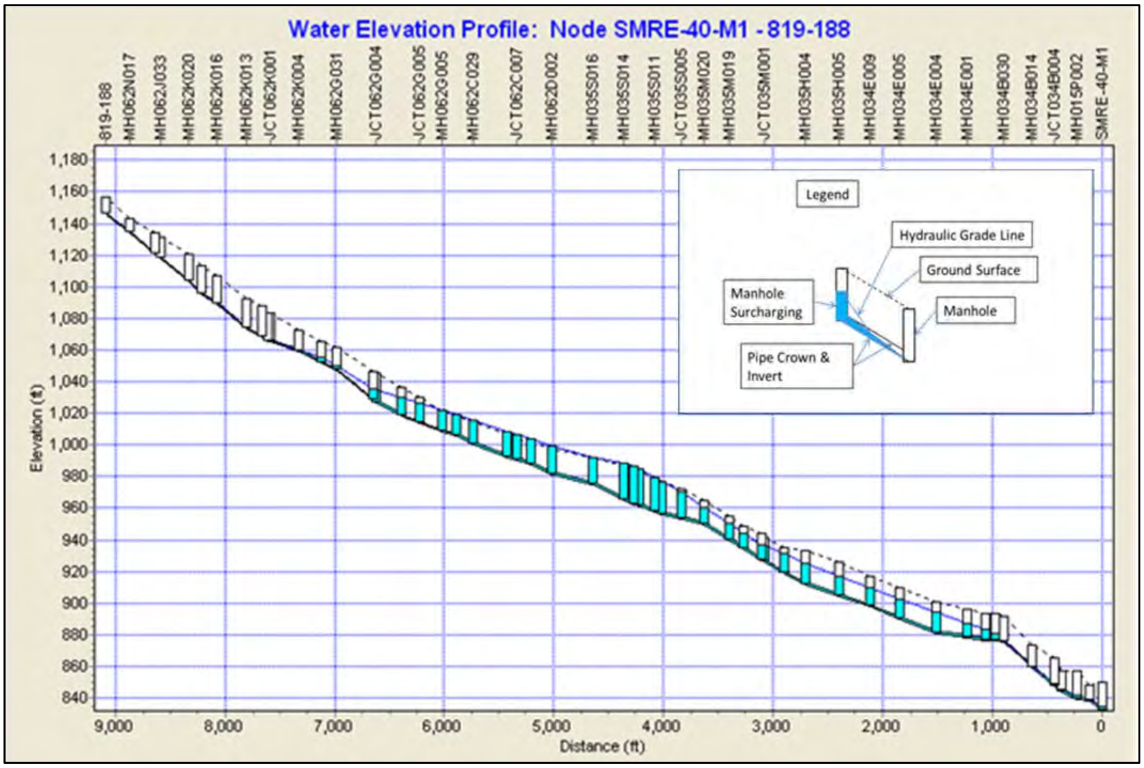
- Peak flow hydraulic grade line (HGL) of the trunk sewer
- 2046 peak flows and volumes to the SMRE-40 POC
- Quantification of I/I
- Variances from the ALCOSAN WWP
- Volume captured, treated or conveyed by tributary municipalities
- Green infrastructure / source reduction plans
- Release rates from storage / retention units

5.2.1 Peak Flow HGLs

Peak flow HGLs along the main trunk sewer, prior to implementation of the recommended alternative, were calculated for the 2-yr, 5-yr and 10-yr storm events. Figures illustrating these HGLs were included in the July 2012 report; Figure 3 from that report presented profiles of the main trunk sewer under existing conditions / mode of operation and peak 2-yr design storm conditions. The figure is reproduced below as Figure SMRE40-5-3. Under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging and manhole flooding occurs along the length of the trunk sewer.

The HGL along the main trunk sewer following implementation of alternative POC-SMRE40-C-0 has not been plotted. However, the design of the additional conveyance piping was contingent upon that conveyance being able to convey the flows associated with zero overflows per typical year, under the 2-year design storm condition, without manhole surcharging. Thus, modification of the diversion structures combined with additional conveyance capacity (0 OF/yr; 2-yr storm) will satisfactorily reduce manhole surcharging and manhole flooding along the length of the trunk sewer.

FIGURE SMRE40-5-3: SMRE-40 UPPER MAIN TRUNK SEWER HGL (EXISTING CONDITIONS)



As is indicated in Figure SMRE40-5-3, under the current system configuration, including existing CSO diversion chamber settings, extensive manhole surcharging, including manhole flooding occurs along a significant portion of the trunk sewer.

5.2.2 2046 Peak Flows and Volumes to SMRE-40 POC

Throughout the PWSA's wet weather planning process, close coordination was maintained with ALCOSAN as well as with the communities tributary to each POC sewershed. This coordination allowed the PWSA to continually integrate known municipal planning information into their control alternatives, and also allowed ALCOSAN to integrate known PWSA planning information into their WWP.

If a municipality was unable to provide planning information, the PWSA made the conservative assumption that the municipality would "Convey all Flows" to the PWSA system. ALCOSAN made similar assumptions[1], and once flows had been

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[1] ALCOSAN WWP: Table 9-68: Summary of System-Wide Alternatives Evaluated.

conveyed to the ALCOSAN POC, ALCOSAN would assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

5.2.3 Quantification of I/I

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, sewer separation, as well as additional consolidation piping to convey increased flows to the SMRE-40 POC. It is not anticipated that these modifications will have much, if any, effect on future levels of I/I within the SMRE-40 sewershed.

The PWSA's plans related to the future implementation of GI and/or other source reduction are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.4 Variances from ALCOSAN WWP

ALCOSAN's recommended improvements were developed to provide a level of control associated with 4 untreated overflows per typical year. This contrasts with the PWSA's water quality based decision to recommend a zero OF/yr level of control within the Saw Mill Run planning basin.

However, the control alternatives developed and evaluated by both entities, at all levels of control, assumed that the PWSA would convey all flows to the ALCOSAN POC and that ALCOSAN would accept those flows. In that respect, the PWSA's recommended alternative does not vary from ALCOSAN's WWP. ALCOSAN intends to retain, store, convey and/or treat all flows delivered to the SMRE-40 POC.

5.2.5 Volume Captured, Treated or Conveyed by Tributary Municipalities

Information received to date from the Borough of Dormont indicates that they plan to convey all their flows to the SMRE-40 trunk sewer for the duration of the planning period. They have no plans to implement controls that would alter the modeled flows upon which the recommended alternative was based. This information is summarized in Table SMRE40-5-6.

TABLE SMRE40-5-6: SMRE-40 – FUTURE FLOWS FROM TRIBUTARY MUNICIPALITIES

Tributary Municipality	Volume*		
	Captured	Treated	Conveyed
Borough of Dormont	N/A	N/A	All modeled flows

*Following implementation of recommended alternative.

5.2.6 Green Infrastructure / Source Reduction Plans

Implementation of the recommended alternative involves modifications to existing diversion structures to achieve zero overflows per typical year, sewer separation, as well as increased conveyance piping to convey increased flows to the SMRE-40 POC. Although PWSA's goal is ultimately to use GI to manage to wet weather flows to the maximum appropriate extent, the recommended alternative, as currently constituted, does not include specific GI or source reduction components.

The purpose of this Feasibility Study is to present a baseline plan that is capable of achieving the PWSA's water quality objectives. However, this is a long-term plan and the PWSA intends to utilize an Adaptive Management approach to manage the overall program. The currently recommended baseline plan will be periodically reviewed to identify areas where GI, source reduction and/or watershed-based controls can be implemented cost-effectively.

As part of the overall adaptive management approach, the PWSA is currently investigating the potential for incorporating Integrated Watershed Planning (IWP) during the first four years of the plan. IWP would include GI demonstration projects. The IWP process will assess impaired water body pollutant sources to optimize possible solutions that may consist of a combination of gray, green, and watershed-based controls. IWP aims to identify effective solutions that may supplement or replace gray infrastructure needs, while still mitigating water body impairments.

As the primary flow contributor within this sewershed, the PWSA intends to extend the incorporation of IWP to the entire sewershed. The PWSA will continue to encourage their tributary municipalities to examine the use of GI, source control and/or watershed-based controls within their own portions of the sewershed. Details on the PWSA's plans regarding the future implementation of GI and/or other source reduction methods are discussed in Section 9 of the Wet Weather Feasibility Study.

5.2.7 Release Rates From Storage / Retention Units

There are no storage / retention units included in the recommended alternative.

5.3 WATER QUALITY IMPACTS AFTER IMPLEMENTATION

The PWSA's recommended alternative includes a combination of regulator modifications and additional consolidation piping designed to control CSOs from the PWSA diversion structures to zero overflows per year. Implementation will also result in the conveyance of increased flows and volumes to the SMRE-40 POC. At that point, ALCOSAN will assume the responsibility to retain, store, convey and/or treat those flows as appropriate.

The full water quality benefits of implementing the recommended alternative will be realized once both the PWSA and ALCOSAN controls have been implemented. Remaining water quality impacts in Saw Mill Run and Plummer's Run due to CSOs would only occur during rain events that exceed those of the typical year.

5.4 COST EFFECTIVENESS

The ALCOSAN Alternative Costing Tool (ACT) was used to estimate costs of the control alternatives based upon the various cost components included in each alternative. The cost components included in alternative POC-SMRE40-C-0 are consolidation piping (including sewer separation), CSO screening facilities, and diversion structure modifications. A knee-of-the-curve analysis that compared typical year annual untreated overflow volumes of alternatives against the present worth cost of the alternatives was also completed.

The results of the ACT cost estimating process may be found in Attachment SMRE40-5-1.

5.4.1 Consolidation Piping / Sewer Separation

In the SMRE-40 sewershed, additional conveyance capacity was provided through upstream sewer separation to convey flows to the SMRE-40 POC. As detailed earlier, relief sewers were added to areas of the system that exhibited manhole flooding or surcharging at any time during the 24-hour design storm events. All improvements added to the model were designed to eliminate surcharging in both the existing sewer and relief sewer.

Significant parameters within the ACT used to calculate main and collector sewer costs were determined as follows:

- Length – Measured from the improvements in the model
- Diameter – Determined from the model runs to eliminate surcharging
- Pipe Material – CL V
- Average Depth to Invert – Assumed 12-ft
- Pavement Type – 8-in Bituminous
- Utility Crossings – Assumed a crossing approximately every 500-ft
- Street Width – 30-ft
- Number of Manholes – Assumed manhole approximately every 300-ft
- Street Opening and Restoration Type – Complete
- Sidewalk and Curb Restoration – Assumed restoration on one side of street
- Other values included in the cost – Trench excavations and backfill, rock excavation, trench wall support, street opening, clearing and grubbing, street restoration, flow maintenance, traffic maintenance.

5.4.2 CSO Screening Facilities

It was assumed that each outfall location will receive screening prior to discharging. The unit cost associated with the installation of each screening facility was assumed to be $250,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $450,000.

5.4.3 Diversion Structure Modifications

It was assumed that adjustments to existing regulator settings, including more effective and improved methods of flow control and monitoring, improved access, etc., would be sufficiently extensive as to make it more cost effective to simply replace each structure. The unit cost associated with the installation of each new diversion structure was assumed to be $200,000. After the addition of contingencies, non-construction costs etc., the current year capital cost for each structure was approximately $360,000.

5.4.4 Knee of the Curve Analysis

The costs of improvements, as compared to the resulting remaining annual CSO volumes at zero, 4 and 10 untreated overflows per year, are illustrated in Figure SMRE40-5-4. This figure compares typical year annual untreated overflow volumes of each alternative against the present worth cost of each alternative, under the 2-yr, 5-yr and 10-yr storm scenarios. No discernible "knee of the curve" is evident from this data.

These costs are also presented in a tabular format in Table SMRE40-5-7.

The selected level of CSO control - 0 OF/yr - was determined based upon water quality considerations. The selection of the 2-year design storm design condition for trunk sewer sizing was made to maintain consistency with the ALCOSAN WWP and most other municipalities in the region.

The capital improvements to be included in alternative POC-SMRE40-C-0 are summarized in Table SMRE40-5-8. Current year capital costs have been included in the table, as they will be used to determine capital cost allocations between participating municipalities.

FIGURE SMRE40-5-4: SMRE-40 COSTS OF IMPROVEMENTS VS. ANNUAL CSO VOLUMES

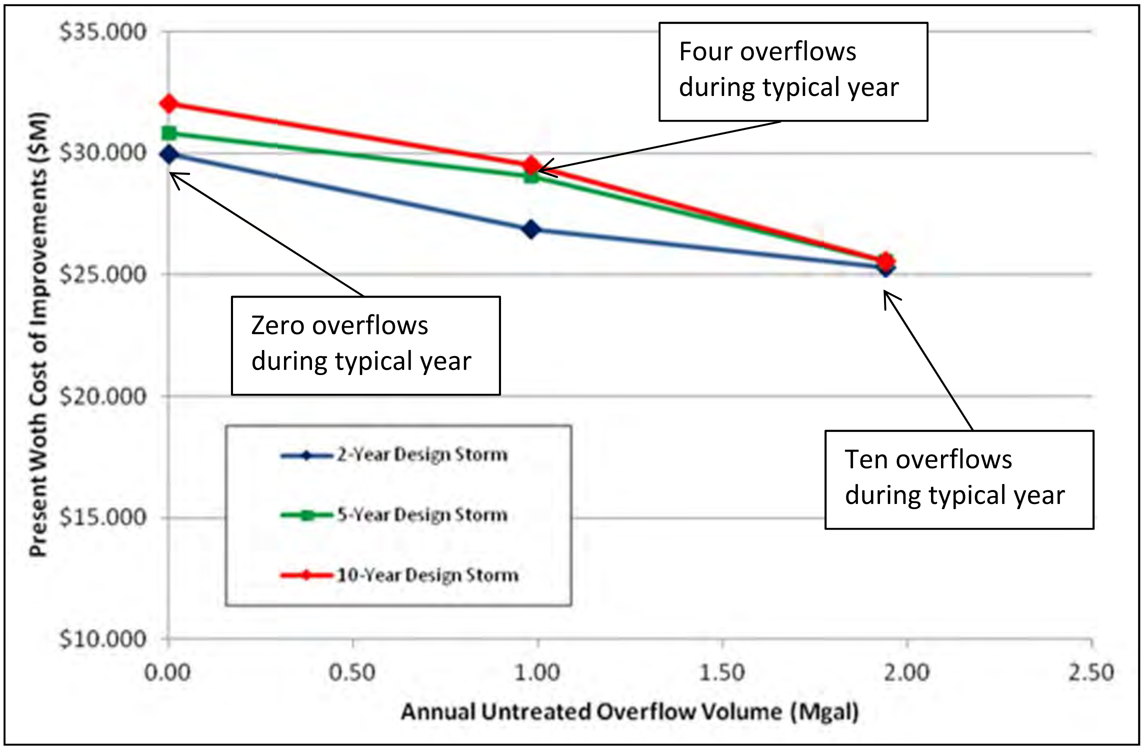


TABLE SMRE40-5-7: SMRE-40 ALTERNATIVE PRESENT WORTH COSTS

Alternative Name	CSO Control				
	Untreated CSO Volume (MG)	**CSO Control Level (OF/yr)**	**PW Capital Cost ($MM)**	**PW O&M Cost* ($MM)**	**TPW CSO Control ($MM)**
POC-SMRE40-CS-0	0	0	$29.5	$0.4	$29.9
POC-SMRE40-CS-4	1.0	4	$26.5	$0.4	$26.9
POC-SMRE40-CS-10	1.9	10	$24.9	$0.4	$25.3
Alternative Name	**SSO Control**				
	Untreated SSO Volume (MG)	**SSO Control Level**	**PW Capital Cost ($MM)**	**PW O&M Cost ($MM)**	**TPW SSO Control ($MM)**
POC-SMRE40-CS-0	0	2-year	$0	$0	$0
POC-SMRE40-CS-4	0	2-year	$0	$0	$0
POC-SMRE40-CS-10	0	2-year	$0	$0	$0

*Rehabilitation and repair (R&R) costs were not calculated.

TABLE SMRE40-5-8: SUMMARY OF CAPITAL IMPROVEMENTS FOR POC-SMRE40-C-0

Capital Improvements	Size/Capacity	Current Year Capital Costs ($MM)	Present Worth Capital Cost ($MM)	Total Present Worth ($MM)
Close diversion structures: DC034N001 DC035P001 DC062C001 DC062K002	N/A	$0.00	$0.00	$0.00
Replace diversion structures: DC034E001 DC035M001 DC035S001 DC062D001 DC062K001	0 OF/yr Each	$1.80	$1.80	$1.82
Add screening to diversion structures: DC034E001 DC035M001 DC035S001 DC062C002 DC062D001 DC062K001	1.0 to 49.0 mgd overflow rates	$2.70	$2.70	$2.73
Conveyance Piping (Open cut)	8-in dia.	$6.04	$6.04	$6.18
Conveyance Piping (Open cut)	24-in dia.	$0.65	$0.65	$0.67
Conveyance Piping (Trenchless)	24-in dia.	$4.34	$4.34	$4.39
Conveyance Piping (Trenchless)	30-in dia.	$3.46	$3.46	$3.50
Conveyance Piping (Trenchless)	36-in dia.	$2.63	$2.63	$2.66
Conveyance Piping (Trenchless)	42-in dia.	$7.92	$7.92	$8.00

5.5 RECOMMENDED ALTERNATIVE OPERATION AND MAINTENANCE

For the purpose of submitting this Feasibility Study, the PWSA and their tributary municipalities have agreed that the basis of allocation for future operation and maintenance costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of each applicable component or components of the recommended alternative.

5.6 STREAM REMOVALS

No stream removal projects have been identified by any of the municipalities within the SMRE-40 sewershed.

5.7 INTEGRATION WITH ALCOSAN REGIONAL WET WEATHER PLAN

PWSA coordinated with ALCOSAN during their respective plan development processes. PWSA also reviewed ALCOSAN's most recent draft of the Regional Wet Weather Plan in late 2012, in part to ensure that the final wet weather plan recommendations are compatible with the PWSA recommendations.

The proposed complete regional wet weather plan, referred to in ALCOSAN's plan as the "Selected Plan", consists of wastewater treatment plant (WWTP) improvements, a regional tunnel that generally extends parallel to the existing interceptors up the Allegheny, Monongahela, and Ohio Rivers, cross-connections between the regional tunnel and existing interceptor, parallel relief sewers and a storage tank along Chartiers Creek, parallel relief sewers along Saw Mill Run, storage tanks along Turtle Creek, and all the planned tributary municipal improvements.

According to the ALCOSAN Wet Weather Plan, the wastewater flow will continue to flow from the PWSA system to the existing ALCOSAN interceptor via the existing POCs. The difference is that some of the POCs will have their outfalls connected to a portion of the "Selected Plan" through another regulator diverting flow to a tunnel drop shaft, to a consolidation sewer that leads to a storage tank or other means. This is intended to allow a large portion of the overflow to drain directly into the new

wet weather facilities which would reduce or eliminate the amount of overflows discharging to receiving water and meet or exceed the control limits. The remaining POCs that will not drain directly to a new regional wet weather facility will have minor regulator modifications to reduce overflows to the extent possible. The cross connections between the new and existing tunnel systems is intended to relieve the existing tunnel by allowing flows into to the new tunnel, thus providing more capacity in the existing interceptor with the intent of accommodating the increased flows from the sewershed. According to the ALCOSAN Wet Weather Plan, after the regional plan (Selected Plan) is implemented, the POC SMRE-40 overflow is not intended to be connected to the new ALCOSAN relief tunnel.

5.8 IMPLEMENTATION SCHEDULE

According to the ALCOSAN WWP, although ALCOSAN ultimately suggests the “Selected Plan” to meet the Consent Decree requirements, ALCOSAN is acknowledging that certain challenges in implementing the complete plan by the 2026 deadline. Consequently, ALCOSAN proposes in the WWP an initial phase of the Selected Plan, which ALCOSAN calls the “Recommended Plan”. This initial phase would be implemented by 2026. An implementation schedule of the remaining portions of the “Selected Plan” is not specified in the plan. This Recommended Plan contains a portion of the intended WWTP improvements, portions of the regional tunnels along the three rivers, and a relief sewer and RTB along Chartiers Creek. The ALCOSAN plan schedule includes the municipal improvements being completed by 2026, but is only included for reference purposes. The WWP acknowledges that the schedule of municipal improvements is controlled by the municipality/ agency.

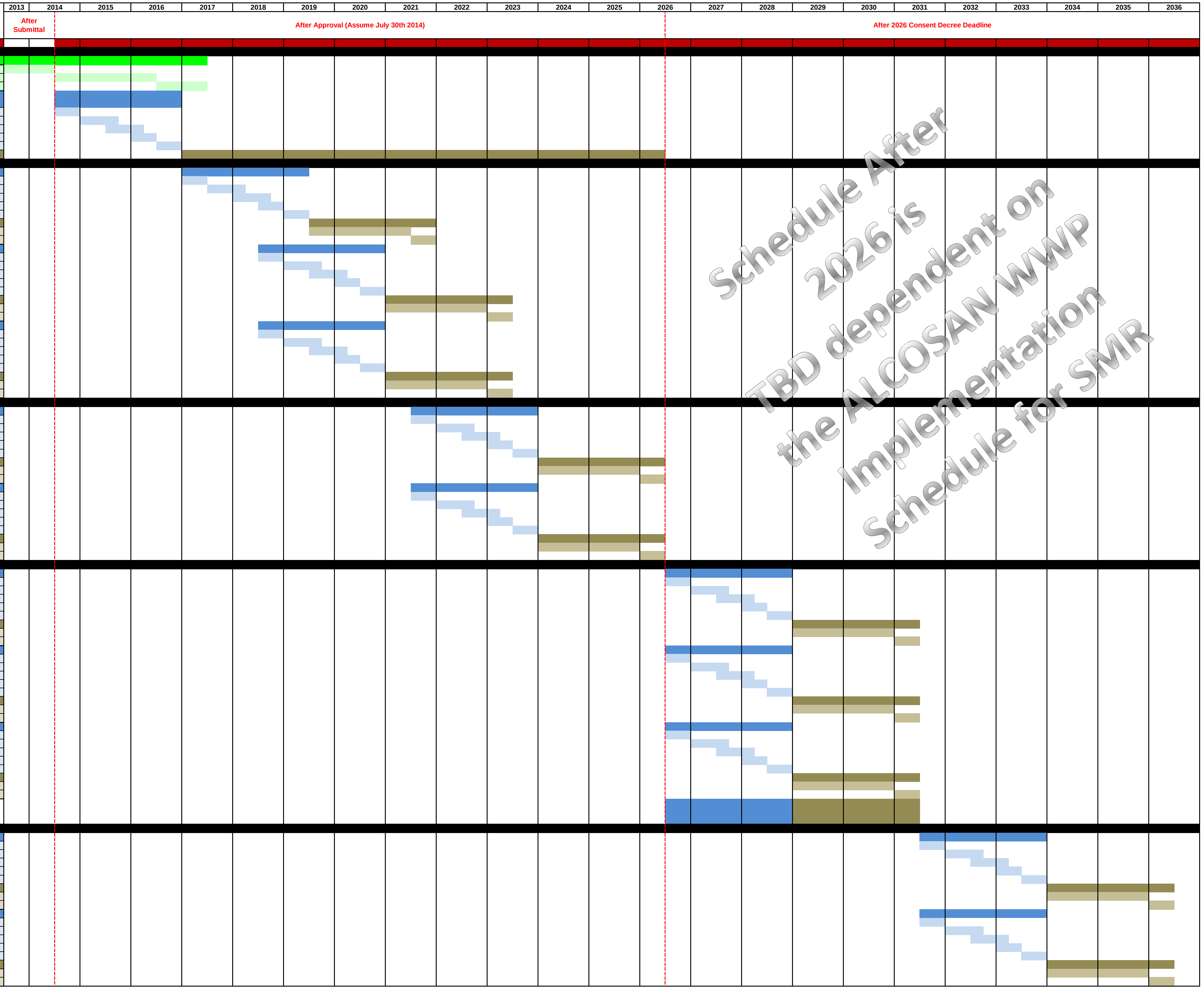
The PWSA plans to coordinate closely with the implementation schedule of the regional alternatives. Since the PWSA improvements are intended to increase the amount of flow that can discharge to the ALCOSAN POC, it’s important to ensure that the ALCOSAN system downstream of the POCs have the capacity to retain, store, convey and/or treat the flows delivered from PWSA. Also it is recommended that the PWSA improvements be up and running as soon as possible after the ALCOSAN improvements are in place to see the benefits of the system improvements as soon as possible. Therefore, the schedule is made with the construction of the PWSA improvements dovetailing the ALCOSAN capacity improvements within the portions that ALCOSAN is constructing.

According to the ALCOSAN WWP, the SMR portion of the regional plan is not being implemented by 2026, and an implementation date is not specified in the plan. Therefore, an implementation schedule for SMRE-40 improvements cannot be specified at this time as it depends on the ALCOSAN WWP' SMR implementation schedule. The deadline shown in the schedule for SMRE-40, which is shown in Figure SMRE40-5-5, is for reference purposes only.

ATTACHMENT B

FIGURE SMRE40-5-5: PWSA IMPLEMENTATION PLAN

POC/ Sewershed	SubSystem	Improvement Description	PWSA Capital Cost Distribution ($Million)	Task	Start Date	Duration
All		N/A		Task 1 - Meetings and Project Management	Aug-14	10 years
Phase 1			54.1			
All	Multiple	N/A	9.6	Task 2 - Adaptive Management Plan	Aug-13	4 years
				Project Planning and Coordination		1 yr
				Project Implementation, Manual Development		2 yrs
				Project Assessment and Plan Development		1 yr
All	Multiple	49 Diversion Chamber Modification 54 Screen (Includes all of M-34/ Becks Run, MH-55/ Timberland St. disconnection, MH-80/ Englart St., and MH-89 Weymans Run)	44.5	Design, Permitting, Public Bid	Aug-14	2 yrs, 5 months
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-17	Within 9.5 yrs
Phase 2			27.6			
C-25/ Bells Run	Chartiers-Glen Mawr	Parallel Relief Sewer (~12,900LF)	8.8	Design, Permitting, Public Bid	Jan-17	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-19	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-51/ East Street	Allegheny North	New Pipe for Sewer Separation 8" (~3,100LF), CSO Pipe 12'x4' (~140LF)	3.3	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
A-42/ Negley Run & Upper Nine Mile Run	Allegheny South	Underground Storage Tank w/ Pump Station and Screens (2.25 MGD); Relief Sewers (~4,000LF)	15.5	Design, Permitting, Public Bid	Jan-20	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-22	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 3			21.7			
M-42/ Streets Run	Monongahela - Ohio	Parallel Relief Sewer (~37,100LF)	5.1	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
M-47/ Nine Mile Run	Monongahela - Ohio	Parallel Relief Sewers, tunnels, and pipe upsizing (~25,000 LF total)	16.6	Design, Permitting, Public Bid	Jul-21	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jan-24	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
Phase 4			31.5			
Misc (MH-77, S-23)	Saw Mill Run	Parallel Relief Sewer (~5,200 LF)	5.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-11/ McCartney Run	Saw Mill Run	Parallel Relief Sewers (~4,400 LF)	2.4	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
SMRE-40/ Plummers Run	Saw Mill Run	Parallel Relief Sewer (~15,000 LF)	23.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
MH-89/ Weymans Run	Saw Mill Run	Parallel Relief Sewer	0.3	Primary work in this POC to be lead by Whitehall Borough. Refer to Whitehall's MH-89 POC report for more details.		
Phase 5			25.8			
MH-18/ Little Saw Mill Run	Saw Mill Run	Parallel Relief Sewer (~15,600 LF)	16.6	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months
S-15/ McDonoughs Run	Saw Mill Run	Parallel Relief Sewer (~14,400 LF)	9.2	Design, Permitting, Public Bid	Jan-27	2.5 yrs
				Task 3 - Funding and Public Coordination		6 months
				Task 4 - Preliminary Design (w/ property acquisition)		9 months
				Task 5 - Final Design		9 months
				Task 6 - Permitting (Including ACT 537 submittals)		6 months
				Task 7 - Public Bid/ Contract Award		6 months
				Construction, Closeout	Jul-29	2.5 yrs
				Task 8 - Construction Phase		2 yrs
				Task 9 - Commissioning and Closeout		6 months



Schedule After 2026 is TBD dependent on the ALCOSAN WWP Implementation Schedule for SMR

6.0 FINANCIAL AND INSTITUTIONAL CONSIDERATIONS

This section presents the requirements, goals, and process for resolving financial and institutional considerations in regards to implementing the selected system improvements for the SMRE-40 sewershed. These considerations include Cost Allocation and Inter-Municipal Agreements between the stakeholder municipalities: Dormont Borough and the Pittsburgh Water and Sewer Authority. Other considerations regarding the SMRE-40 improvements addressed in this section include the implementation schedule, the plan to meet regulatory and/or institutional reporting obligations, funding alternatives, estimated annual cost per household, and affordability.

6.1 COST ALLOCATION

The PWSA and their tributary municipalities have entered into a Consent Order and Agreement (COA) with the Pennsylvania Department of Environmental Protection (PADEP) and/or an Administrative Consent Order (ACO) with the Allegheny County Health Department (ACHD). As such, the PWSA is required to prepare and submit a Feasibility Study by July 31, 2013. The preparation of the Feasibility Study will require the coordination and cooperation of all the municipalities.

To this end, the municipalities have agreed that the recommended control alternative will be proposed to provide the system improvements required by the COA and/or ACO. In addition, the proposed level of control is the "2-year design storm" for the municipal separate sanitary system portions and "4 OF/ typical year" for the PWSA's combined system outside of Saw Mill Run where "0 OF/ typical year" is proposed.

A set of guiding principles were produced for use in developing cost allocation procedures. These principles form the basis of a DRAFT Memorandum of Understanding by and between Dormont Borough and The Pittsburgh Water and Sewer Authority, and include:

- The major goal is to develop a fair and equitable cost allocation process.
- One municipality's share of the cost of the project should be directly proportional to the level to which their flows contribute to the cost of the project.

- Cost allocation should allow for an individual municipality's system improvement(s) – such as GI and Source Reduction.

- Cost allocations should be simple and easy to calculate in the future.

- The final cost allocation methodology should encourage efficiencies between municipalities.

- A properly calibrated H&H Model, with future agreed upon improvements, should be used as a basis for estimating flows.

- Unless agreed to by all parties, existing contracts should not form the only basis for cost allocations.

6.1.1 Cost Sharing Concept and Method

Two distinctive categories of cost allocations will need to be addressed by the PWSA and their tributary municipalities: capital cost allocations and O&M cost allocations. A number of methods for capital cost allocation were considered, based on the following:

- "Agreed upon" basis

- Capacity basis

- Expected annual flow contribution

- Proportion of internal municipal costs

All of these approaches could be modified by the addition of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc. The following discussion describes each of these methodologies.

"Agreed Upon" Basis: This approach could be as simple as each party agreeing to a fixed share of each element of cost or all costs across the board. Negotiation of the basis of the percent share is left to the discretion of the involved parties. Shares could be fixed for the term of the agreement, or they could be adjustable on a scheduled or otherwise agreed to basis. This approach is usually successful where

there are existing agreements or a long history of collaboration between the affected parties.

Capacity Basis: Capacity based cost sharing is predicated on the design capacity of the shared facilities and the portion that is allocable to the various parties to the Agreement. For the types of facilities being evaluated, wet weather flow rate and volume would be the primary capacity parameters. A Design Engineer's Report, normally submitted as part of the construction permitting process, should clearly specify and set forth the flow rate and volumetric design basis, as well as the capacity needs associated with all municipal entities. This information can serve as the basis for pro rata distribution of cost elements such as Debt Service and initial costs. One issue that should be addressed is how and whether unused and/or excess capacity utilized by "others" will be subject to cost reimbursement.

Expected Annual Flow Contribution: This method would utilize estimated flow rates for a predetermined average year as the basis for the evaluation of cost allocations. This may work well for systems where a hybrid approach of wet weather flow rate and volume is desired.

Proportion of Internal Municipal Cost: This approach requires municipalities to evaluate their own internal projects. This evaluation would include outlining control alternatives and selecting the highest ranked alternative for their internal solution. The municipalities' share of the combined project becomes a "not-to-exceed" or proportional value of its internal cost to the total regional cost.

6.1.2 Evaluation and Selection of Capital Cost Allocation Methodology

Four sewersheds were selected by 3RWW and their PM Team as pilot sewersheds for cost allocation evaluations. Monthly meetings were held at which the meeting attendees selected the methodologies that they thought were appropriate, and the 3RWW/PM Team provided the necessary statistics for use in evaluating and selecting the best methodology.

Statistics intended to support the various allocation methodologies were developed and discussed with each POC participant. Over the course of several meetings, the major point of discussion was the identification of ways to ensure the allocation was fair and equitable by assigning the costs proportionally to the cost-causative items. In addition, participants agreed with the idea that it would not be fair for

downstream municipalities pay for upstream sections of the project, given that they did not contribute flows directly into that sewer.

Following these discussions, the first decision regarded the need to use peak wet weather flows as the basis for the cost allocation. The PM Team evaluated three main types of peak flow based analysis:

Percentage of Flow at POC: In this approach, the total flows at the POC and at each connection point tributary to the POC are obtained from the H&H Model. The flow rate for each connection point is then divided by the total POC flow to obtain its ratio. This represents the connection point's portion of the total cost of the regional project. It should be noted that portions of the project dedicated to a single municipality would be subtracted from the total cost of the regional project.

Percentage by Length of Use: In this approach, the distance from the POC is used as a "weighing factor" in the cost allocation calculation.

Segmental: In this approach, areas that are tributary to a project or a portion of a project would divide the cost based on peak wet weather flow rates from each tributary area.

In all of the cost allocation procedures, the use of the calibrated ALCOSAN H&H Model was the accepted tool for determining peak flow rates. In some cases where two or more municipalities were combined into one loading point, the agreement was to use the model to affect the required split through RTK and area adjustments (if separate) and area adjustment (if combined).

6.1.3 Operation & Maintenance Cost Allocation

In the development of O&M cost allocation methods, it is important to define what constitutes O&M. The following is a general list of those items considered for each POC sewershed:

- Sewer Inspection
- CCTV and cleaning
- Utilities and power requirements for pump stations and storage basins
- Chemical costs for CSO facilities

- Minor repair and rehabilitation
- Staff salaries, wages and fringe benefits
- Replacement costs (sewers and structures - 100 years; mechanical equipment – 25 years)
- SSO Response Plan

The next step was to categorize these expenses into at least groups – those items impacted by peak flow (such as CCTV and sewer cleaning) and those items impacted by volume of wastewater (such as storage basins). Once categorized, various methodologies for O&M cost allocation could be investigated. A number of approaches to O&M cost allocation were considered, and three of those chosen for capital cost allocation were also chosen for O&M cost allocations:

- "Agreed upon" basis
- Capacity basis
- Expected annual flow contribution

As was the case for the capital cost allocation methods, each of these approaches can be modified by the application of various weighting criteria or "refining components". These refining components are items used to correct for various factors such as: ownership of existing sewer lines, proximity to the POC connection point, etc.

6.1.4 Selected Capital Cost Allocation Method

The selected method of capital cost allocation between the PWSA and their tributary municipalities is based upon the use of peak wet weather flows, as determined using the segmental approach.

Using this approach, areas of each municipality tributary to a section of new consolidation / conveyance piping would divide the cost based on peak wet weather flow rates from each municipal tributary area. The calibrated ALCOSAN H&H Model was the accepted tool for use in determining those peak flow rates.

For the purposes of this Feasibility Study, alternative POC-SMRE40-C-0 has been divided into four (4) segments. Three (3) of these segments receive flows from

Dormont Borough, and are subject to the allocation of capital costs. The remaining segment conveys flows generated solely by the City of Pittsburgh. General locations of the four (4) inter-municipal segments of the recommended alternative are illustrated in Figure SMRE40-6-1.

It is anticipated that the conceptual capital cost allocation estimates for each segment will be based on the municipal peak wet weather flow percentages shown in Table SMRE40-6-1.

TABLE SMRE40-6-1: MUNICIPAL PEAK WET WEATHER FLOW PERCENTAGES

Segment	Percentage (%)	
	PWSA	Borough of Dormont
1	37.1	62.9
2	79.4	20.6
3	100	0
4	97.4	2.6

If work is done by a municipality to reduce flow below the flows currently predicted and the municipality wants to revise these percentages, that municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties prior to the commencement of design.

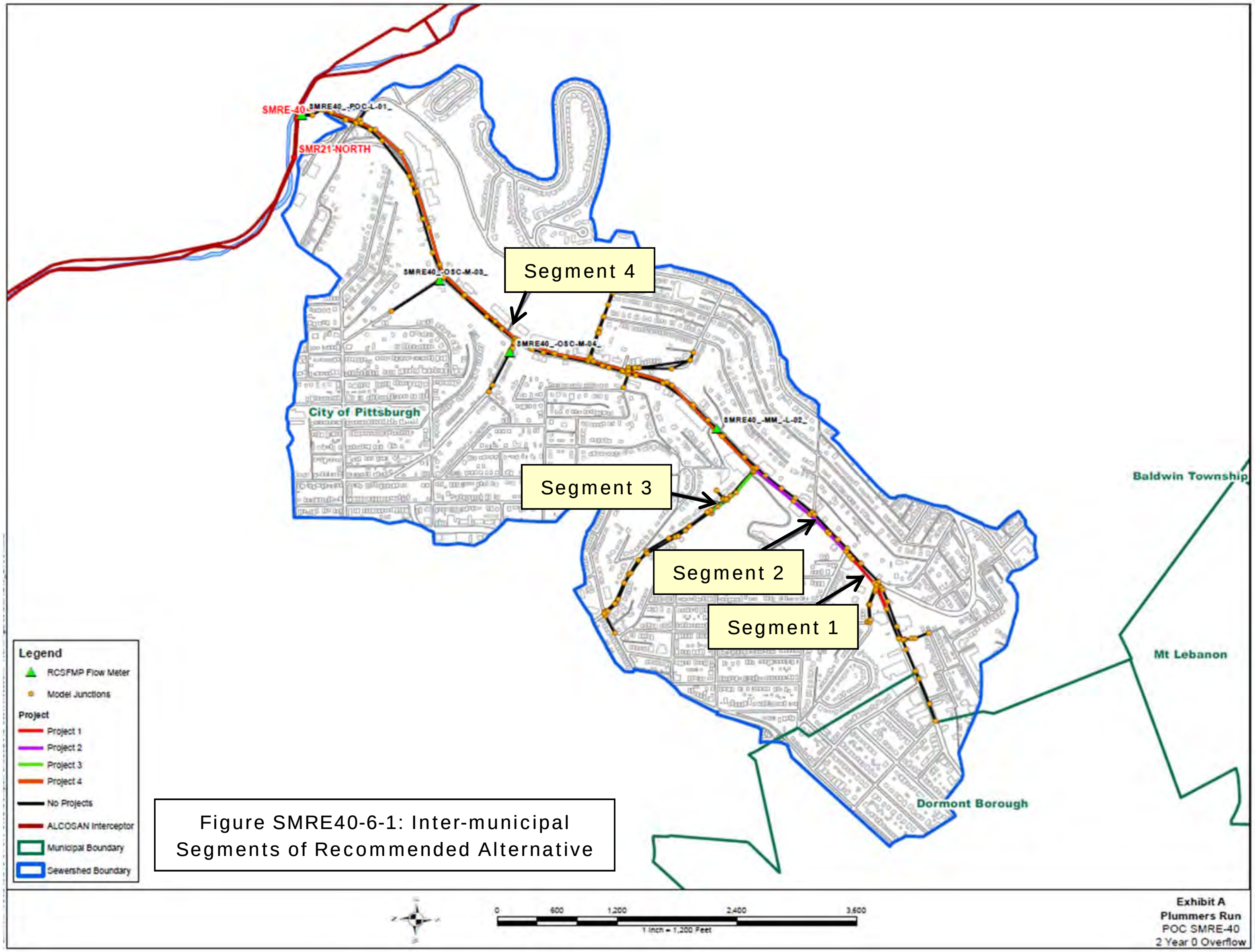


Figure SMRE40-6-1: Inter-municipal Segments of Recommended Alternative

6.1.5 Selected O&M Cost Allocation Method

For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.2 MOU AND INTER-MUNICIPAL AGREEMENTS

One of the early steps taken to facilitate the development of up-to-date and relevant MOUs and/or inter-municipal agreements was to determine whether or not there were any existing, applicable MOUs or service agreements. 3RWW, working with the University of Pittsburgh, collected many of the existing agreements. The FSWG also formed an inter-municipal agreements subcommittee to review those existing agreements, develop an agreement outline for use by the municipalities, and prepare draft agendas for use in multi-municipal meetings.

The various inter-municipal agreements that have been compiled by 3RWW were reviewed for the purpose of summarizing the provisions that are relevant to allowable flow contributions. The results of this review are presented below. All specific references to “sanitary sewers”, “sanitary sewage” or other characterizations of the tributary sewer systems were extracted and presented below. In addition, specific information regarding cost sharing arrangements was also extracted from the agreements and is presented below.

1. In an agreement dated April 6, 1911, the City of Pittsburgh and Dormont Borough reached an agreement. Relevant terms of that agreement are:
    - City permits the Borough of Dormont to drain sewage from a section of the Borough to an existing City sewer on West Liberty Avenue.
    - The Borough agrees “that the sewage drained into the City sewer by the Borough shall be as is known as house drainage only.”
    - The Borough agrees “that the sewers constructed by the Borough on the various streets … shall be sanitary sewers constructed with water-tight joints.”
    - The Borough agrees “that no catch basins shall be connected to the sewers nor shall any roof drainage be permitted to enter the sewers except such as may be permitted by the City for the purpose of flushing said sewers.”

It should be emphasized that this 1911 agreement is not anticipated to be used as the inter-municipal agreement for this project. The draft MOU developed per the following subsections would serve as an initial understanding of what would form a new future agreement between the municipalities.

6.2.1 Development of MOU and Inter-Municipal Agreements

When more than one municipality is involved in the design, construction and operation of wet weather control facilities, it is intended that they will develop inter-municipal agreements to outline their mutual understanding of the project as well as their municipal, customer and legal responsibilities. These responsibilities include, but are not limited to, joint permitting, joint ownership, joint cost sharing, and who will operate and maintain the facility on a long term basis.

In addition, it is the PWSA’s position that any agreements or MOUs should contain provisions for periodic review and amendment as necessary by the respective parties and their solicitors.

6.2.2 MOU and Inter-Municipal Agreements

A Memorandum of Understanding (MOU) has been drafted to document the intent to complete and submit a coordinated Feasibility Study for this sewershed. It is currently being reviewed by each of the parties.

A lead entity was selected to be responsible for the coordination, assembly and preparation of the Feasibility Study. The PWSA was selected as, and has agreed to be, the lead entity for this sewershed.

Each of the other municipalities was responsible for providing the PWSA with supplemental information regarding municipality-specific projects and required improvements. The PWSA, as the lead entity, is relying upon the accuracy and completeness of the information provided by the others.

For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

In summary, the draft MOU states that, for the purpose of submitting the feasibility study, the municipalities agree that the preliminary estimated total cost to be expended on the inter-municipal segments of the recommended alternative, as shown in Figure SMRE40-6-1, is $19,010,000. This cost represents the cost associated with the elements of the required improvements in the sewershed that provide multi-municipal service (i.e. convey or otherwise handle flows generated by more than one municipality). Each municipality shall have the right to void the MOU if the total cost exceeds $22,800,000. The draft MOU also states that the municipalities agree that the basis of allocation for costs of each segment is based on percentage of peak flow contributed to each segment at the time of the MOU, multiplied by the preliminary estimated total cost of each segment agreed to by the municipalities that will share in such costs.

It is intended that an agreement will be entered into by all parties after an implementation order has been issued by the PADEP and/or the ACHD. Such an order would indicate that the cost to each party would be based on the cost of each segment, to be adjusted for changes in costs made during construction.

The draft MOU further states that, for the purpose of submitting the Feasibility Study, the municipalities agree that the preliminary estimate of the percentage and amount of the total cost of implementation of the recommended alternative for each municipality will be as indicated below:

- Dormont Borough 7.7% ($1,470,000)
- The Pittsburgh Water and Sewer Authority 92.3% ($17,540,000)

It is noted that these costs represent the allocated costs for joint conveyance facilities. These costs do not include additional costs that may be associated with other recommended improvements in the sewershed within individual municipalities. The draft MOU is provided in Attachment SMRE40-6-1. Also, signed copies of the MOU, if provided by the municipality, would be provided Addendum SMRE-6-1. PWSA received a signed MOU on behalf of Dormont Borough and POC SMRE-40. A copy of the signed MOU is presented in Addendum SMRE40-6-1.

6.3 IMPLEMENTATION SCHEDULE AND PLANNING

In this section, PWSA provides the plan and schedule for implementing the recommended SMRE-40 system improvements, the process of planning the implementation plan jointly with the tributary municipalities, and the plan to meet regulatory reporting obligations during and after SMRE-40 improvement implementation.

6.3.1 Implementation Schedule

A conceptual implementation schedule for the recommended alternative has been developed that would provide for the construction and implementation of the proposed facilities by the earliest feasible date. Careful consideration was given to the identification of appropriate planning-level project parameters, from which measureable milestones for the flow management and Feasibility Study implementation tasks can be derived. The overall Feasibility Study implementation schedule has been organized by POC sewershed, and has been synchronized with the regional WWP wherever possible.

Typically, design and construction projects require completion of a number of major tasks as they progress from project initiation to project closeout. The major tasks considered during this schedule development process included:

- Funding and public coordination
- Preliminary design (includes siting and property acquisition)
- Permitting
- Final design
- Public bid and contract award
- Construction
- Commissioning and project closeout

Detailed descriptions of these tasks are included in Section 12 of the Wet Weather Feasibility Study.

It is important to realize that the regional WWP proposes that construction of ALCOSAN-owned controls within the Saw Mill Run planning basin be completed after the year 2026. With that in mind, the PWSA has divided the overall implementation schedule into the following five phases:

- Phase I 2013 through 2017
- Phase II 2017 through 2023
- Phase III 2021 through 2026
- Phase IV TBD
- Phase V TBD

Conveyance improvements in all of the Saw Mill Run Basin sewershed have been included in Phase IV and Phase V. The Saw Mill Run Basin conveyance improvements, including SMRE-40, are not scheduled to be implemented before the implementation of the Saw Mill Run portion of the selected ALCOSAN Wet Weather Plan which is not currently scheduled to be completed before 2026. Consequently, the start times for the final 2 phases, which consists of the Saw Mill Run improvements, are contingent with the ALCOSAN Selected WWP schedule after 2026. However, the Saw Mill Run Basin sewersheds are proposed to be the focus of PWSA's Green Infrastructure/Adaptive Management/ Integrated Watershed Planning activities that are scheduled for the first phase of implementation. In addition, the construction of improvements that will provide for the improved performance, effective monitoring and control and screening at all PWSA CSO diversion chambers is proposed for the first three phases of the implementation plan.

The overall implementation schedule, consisting of project milestones derived from the tasks listed above for all the POCs, is depicted in Figure SMRE40-5-5. Each project is grouped by POC except for the diversion structure construction and outfall screen installation which are all grouped and combined into Phase I. A municipal-specific project schedule has not yet been developed within the SMRE-40 shed. For the purpose of submitting this feasibility study, it is intended that the design of the recommended alternative, the responsibility for construction of specific portions of the alternative, ownership of the completed alternative (or portions thereof), and the details of the construction contract(s) will be determined by the municipalities at a future time when the scope and schedule of the overall project is better understood.

ACT 537, the Pennsylvania Sewage Facilities Act was enacted in 1966. The act requires the municipalities within Pennsylvania to develop and maintain an up-to-date system-wide sewage facility plan. The plan identifies existing challenges within the system and recommends immediate and future sewer repair and improvements based on existing and future projected needs. [1]

The sewage plan is updated regularly to reflect new development projects. To update the sewage plan, the final plans of a given project along with cost estimates, implementation schedule and a Component 4A form is submitted for review to Allegheny County Sanitary Authority, the Allegheny County Health Department, the City Planning office. Then once approval of the plan is obtained from these entities, a resolution officially updating the sewage plan is put into the adoption process. Adoption must happen before construction of the project begins.

U.S.EPA CSO Control policy requires a post-construction water quality monitoring program that adequately verifies that after construction, the CSO discharges do not contribute non-compliance of water quality standards and goals. The plan will include but not necessarily be limited to monitoring at the PWSA diversion structure overflows.

6.3.2 Joint Municipal Planning and Implementation

It is the intent of the PWSA and their tributary municipalities to continue to cooperate in the joint planning and implementation of the recommended alternative. The draft MOU contains provisions under which the parties can revise their agreements through demonstrated need.

The ALCOSAN H&H model is the primary means through which an entity can demonstrate their need. It has been accepted as the model to be used to calculate the peak flow capacity rates throughout the sewershed, particularly at each inter-municipal connection point.

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[1] Text is derived from “A Guide for Preparing Act 537 Update Revisions, 2003”.

The specific municipal tasks and efforts necessary to effect implementation of the Feasibility Study involve the completion of the 4 project segments listed above in Table SMRE40-6-1.

All associated parties in the POC sewershed have participated in planning meetings to review and discuss the selected flow management plan and required improvements, associated cost estimates and proposed method of allocating shared costs. While there is agreement on the flow management strategy and the general approach to the allocation of costs, additional time, discussions and negotiations will be required in order to finalize municipal agreements. Signature pages of executed MOUs or other expressions of agreement as provided by the municipalities are attached as Addendum SMRE40-6-1 to this POC report.

6.3.3 Regulatory Compliance Reporting

A discussion of the PWSA's compliance reporting procedures is contained in Section 12 of the Wet Weather Feasibility Study.

6.4 FUNDING ALTERNATIVES

Sources of funding for capital programs and the ability to generate revenues to cover debt and operation and maintenance costs will vary depending on the legal stature of the entity and its ability to issue bonds, levy taxes, assess fees, etc. These considerations are explained in more detail in Section 10 of the Wet Weather Feasibility Study.

The proposed flow management facility funding plan can be summarized as follows:

- Estimated Total Capital Costs (total, 2010 dollars): ~$29,546,000; $19,010,000 of which would be part of the inter-municipal agreement.

- Anticipated funding sources: Municipal Bonds, Federal and/or State assistance

- Projected annual PWSA Wastewater Costs of the system without PWSA or ALCOSAN planned improvements such as Operations and Maintenance and Estimated incremental annual debt service payments: The projection of annual Debt Service payments for the entire PWSA service area is presented in Section 10 of the Wet Weather Feasibility Study.

At this time, there are no long term capital improvements to the PWSA or other municipal collection systems that are not directly attributed to the recommended alternative.

An O&M plan / cost allocation method for the shared facilities has not yet been developed. For the purpose of submitting the Feasibility Study, the Municipalities have agreed that the basis of allocation for future O&M costs is to be determined at a future time. It is anticipated that the affected municipalities will agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the recommended alternative.

6.5 USER COST ANALYSIS

The estimated annual costs per household under current conditions and following implementation of the recommended alternative are shown in Table SMRE40-6-2. The projected costs per household includes the "normal" current and future PWSA and ALCOSAN system charges as well as charges attributed to the PWSA Wet Weather Plan and ALCSOSAN Regional Wet Weather Plan after implementation. Further details are explained in Section 10 of the Wet Weather Feasibility Study.

TABLE SMRE40-6-2: ESTIMATED ANNUAL COST PER HOUSEHOLD

Municipality	Annual Costs		
	Current 2012	First Year After Alternatives are implemented -2027[2]	2046
City of Pittsburgh[3]	$399	$1,113	$1,638
Borough of Dormont	Not Available	Not Available	Not Available

6.6 AFFORDABILITY

The projected costs per PWSA household resulting from the implementation of the PWSA's recommended alternative and ALCOSAN's WWP are $1,113. This is three times the current annual household cost. Of this $1,113, 27% ($306) can be attributed to PWSA's improvements, and 73% ($807) can be attributed to ALCOSAN improvements.

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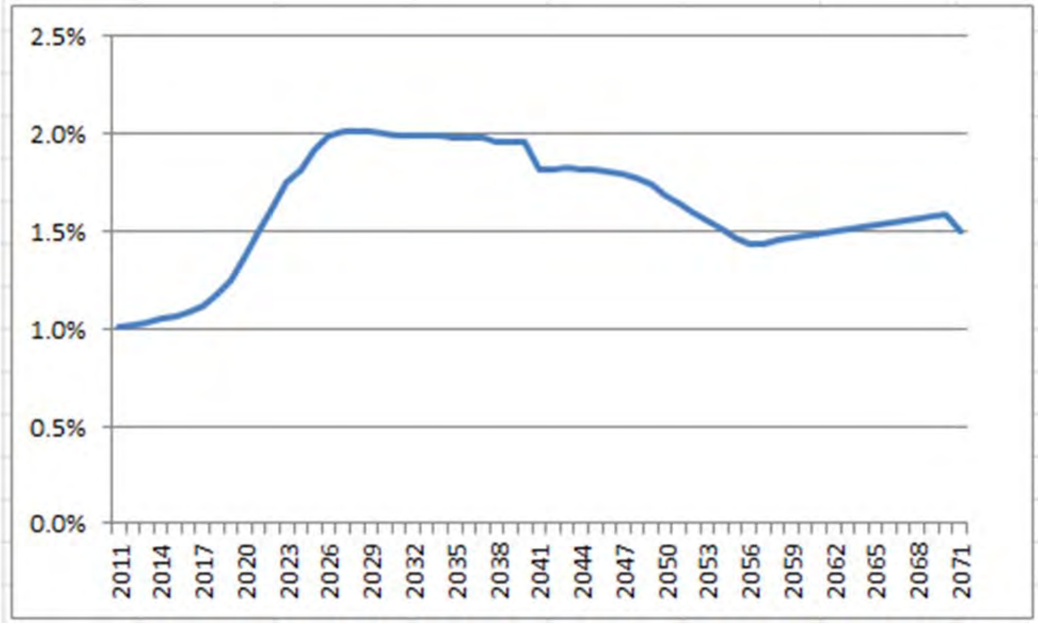
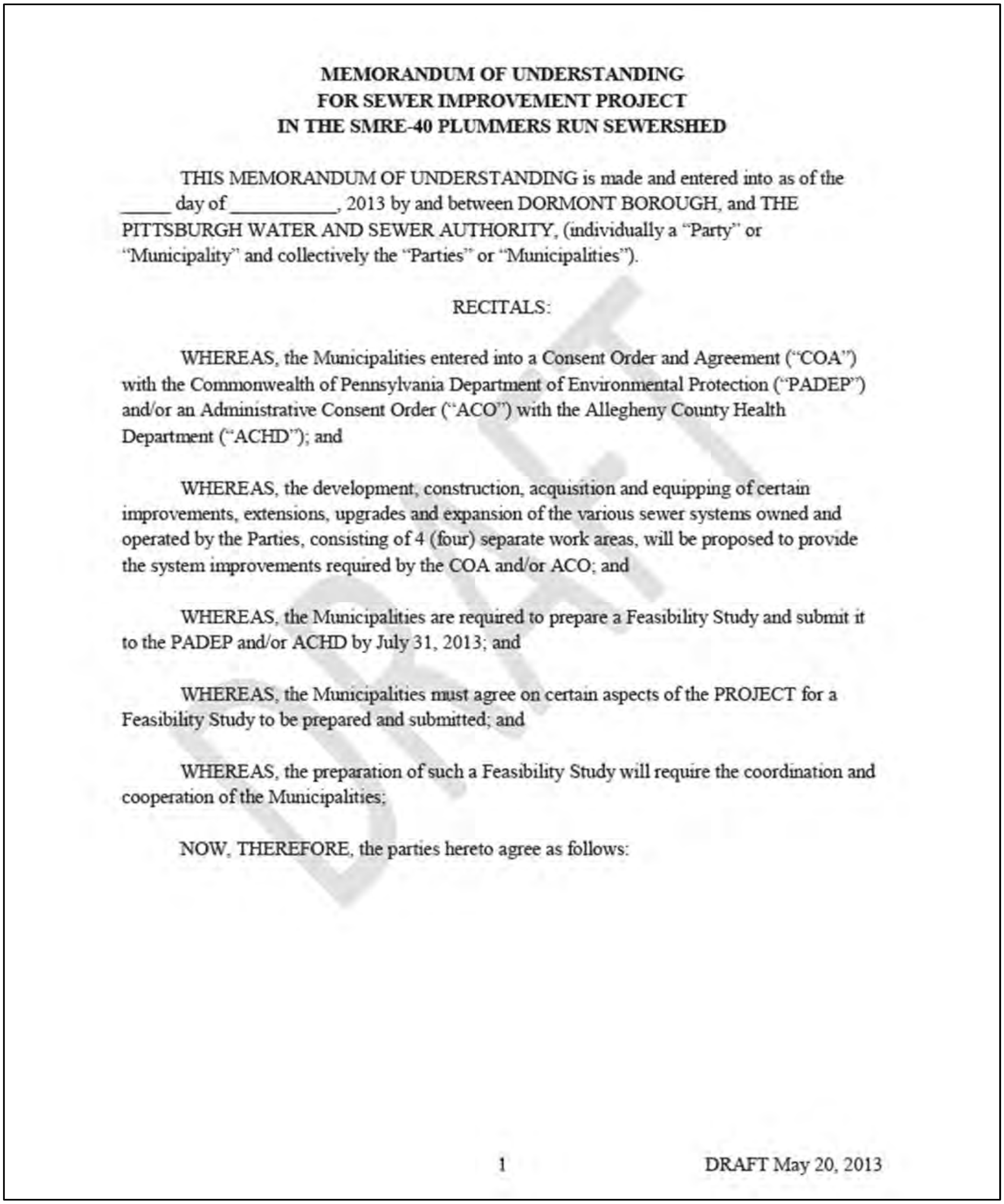
[2] The year 2027 was chosen for reference purposes since the final date of implementation is not finalized.
[3] Source: PWSA Feasibility Study, Section 10.4: Affordability and Financial Capability Analysis, July 2013.

The Residential Indicator is projected to stay between 1% and 2% until 2026, after which it is expected to remain above 2% until 2034, before declining again. A graph showing this projection is illustrated in Figure SMRE40-6-2.

FIGURE SMRE40-6-2 ESTIMATED RESIDENTIAL INDICATOR FOR CITY OF PITTSBURGH THROUGH 2046



Additional details regarding the PWSA's affordability analysis can be found in Section 10.4 of the Wet Weather Feasibility Study.



MEMORANDUM OF UNDERSTANDING
FOR SEWER IMPROVEMENT PROJECT
IN THE SMRE-40 PLUMMERS RUN SEWERSHED

THIS MEMORANDUM OF UNDERSTANDING is made and entered into as of the _____ day of ___________, 2013 by and between DORMONT BOROUGH, and THE PITTSBURGH WATER AND SEWER AUTHORITY, (individually a "Party" or "Municipality" and collectively the "Parties" or "Municipalities").

RECITALS:

WHEREAS, the Municipalities entered into a Consent Order and Agreement ("COA") with the Commonwealth of Pennsylvania Department of Environmental Protection ("PADEP") and/or an Administrative Consent Order ("ACO") with the Allegheny County Health Department ("ACHD"); and

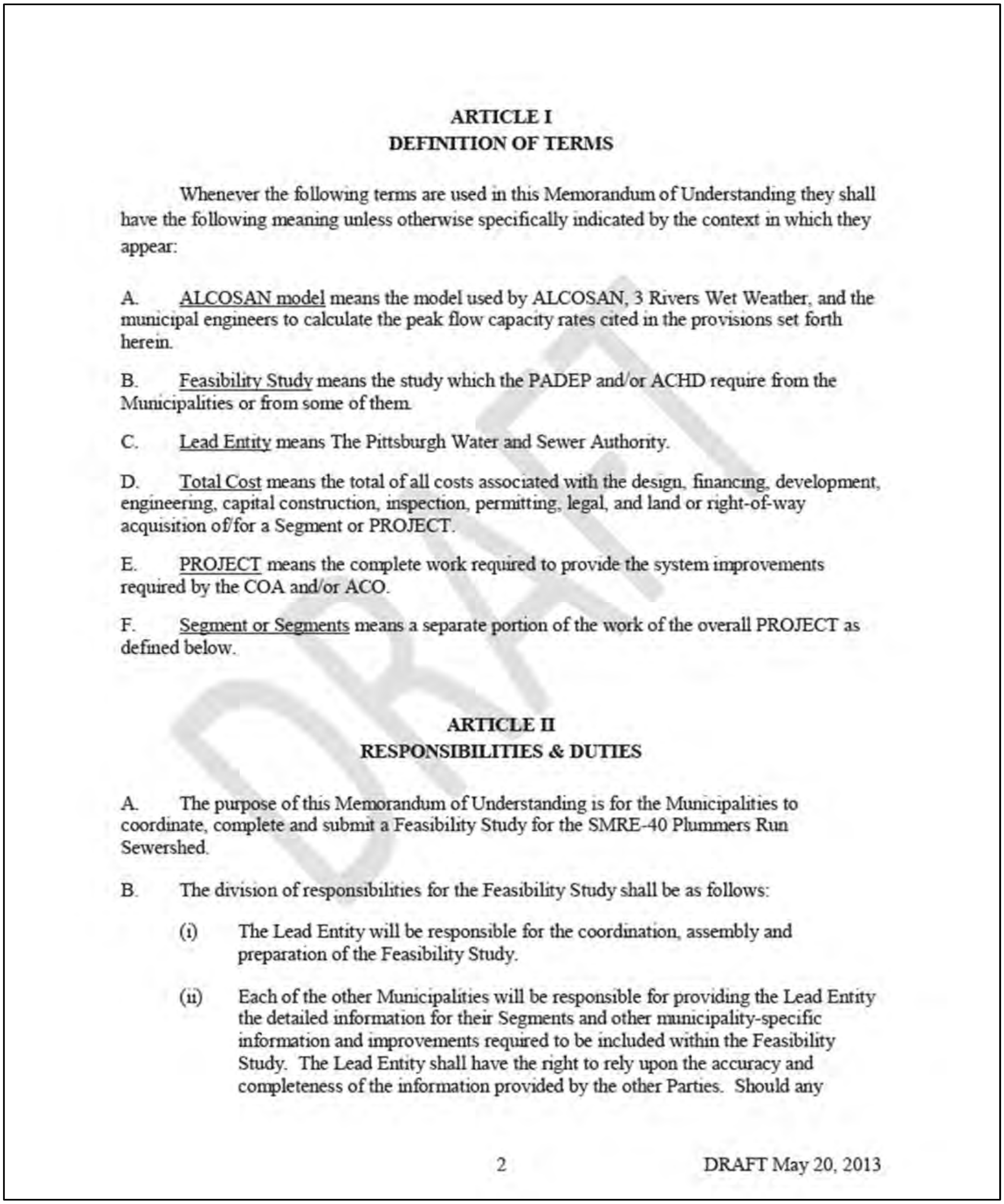
WHEREAS, the development, construction, acquisition and equipping of certain improvements, extensions, upgrades and expansion of the various sewer systems owned and operated by the Parties, consisting of 4 (four) separate work areas, will be proposed to provide the system improvements required by the COA and/or ACO; and

WHEREAS, the Municipalities are required to prepare a Feasibility Study and submit it to the PADEP and/or ACHD by July 31, 2013; and

WHEREAS, the Municipalities must agree on certain aspects of the PROJECT for a Feasibility Study to be prepared and submitted; and

WHEREAS, the preparation of such a Feasibility Study will require the coordination and cooperation of the Municipalities;

NOW, THEREFORE, the parties hereto agree as follows:



ARTICLE I
DEFINITION OF TERMS

Whenever the following terms are used in this Memorandum of Understanding they shall have the following meaning unless otherwise specifically indicated by the context in which they appear:

A. ALCOSAN model means the model used by ALCOSAN, 3 Rivers Wet Weather, and the municipal engineers to calculate the peak flow capacity rates cited in the provisions set forth herein.

B. Feasibility Study means the study which the PADEP and/or ACHD require from the Municipalities or from some of them.

C. Lead Entity means The Pittsburgh Water and Sewer Authority.

D. Total Cost means the total of all costs associated with the design, financing, development, engineering, capital construction, inspection, permitting, legal, and land or right-of-way acquisition of/for a Segment or PROJECT.

E. PROJECT means the complete work required to provide the system improvements required by the COA and/or ACO.

F. Segment or Segments means a separate portion of the work of the overall PROJECT as defined below.

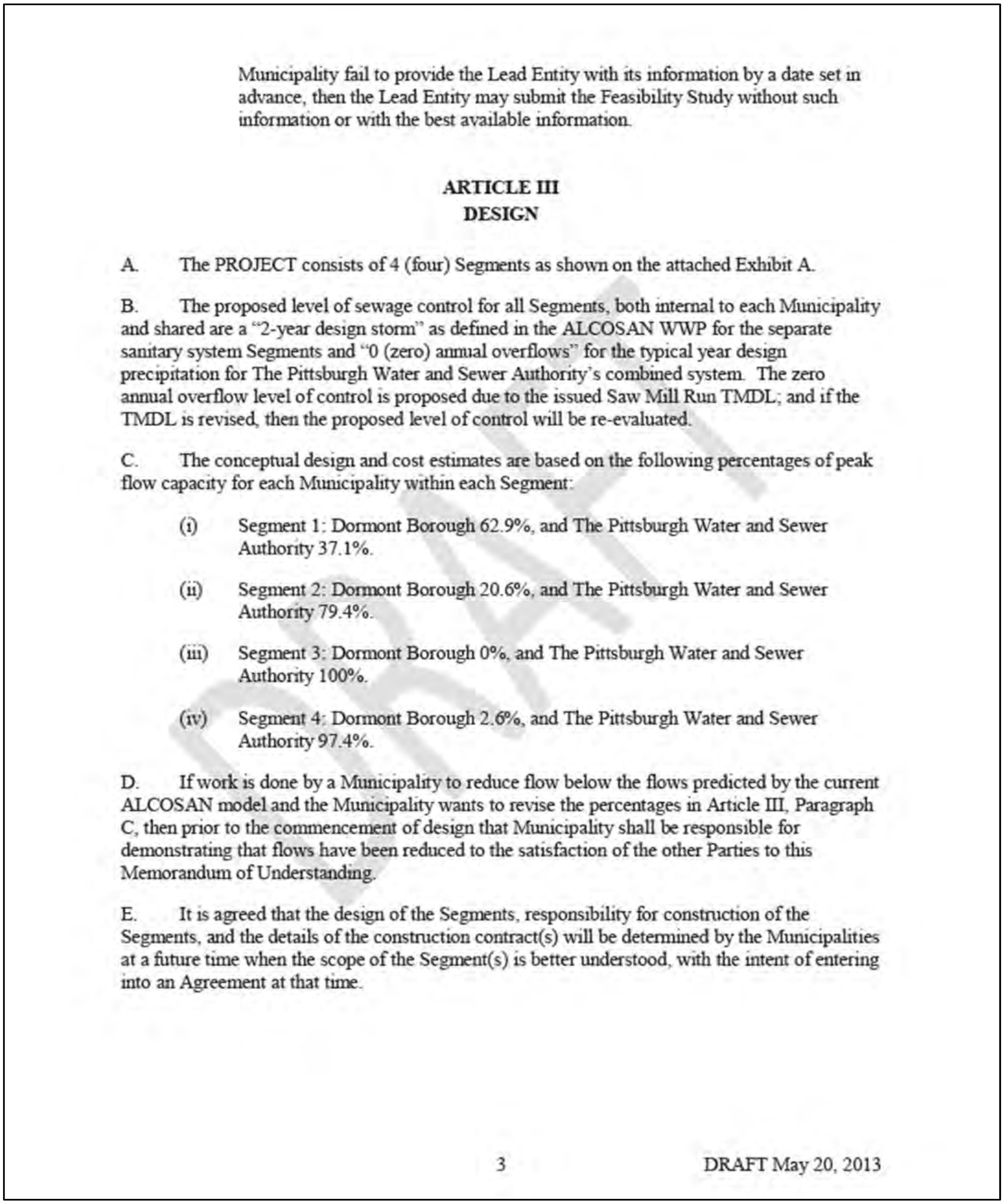
ARTICLE II
RESPONSIBILITIES & DUTIES

A. The purpose of this Memorandum of Understanding is for the Municipalities to coordinate, complete and submit a Feasibility Study for the SMRE-40 Plummers Run Sewershed.

B. The division of responsibilities for the Feasibility Study shall be as follows:

(i) The Lead Entity will be responsible for the coordination, assembly and preparation of the Feasibility Study.

(ii) Each of the other Municipalities will be responsible for providing the Lead Entity the detailed information for their Segments and other municipality-specific information and improvements required to be included within the Feasibility Study. The Lead Entity shall have the right to rely upon the accuracy and completeness of the information provided by the other Parties. Should any



Municipality fail to provide the Lead Entity with its information by a date set in advance, then the Lead Entity may submit the Feasibility Study without such information or with the best available information.

ARTICLE III
DESIGN

A. The PROJECT consists of 4 (four) Segments as shown on the attached Exhibit A.

B. The proposed level of sewage control for all Segments, both internal to each Municipality and shared are a "2-year design storm" as defined in the ALCOSAN WWP for the separate sanitary system Segments and "0 (zero) annual overflows" for the typical year design precipitation for The Pittsburgh Water and Sewer Authority's combined system. The zero annual overflow level of control is proposed due to the issued Saw Mill Run TMDL; and if the TMDL is revised, then the proposed level of control will be re-evaluated.

C. The conceptual design and cost estimates are based on the following percentages of peak flow capacity for each Municipality within each Segment:

(i) Segment 1: Dormont Borough 62.9%, and The Pittsburgh Water and Sewer Authority 37.1%.

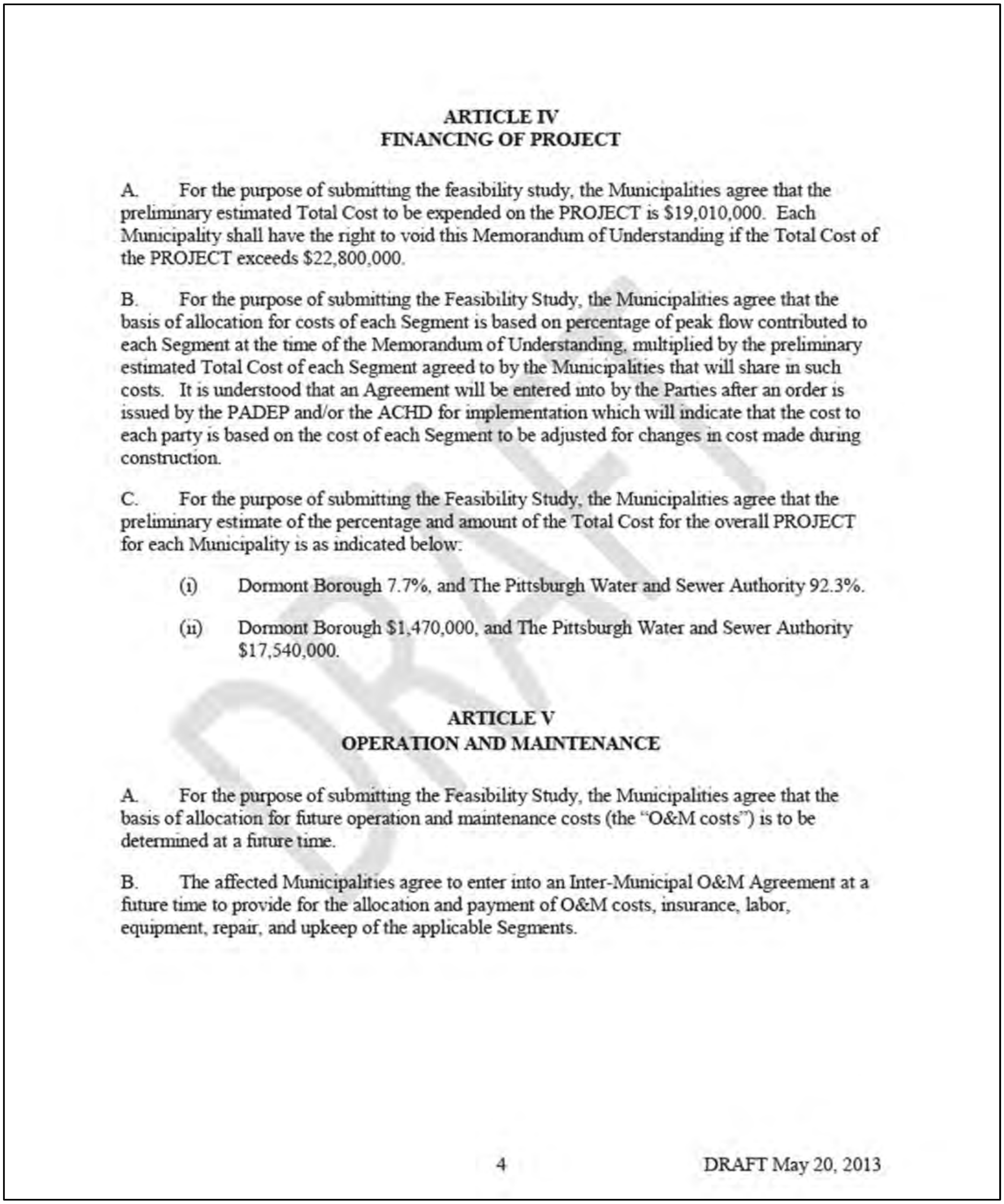
(ii) Segment 2: Dormont Borough 20.6%, and The Pittsburgh Water and Sewer Authority 79.4%.

(iii) Segment 3: Dormont Borough 0%, and The Pittsburgh Water and Sewer Authority 100%.

(iv) Segment 4: Dormont Borough 2.6%, and The Pittsburgh Water and Sewer Authority 97.4%.

D. If work is done by a Municipality to reduce flow below the flows predicted by the current ALCOSAN model and the Municipality wants to revise the percentages in Article III, Paragraph C, then prior to the commencement of design that Municipality shall be responsible for demonstrating that flows have been reduced to the satisfaction of the other Parties to this Memorandum of Understanding.

E. It is agreed that the design of the Segments, responsibility for construction of the Segments, and the details of the construction contract(s) will be determined by the Municipalities at a future time when the scope of the Segment(s) is better understood, with the intent of entering into an Agreement at that time.



ARTICLE IV
FINANCING OF PROJECT

A. For the purpose of submitting the feasibility study, the Municipalities agree that the preliminary estimated Total Cost to be expended on the PROJECT is $19,010,000. Each Municipality shall have the right to void this Memorandum of Understanding if the Total Cost of the PROJECT exceeds $22,800,000.

B. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for costs of each Segment is based on percentage of peak flow contributed to each Segment at the time of the Memorandum of Understanding, multiplied by the preliminary estimated Total Cost of each Segment agreed to by the Municipalities that will share in such costs. It is understood that an Agreement will be entered into by the Parties after an order is issued by the PADEP and/or the ACHD for implementation which will indicate that the cost to each party is based on the cost of each Segment to be adjusted for changes in cost made during construction.

C. For the purpose of submitting the Feasibility Study, the Municipalities agree that the preliminary estimate of the percentage and amount of the Total Cost for the overall PROJECT for each Municipality is as indicated below:

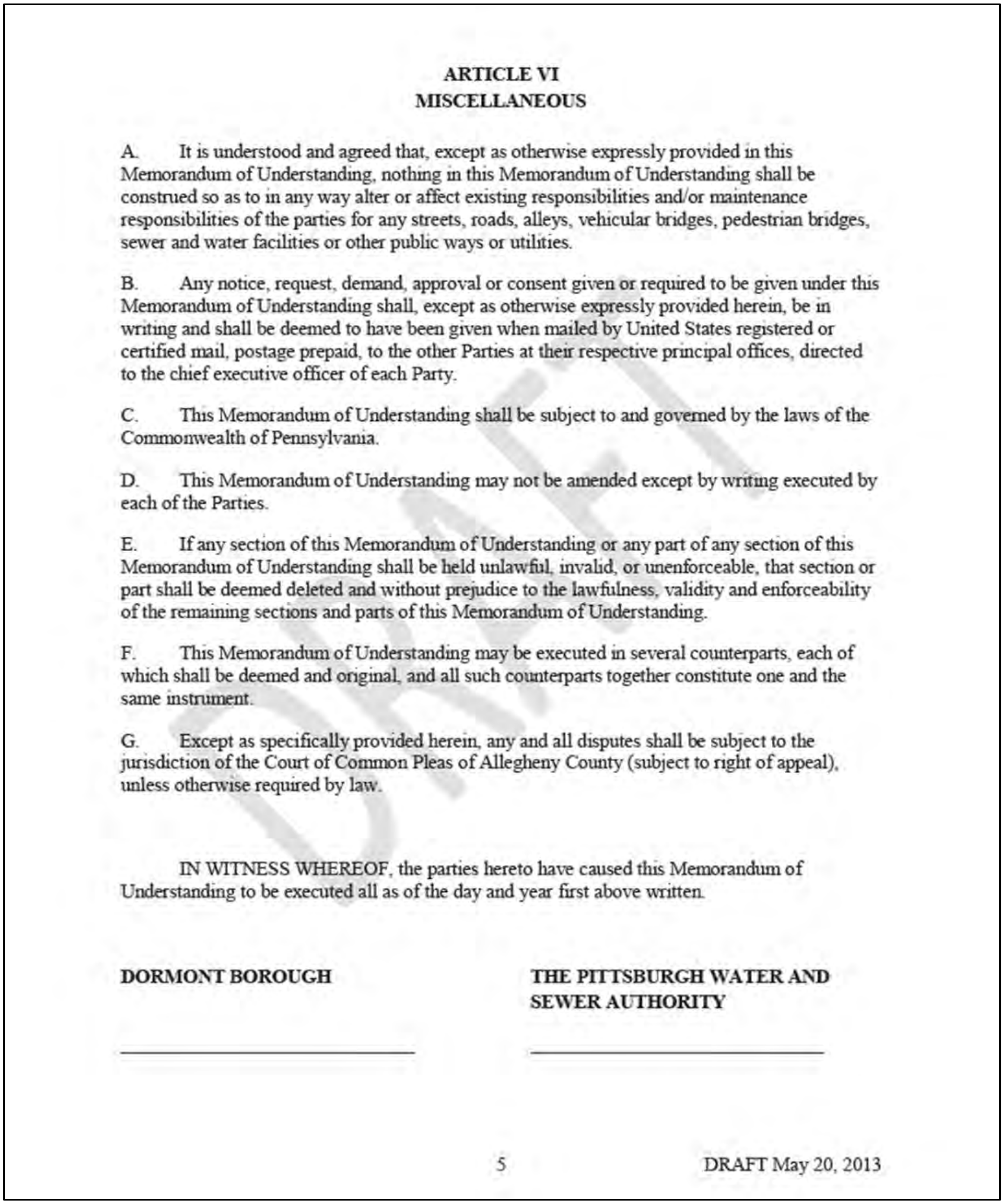
(i) Dormont Borough 7.7%, and The Pittsburgh Water and Sewer Authority 92.3%.

(ii) Dormont Borough $1,470,000, and The Pittsburgh Water and Sewer Authority $17,540,000.

ARTICLE V
OPERATION AND MAINTENANCE

A. For the purpose of submitting the Feasibility Study, the Municipalities agree that the basis of allocation for future operation and maintenance costs (the "O&M costs") is to be determined at a future time.

B. The affected Municipalities agree to enter into an Inter-Municipal O&M Agreement at a future time to provide for the allocation and payment of O&M costs, insurance, labor, equipment, repair, and upkeep of the applicable Segments.



ARTICLE VI
MISCELLANEOUS

A. It is understood and agreed that, except as otherwise expressly provided in this Memorandum of Understanding, nothing in this Memorandum of Understanding shall be construed so as to in any way alter or affect existing responsibilities and/or maintenance responsibilities of the parties for any streets, roads, alleys, vehicular bridges, pedestrian bridges, sewer and water facilities or other public ways or utilities.

B. Any notice, request, demand, approval or consent given or required to be given under this Memorandum of Understanding shall, except as otherwise expressly provided herein, be in writing and shall be deemed to have been given when mailed by United States registered or certified mail, postage prepaid, to the other Parties at their respective principal offices, directed to the chief executive officer of each Party.

C. This Memorandum of Understanding shall be subject to and governed by the laws of the Commonwealth of Pennsylvania.

D. This Memorandum of Understanding may not be amended except by writing executed by each of the Parties.

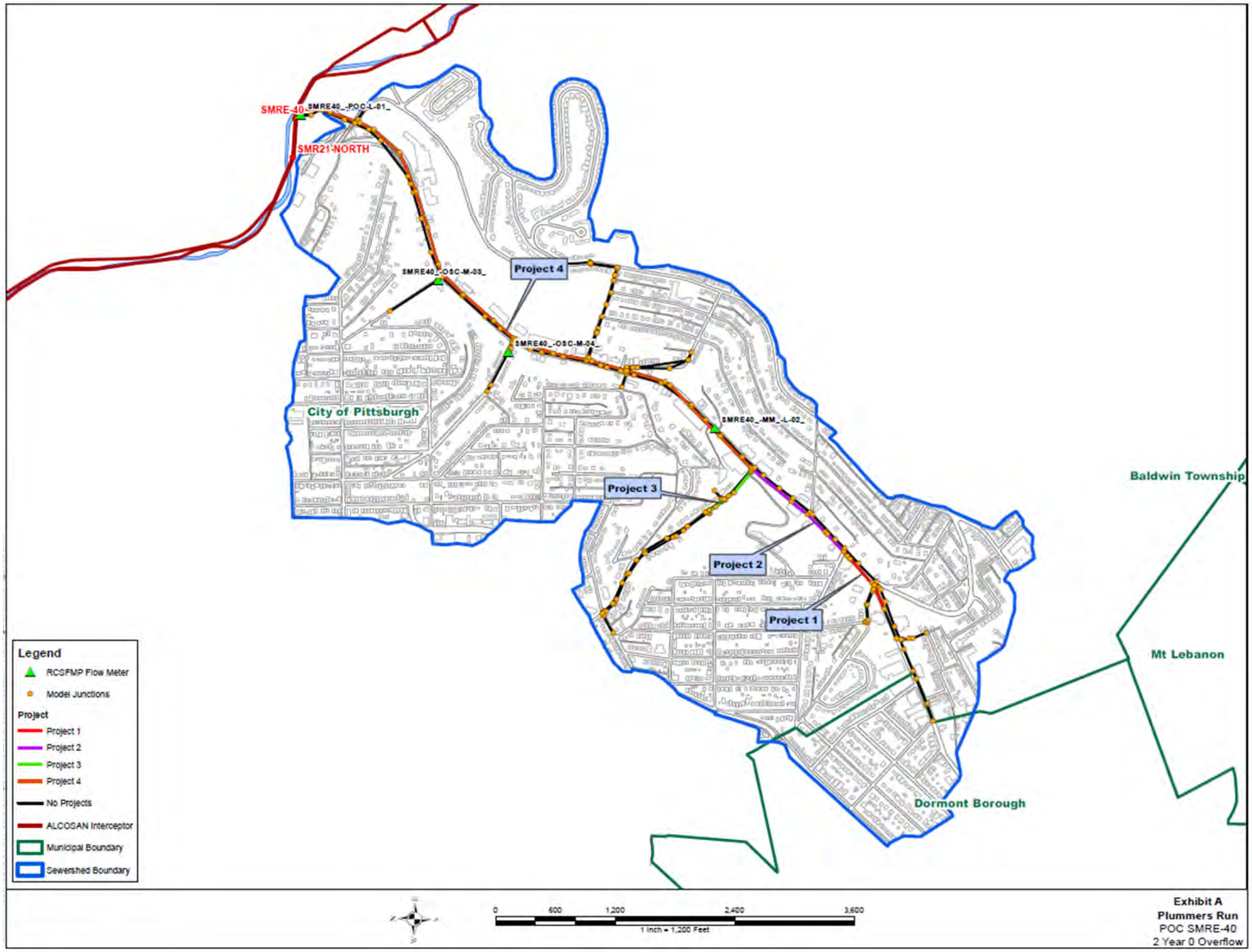
E. If any section of this Memorandum of Understanding or any part of any section of this Memorandum of Understanding shall be held unlawful, invalid, or unenforceable, that section or part shall be deemed deleted and without prejudice to the lawfulness, validity and enforceability of the remaining sections and parts of this Memorandum of Understanding.

F. This Memorandum of Understanding may be executed in several counterparts, each of which shall be deemed and original, and all such counterparts together constitute one and the same instrument.

G. Except as specifically provided herein, any and all disputes shall be subject to the jurisdiction of the Court of Common Pleas of Allegheny County (subject to right of appeal), unless otherwise required by law.

IN WITNESS WHEREOF, the parties hereto have caused this Memorandum of Understanding to be executed all as of the day and year first above written.

DORMONT BOROUGH	**THE PITTSBURGH WATER AND SEWER AUTHORITY**
____________________________	____________________________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SMR21-NORTH
SMRE40_-OSC-M-03_
Project 4
SMRE40_-OSC-M-04_
City of Pittsburgh
SMRE40_-MM_-L-02_
Project 3
Project 2
Project 1
Baldwin Township
Mt Lebanon
Dormont Borough
Legend
RCSFMP Flow Meter
Model Junctions
Project
Project 1
Project 2
Project 3
Project 4
No Projects
ALCOSAN Interceptor
Municipal Boundary
Sewershed Boundary
0
600
1,200
2,400
3,600
1 inch = 1,200 Feet
Exhibit A
Plummers Run
POC SMRE-40
2 Year 0 Overflow

7.0 STAKEHOLDER INVOLVEMENT

Stakeholder meetings titled POC Sewershed Coordination Meetings, facilitated by 3RWW, were held during the site and technology selection and alternative development processes. These meetings facilitated cooperation, information exchange and consensus building between the PWSA, its stakeholders and tributary municipalities essential to the development of the PWSA Feasibility Study Report and supporting POC-based feasibility studies. For the meetings listed in Table 7-1, POC SMRE-40 was the focus of the discussion and representatives from municipalities' tributary to the Plummer's Run sewershed were in attendance. Meeting topics included source reduction and green infrastructure, alternatives analysis, affordability and implementation schedule, and cost allocation. Other stakeholder involvement efforts are discussed in Section 11 of the Wet Weather Feasibility Study.

The Wet Weather Feasibility Study Coordination Meeting, led by the PWSA, facilitated stakeholder participation between the PWSA and the Dormont Borough community tributary to the Plummer's Run watershed. The purpose of this meeting was to coordinate the development of planning information specific to the multi-municipal sewershed, reach a consensus agreement on the recommended improvements and receive authorization to submit the results.

TABLE 7-1: PLUMMERS RUN SMRE-40 POC MEETINGS

Title/Purpose	Date	Time	Location
WW Feasibility Study Coordination	4/10/12	3:00 PM	PWSA Office
POC Sewershed Coordination	2/27/13	3:00 PM	PWSA Office
POC Sewershed Coordination	3/19/13	3:00 PM	Green Tree Municipal Building

APPENDIX B

WET WEATHER FEASIBILITY STUDY

GREENING THE PITTSBURGH WET WEATHER PLAN

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

ATTACHMENT B

Greening the Pittsburgh Wet Weather Plan

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

ATTACHMENT B

Acknowledgements

The City of Pittsburgh and the Pittsburgh Water and Sewer Authority would first and foremost like to thank everyone who presented at and participated in the Greening the Wet Weather Plan Charrette Project. Your time, ideas, and energy have been invaluable in helping us to plan for green infrastructure.

We would also like to thank the Colcom Foundation, Heinz Endowments, Pittsburgh Foundation, and R. K. Mellon Foundation whose generous support made these charrettes possible.

The charrettes were facilitated by Fourth Economy Consulting, with support from Brean Associates and Pittsburgh Public Allies. July 2013

Colcom Foundation

THE HEINZ ENDOWMENTS
HOWARD HEINZ ENDOWMENT • VIRA I. HEINZ ENDOWMENT

THE
PITTSBURGH
FOUNDATION

Richard
King
Mellon
Foundation

FOURTH
economy

ATTACHMENT B

Executive Summary

Introduction

The City of Pittsburgh, like its neighboring municipalities and cities across the nation, is faced with a daunting challenge: how to address the overflow of sewage into its rivers during wet weather events. Traditional grey infrastructure has been the go-to solution to date. Increasingly though, cities are turning to the natural ability of environmental systems to help reduce the flow of stormwater, and thus combined sewer overflows. However, as with any new approach or technology, many challenges exist with understanding how to effectively implement green infrastructure in Pittsburgh. That is not to say that solutions to those challenges don't exist; rather, they are not currently embedded within the institutions traditionally tasked with dealing with our stormwater and wastewater systems.

Therefore, at the behest of Mayor Luke Ravenstahl and the Honorable Daniel Deasy, the City of Pittsburgh and the Pittsburgh Water and Sewer Authority decided to turn outwards, to ask the professors and researchers, architects and engineers, and environmental non-profit practitioners who live and work in the City of Pittsburgh for help. They also reached out to national experts and international colleagues to help inform the discussion.

The Greening the Pittsburgh Wet Weather Plan Charrette Project was developed with the primary objective to develop a consensus approach to reviewing, recommending and incorporating a plan for the implementation of green stormwater infrastructure technologies and policies into the PWSA Wet Weather Feasibility Study.

The Charrettes

The project was comprised of three charrettes designed to identify green infrastructure opportunities, associated benefits and concerns, and the legal, institutional, and financial issues. From February to April 2013, three charrettes were held to explore these various topics. Overall, 125 independent individuals participated, representing a diverse array of public, private, and non-profit organizations. In fact, each charrette had nearly equal representation from all three sectors. These individuals collectively donated over 1,000 hours of their time to assist PWSA in its effort to better understand the challenges and opportunities associated with green infrastructure.

Allegheny County Office Building Green Roof - John Buck, Civil and Environmental Consulting

The first charrette featured presentations from PWSA and their partners on the wet weather planning process and how green infrastructure would be included in the plan, and from Kari Mackenbach, of the URS Corporation, who discussed how other cities have successfully implemented green infrastructure. These presentations served to ensure that participants were knowledgeable about the wet weather planning process and about what is possible, based on the experience of other cities. The presentations were followed by energetic small-group conversations about what green infrastructure technologies would be best suited for public, large-scale private, and residential land uses. Many participants reported afterwards that this was the first time that they were part of such diverse and solutions-oriented conversations about green infrastructure.

Due to participants' interest in the institutional challenges to green infrastructure, the second charrette featured a panel of regional leaders, moderated by Bill Flanagan of the Allegheny Conference on Community Development, and included:

- Bob Hutton, GIS Project Coordinator, Pittsburgh Water and Sewer Authority
- Jan Oliver, Director of Regional Conveyance, ALCOSAN
- Dan Sentz, Environmental Planner, City of Pittsburgh
- Rob Kaczorowski, Public Works Director, City of Pittsburgh
- Michelle Buys, Environmental Engineer, Allegheny County Health Department
- Cheryl Moon-Sirianni, P.E., Assistant District Executive for Design, PENNDOT District 11
- Brenda Smith, Executive Director, Nine Mile Run Watershed Association
- Todd Reidbord, President, Walnut Capital – Developers of Bakery Square

Panelists discussed their organization's role relative to green infrastructure, and what they saw as their main barriers and opportunities associated with implementing green infrastructure. PWSA's Bob Hutton concluded the panel discussion by saying that green infrastructure will be successful in Pittsburgh if there is collaboration and commitment; he said that we have to believe in it, identify opportunities, and make it happen! Following the panel, participants worked with panelists in small groups to discuss those barriers, and possible solutions, in greater detail. A second working group that afternoon focused on identifying possible early demonstration projects at specific locations in Pittsburgh. Equipped with several maps, participants discussed types of green infrastructure technologies, locations, and socio-political considerations for projects in several different watersheds.

ATTACHMENT B

Finally, the third charrette featured an in-depth presentation about the Green Infrastructure Section of PWSA's Wet Weather Feasibility Study, with some high-level suggestions of the types of short-term actions that would be taken to further inform PWSA's decision making process, such as the creation of a task force and implementation of early demonstration projects. The presentation also highlighted both the adaptive management approach, which focuses on monitoring and regular assessment/evaluation to inform future actions, and the Integrated Watershed Management & Planning approach, which would establish a process to provide flexibility to meet broader water quality requirements through the most cost-effective and beneficial means. Again, two working groups allowed participants to react to and expand upon what was presented. For the first working group, participants discussed what was exciting to them about the green infrastructure section and the adaptive management approach, as well as what was missing and what concerns they had. The second working group focused on how PWSA could partner with other organizations to implement what was outlined in the green infrastructure section. The charrette concluded with a presentation by Camille Grandet, from 2EI, a subsidiary of Veolia France, who spoke about his experience implementing green infrastructure in France.

Findings

Overall, the charrettes provided a forum for stakeholders to learn more about the wet weather planning process, to build new partnerships, and to share their knowledge about green infrastructure with PWSA. That knowledge is captured in the Findings section of this report, which outlines identified challenges and suggested recommendations relative to the general categories of Authority to Implement, Education and Outreach, Regulations, Financial Considerations, Maintenance, and Monitoring. Several of the challenges and recommendations were heard consistently throughout the charrette process by a wide array of stakeholders.

Top Recommendations

1 Create a stormwater utility.

2 PWSA should lead efforts to implement green infrastructure, while partnering with the City, local NGOs, industry stakeholders, and universities.

3 Implement a comprehensive education and engagement campaign targeted at both residents and the building community.

Create a Stormwater Utility

Though certainly not a silver bullet, the creation of a stormwater utility was discussed as a possible solution to many green infrastructure challenges. The creation of a stormwater utility has the potential to consolidate responsibility for stormwater management and green infrastructure within one, or at least fewer, entities. It could provide a single entity to review stormwater management plans, thus easing the burden on developers and ensuring better coordination between city departments. And it could generate a revenue source to be used for maintenance and could even possibly be the lead entity in charge of green infrastructure maintenance. There was little consensus on the details of a utility (e.g. geographic scope, management, fee structure, etc.), though it was clear that additional exploration of how to create a utility would be welcomed by stakeholders in attendance.

PWSA: Leader and Partner

Whether it was Kari Mackenbach discussing Louisville, Kentucky or Camille Grandet discussing Paris, France, it was clear that successful implementation of green infrastructure requires both strong leadership and partnerships. Nearly every stakeholder who participated in the charrettes also expressed the need for a strong leader and partnerships in order to make green infrastructure successful.

Stakeholders felt that one entity would need to take the lead in fronting a green infrastructure initiative, bringing in new partners, facilitating new ways of working together, developing partnership agreements, and keeping partners engaged in the process. Given the leadership already shown through hosting these charrettes, PWSA was clearly seen as an organization to take on that role. However, no one expects the leader to be able to implement green infrastructure alone. Several recommendations pointed to the need for an integrated approach, involving many parties. These included streamlining the review of stormwater plans, identifying opportunities for cost-sharing, leveraging the expertise of local NGOs and landscape industry stakeholders to identify maintenance best practices and train city and private employees, and leveraging the expertise of universities to monitor green infrastructure early demonstration projects.

Education and Engagement

Another theme that was echoed by presenters and participants throughout the charrette process was that of community education and engagement. Green infrastructure can only be successful with the support of those who will pay for, build, and live with the results. Residents were one of the main groups discussed. While they potentially have the most to gain from green infrastructure, given its additional aesthetic and environmental benefits, those improvements can only be realized if the residents are informed and engaged in the process. Participants recommended a range of strategies for engaging residents, from a branded public outreach campaign, to providing training and support for community groups to help implement green infrastructure projects. Other key targets for education and engagement were those involved with construction, building operations, property management and development. Strategies for this group included a comprehensive design manual and partnering with organizations, such as the Builders Association or the Allegheny County Conservation District.

Moving Forward

The Pittsburgh Water and Sewer Authority is incredibly grateful for the time and knowledge contributed by stakeholders throughout this process. All of the information gathered during the charrette process is being used to inform the Green Infrastructure Section of PWSA's Wet Weather Feasibility Study. During the events, a number of the charrette participants pointed out that the USEPA had recently issued guidance on Integrated Watershed Management (IWM). One key element of the Study will be a detailed exploration of IWM, which reflects the fact that most stakeholders viewed green infrastructure as a tool for both improving water quality and decreasing the number of CSOs.

Even before the Study is approved by the Pennsylvania Department of Environmental Protection, PWSA is moving forward with implementing green infrastructure. At the conclusion of the final charrette, Jim Good, Interim Executive Director of PWSA, announced the creation of a Green Infrastructure Technical Advisory Committee and a partnership with the Pittsburgh Parks Conservancy, ALCOSAN, and the City of Pittsburgh DPW for an early demonstration project in Schenley Park. Furthermore, PWSA will continue to provide information and seek input on green infrastructure through their website, www.pittsburghgreeninfrastructure.com. PWSA looks forward to continuing to work with the stakeholders engaged through the charrettes on making green infrastructure an integral component of its Wet Weather Plan.

Introduction

The City of Pittsburgh, like its neighboring municipalities and cities across the nation, is faced with a daunting challenge: how to address the overflow of sewage into its rivers during wet weather events. Traditional grey infrastructure has been the go-to solution to date. Increasingly though, cities are turning to the natural ability of environmental systems to help reduce the flow of stormwater, and thus combined sewer overflows. However, as with any new approach or technology, many challenges exist with understanding how to effectively implement green infrastructure in Pittsburgh. That is not to say that solutions to those challenges don't exist; rather, they are not currently embedded within the institutions traditionally tasked with dealing with our stormwater and wastewater systems.

David L. Lawrence Convention Center Green Roof - Pittsburgh Sports & Exhibition Authority

Therefore, at the behest of Mayor Luke Ravenstahl and the Honorable Daniel Deasy, the City of Pittsburgh and the Pittsburgh Water and Sewer Authority decided to turn outwards, to ask the professors and researchers, architects and engineers, and environmental non-profit practitioners who live and work in the City of Pittsburgh for help. They also reached out to national experts and international colleagues to help inform the discussion.

The Greening the Pittsburgh Wet Weather Plan Charrette Project was developed with the primary objective to develop a consensus approach to reviewing, recommending and incorporating a plan for the implementation of green stormwater infrastructure technologies and policies into the PWSA Wet Weather Feasibility Study. The project was comprised of three charrettes, designed to identify green infrastructure opportunities, associated benefits and concerns, and the legal, institutional, and financial issues.

From February to April 2013, three charrettes were held to explore these various topics. Overall, 125 independent individuals participated, representing a diverse array of public, private, and non-profit organizations. These individuals collectively donated over 1,000 hours of their time to assist PWSA in its effort to better understand the challenges and opportunities associated with green infrastructure. The following sections describe the content of each charrette as well as the resulting findings.

Charrette 1

On Friday, February 15th, 2013, stakeholders from the public, private, and non-profit sectors gathered together to discuss how the City of Pittsburgh and the Pittsburgh Water and Sewer Authority can include green infrastructure as part of their Wet Water Feasibility Study. In total, 86 participants attended, with 35 from the public sector, 23 from the private sector, and 29 from the non-profit sector.

Kari Mackenbach from URS Corporation began by showing the participants how San Francisco, Kansas City, and Louisville have implemented green infrastructure (GI). Highlights included:

- Using gardens/landscaping, porous pavement, pervious concrete, and rainwater capture devices – diversity of technologies is important
- Stair-step/cascading gardens with curb cuts were used in the ROW on sloped streets
- Curb extensions with below grade storage allowed for retention, infiltration, and controlled release to sewer while also providing traffic calming
- Pilot testing of porous materials led to improved performance, reduced costs, and simplified maintenance; learned the importance of knowing precise utility locations and flexibility for field adaptation
- Public education & emphasis on neighborhood improvements were important
- University partnerships helped with piloting design, operations and maintenance, and monitoring
- Found that in some cases, GI could address CSOs for less money and with less overall maintenance costs

Kari's presentation was followed by a presentation by Three Rivers Wet Weather and AECOM. The goal of this presentation was to explain Pittsburgh's Wet Weather Feasibility Studying process and how GI would be included in the plan. This included a discussion of the RainWays and SWMM tools and how they would be used to evaluate and prioritize green infrastructure.

For the remainder of the afternoon, the participants were split into working groups. Table groupings were designed to provide a diversity of perspectives and facilitators helped participants discuss what GI solutions were most appropriate for public, private, and residential property. Facilitators worked with each table to complete worksheets outlining specific technologies, where they were currently being used, benefits, and barriers to implementation. At the end of the working group session, participants reported out on their tables' finding.

Charrette 2

During the first charrette it was clear that the participants were more concerned about institutional barriers than technical barriers to implementing green infrastructure. Therefore, for the second charrette, held on March 21st, 2013, a panel of some of the key institutional leaders who would be responsible for implementing green infrastructure was convened. This panel included:

- Bob Hutton, GIS Project Coordinator, Pittsburgh Water and Sewer Authority
- Jan Oliver, Director of Regional Conveyance, ALCOSAN
- Dan Sentz, Environmental Planner, City of Pittsburgh
- Rob Kaczorowski, Public Works Director, City of Pittsburgh
- Michelle Buys, Environmental Engineer, Allegheny County Health Department
- Cheryl Moon-Sirianni, P.E., Assistant District Executive for Design, PENNDOT District 11
- Brenda Smith, Executive Director, Nine Mile Run Watershed Association
- Todd Reidbord, President, Walnut Capital – Developers of Bakery Square

Each participant discussed their organization's role relative to green infrastructure, and what they saw as their main barriers and opportunities associated with implementing green infrastructure. Bill Flanagan of the Allegheny Conference on Community Development then facilitated a dialogue amongst the participants, concluding with their thoughts on the key to successfully implementing green infrastructure in Pittsburgh.

The charrette then featured two working groups: the first engaged participants in addressing the barriers outlined by the panelists, and the second asked participants to identify the best sites for early demonstration projects. Tables for the first working group were organized into four general categories: Authority & Partnerships, Design & Implementation, Maintenance & Monitoring, and Rules & Regulations. Participants were assigned to the table which best matched their knowledge and expertise. Centered on the panel discussion, they identified the top three barriers relative to that category, as well as short- and long-term solutions.

For the second working group, tables were organized by watershed: Saw Mill Run, Nine Mile Run, and A-22 (Bloomfield, Friendship, Shadyside), as well as one for the entire city; participants self-selected a table based on their familiarity with that area. Participants were given an aerial map showing building footprints and the boundaries of combined and sanitary sewershed, a map of publicly owned properties, and a map showing potential GI locations based on a preliminary technical analysis by Three Rivers Wet Weather. Participants used the maps and worksheets to identify possible early demonstration project locations.

Overall, 79 people participated in the second charrette; 34 represented public organizations, 21 represented private-sector organizations, and 24 represented non-profit organizations.

Charrette 3

The third charrette, held on April 19th, 2013, began with a closer look at the green infrastructure section of PWSA's feasibility study. Ross Gordon, of AECOM, gave a presentation about the information to be included in the section, as well as some high-level suggestions of the types of short-term actions that would be taken to further inform PWSA's decision making process, such as the creation of a task force and implementation of early demonstration projects. The presentation highlighted the adaptive management approach, which focuses on monitoring and regular assessment/evaluation to inform future actions. Ross also discussed how the green infrastructure section supports and aligns with USEPA's Integrated Watershed Management Planning framework, defining PWSA's desire to address overall water quality issues above and beyond just those caused by CSOs.

Again, two working groups allowed participants to react to and expand upon what was presented. For the first working group, participants discussed what was exciting to them about the green infrastructure section and the adaptive management approach, as well as what was missing and what concerns they had. The second working group focused on how PWSA could partner with other organizations to implement what was outlined in the green infrastructure section. Participants discussed how PWSA could leverage existing related activities, how other organizations could collaborate with PWSA, and what PWSA could do to support the efforts of other organizations.

After the working groups, Camille Grandet, from 2EI, a subsidiary of Veolia France, gave a presentation about his experience implementing green infrastructure throughout various cities in France. His presentation covered their regulatory environment, the role of local municipalities, the perspective of public and private developers, and operations and maintenance. Mr. Grandet discussed:

- The importance of collaboration between the water department and city planning,
- The need to incorporate design review as early and often as possible during design and construction,
- The ability for green infrastructure to benefit architects and developers by improving design and decreasing cost, and
- The larger performance gap attributable to a lack of operations and maintenance.

Overall 68 stakeholders participated in the third charrette, 21 from the public sector, 23 from the private sector, and 22 from the non-profit sector.

Alexis St. Rain Garden and Pervious Sidewalks - David G. Himes, The Penn State Center, Pittsburgh

Findings

The following findings serve to summarize the comments received from participants during each of the charrettes. As such, they do not represent the opinion of any one person or organization. Furthermore, they do not represent the opinion of the City of Pittsburgh or the Pittsburgh Water and Sewer Authority. PWSA will be reviewing these findings to inform the green infrastructure section of their Wet Weather Feasibility Study. Recommendations are organized roughly according to short- and long-term implementation.

Authority to Implement

Challenges

Questions of authority and ownership surfaced at nearly every level of the discussion during the charrettes. At the highest level, the City of Pittsburgh is just one of 83 municipalities within the ALCOSAN service area, with each having to respond to its own Consent Order and Agreement, despite the fact that stormwater itself does not recognize those municipal boundaries. Next, within each of those municipalities, and for our purposes, Pittsburgh specifically, there are many different parties with authority over stormwater management in one way or another. During the second charrette, Dan Sentz, Environmental Planner for the City of Pittsburgh, mentioned that City Planning, the Bureau of Building Inspection, Public Works, and PWSA all review and approve stormwater plans. If a project involves a county or state owned road, or if it involves any other utilities, the number of responsible entities continues to multiply. And finally there is the issue of who actually owns the land that is responsible for creating the stormwater runoff and to what extent are they inclined to employ green infrastructure solutions. Agencies such as the Urban Redevelopment Authority, the Regional Industrial Development Corporation, and the Housing Authority of Pittsburgh all represent Public land owners with some authority to implement green infrastructure. Private land owners could also bear some responsibility for implementing green infrastructure, but have very different motives and incentives to do so.

ATTACHMENT B

David L. Lawrence Convention Center Green Roof - Sara Thompson, Pashek Associates

Solutions

Recommendation: PWSA can be a leader in convening the various parties with some authority in the implementation of green infrastructure.

Intent: One entity needs to take the lead in fronting a green infrastructure initiative, bringing in new partners, facilitating new ways of working together, developing partnership agreements, and keeping partners engaged in the process.

Recommendation: Prioritize initial implementation of green infrastructure on publicly owned land. Research the use of Envista project management tool to track opportunities.

Intent: Implementing green infrastructure on publicly owned land, such as parks, right-of-ways, and public development, presents fewer barriers than on privately owned land. The use of Envista could help ensure that as improvements are made to roads, sidewalks, utilities, etc. that green infrastructure could be incorporated in an integrated fashion.

Recommendation: Create a stormwater utility. Such an action is a growing trend with large (Philadelphia) and small (Mt. Lebanon) municipalities taking this approach for investing in stormwater solutions. A feasibility study will need to be completed in order to identify the best entity within the region to manage a utility.

Intent: Ultimately, the creation of a stormwater utility has the potential to consolidate responsibility for stormwater management and green infrastructure within one, or at least fewer, entities.

Recommendation: Use an Integrated Watershed Management & Planning approach to unite municipalities in collectively addressing stormwater management based on watershed boundaries rather than political ones.

Intent: Water quality, which would be a focus under an IWM approach, is a common concern regardless of whether a community is addressing CSOs, SSOs, or MS4 and NPDES requirements.

Education and Outreach

Challenges

The charrettes uncovered a multitude of potential challenges based on a lack of education and understanding about green infrastructure. During the first charrette, Kari Mackenbach of URS Corporation explained how landscaping contractors, accustomed to compacting soils, were slow to adapt to new practices of keeping soils loose in green infrastructure projects. Brenda Smith, Executive Director of the Nine Mile Run Watershed, told participants during the second charrette how utility companies have compromised the integrity of green infrastructure elements due to improper construction techniques. And stakeholders throughout all of the charrettes spoke of how a lack of public understanding about how green infrastructure differs from traditional landscaping or how a stormwater utility works, for example, could derail support for a citywide initiative.

Solutions

Recommendation: Implement a public outreach campaign. This would be a multi-faceted campaign, with content ranging from the basics of stormwater and green infrastructure to the intricacies of a stormwater utility and whole watershed solutions. The core component however, would be around the benefits of green infrastructure, including water quality, beautification, and economic development. Partners could include non-profits, including large landowners and smaller community organizations, foundations, sports teams, and private companies. Creating a "cool" and "catchy" brand and marketing campaign would be essential to successfully reaching target audiences. Outreach methods could include community meetings, advertising, signage, competitions (especially among neighborhoods), and school projects.

Intent: Based on stakeholder input and case studies from other cities, public education and outreach will be necessary to ensure the success of a green infrastructure initiative and can help identify new interest and potential partnerships that can support the effort.

Recommendation: Partner with key environmental non-profits to provide training and support for community groups and schools that want to implement green infrastructure, either by themselves or in conjunction with a PWSA early demonstration project.

Intent: Involving community groups can provide education, buy-in, funding opportunities, and possibly the ability to leverage the work of others to reduce stormwater runoff.

Recommendation: Partner with key organizations (e.g. Builders Association, Allegheny County Conservation District, etc.) to conduct targeted education and outreach to the construction, building operations, property management and development community.

Intent: Committed stakeholders will be crucial to the successful physical implementation of green infrastructure.

Regulations

Challenges

Within the City of Pittsburgh, numerous regulations exist that affect where and how green infrastructure could be implemented. Downtown open space requirements, parking minimums, building codes that dictate setbacks from HVAC systems, and allowances for curb cuts were just some of the codes mentioned during the charrettes that can negatively impact the implementation of green infrastructure. Some of these codes, such as requirements for green space in parking lots, create opportunities for green infrastructure, if properly enforced. Others create barriers for green infrastructure, such as the current street standards. And nearly all of the regulations are difficult to read and understand, especially for the general public.

There are currently four City departments (Planning, Buildings, Public Works, and PWSA) who have to review and sign off on stormwater plans. However, there is little cooperation between these departments related to stormwater management. Additionally, many green infrastructure solutions are not approved for use per these reviews. Allegheny County and all of the other municipalities in the ALCOSAN service area also have their own regulations related to stormwater management.

Ultimately, ordinance-based implementation of green infrastructure could be cost-effective. However, it will be a challenge to create ordinances that are unique to Pittsburgh, are based on data, are easy to understand, are consistent with neighboring municipalities, and are enforceable.

Solutions

Recommendation: Build upon the Pitt Law Clinic study and any research conducted by the Green Infrastructure Network to create a better understanding of what ordinances relate to the implementation of green infrastructure.

Intent: Knowing the full scope of ordinances and agencies involved will be the first step in crafting revised ordinances and increasing collaboration.

Recommendation: Amend existing codes to decrease barriers to green infrastructure, e.g. parking maximums instead of parking minimums, allowing for curb cuts, etc.

Intent: Many existing ordinances unintentionally contribute to increased stormwater runoff and/or make it difficult to effectively install green infrastructure. Amending these codes will be critical for effectively reducing stormwater runoff and installing green infrastructure.

Center for Sustainable Landscapes - Paul Wiegman, Phipps Conservatory, Pittsburgh

Recommendation: Craft an ordinance (preferably county-wide) to require source reduction in new development, and potentially redevelopment, that:

- Uses simple and fact-based parameters (including peak controls, design standards, volume retention),
- Is not too strict in terms of a design standard, as that would increase costs,
- Minimizes impediments to a developer's ability to get approval, and
- Dictate compliance versus the means to compliance.

Intent: While ordinances can be a cost-effective method of implementing green infrastructure, effectiveness and compliance will be enhanced by creating an ordinance that is realistic yet allows for flexibility and innovation.

Recommendation: Use codes and/or the permit application process to incentivize private sector implementation of green infrastructure.

Intent: Finding ways to incentivize the private implementation of green infrastructure reduces public costs and demonstrates to developers that the City is interested in a collaborative relationship.

Recommendation: Create a comprehensive design manual which will provide guidance and cover topics such as:

- Inventory existing design guidance (PWSA, PennDOT, Statewide BMP manual, etc.)
- Define vision of design manual – what do we want to look like in 25 years?
- Uniform performance standards, but flexible in design solutions to meet those standards
- Include BMPs for challenging sites
- Provide watershed-specific guidance
- Make it easy and accessible for different audiences
- Note where exceptions should be made and provide in-lieu-of options (e.g. fees)
- Include guidance on monitoring and verification
- Include guidance on maintenance and ongoing operation
- Should be supported by revised codes
- Build capacity to use the manual through education and outreach

Intent: In order to be truly effective, green infrastructure must be properly designed and maintained. However, it cannot be expected that developers will have the knowledge and expertise to implement green infrastructure, if incentivized or required. Therefore, a comprehensive manual, unique to our region, would help ensure that developers are equipped to support the City in its efforts to implement green infrastructure.

Recommendation: Identify a single entity to lead stormwater review. Suggestions from the charrette included a stormwater utility and the Allegheny County Conservation District.

Intent: A single review of stormwater requirements will ease the burden on developers and ensure better coordination between departments.

Financial Considerations

Challenges

Like most of the other topics addressed in this section, a lack of clarity and definitive information is the main challenge associated with financial considerations. Throughout the charrettes, participants expressed uncertainty around how much a gray-green solution would cost versus an all-gray solution. Kari Mackenbach presented data from Louisville during the first charrette that showed a 22% lower capital cost for green infrastructure than grey infrastructure, including maintenance. However, additional data is needed to really be able to make the financial case for how green can reduce the cost of compliance for Pittsburgh and surrounding communities. Most of the charrette participants agreed, though, that when measuring the costs and benefits of various solutions, that a triple bottom line approach be used.

In addition to better understanding how much green infrastructure will cost, participants also expressed concerns over who would be paying for green infrastructure and how. There is not currently a public funding source associated with stormwater mitigation and management. Some private developers are also concerned over the costs of green infrastructure.

Solutions

Recommendation: Implement a stormwater service fee.

Intent: The primary financial solution discussed during the charrettes was the creation of a stormwater utility, which would include a stormwater service fee. Though there was little consensus on the details of a fee (geography, structure, etc.), there was consensus that it would be an integral part of mitigating financial challenges associated with green infrastructure.

Recommendation: Identify partnership opportunities that would allow for cost-sharing.

Intent: Whether it's to compete for federal funding or to make the most efficient use of existing municipal allocations, partnerships with elected officials, NGOs and universities, state agencies (such as PENNDOT), and neighboring municipalities were suggested as critical elements.

Recommendation: Help private developers better understand potential savings, increased revenue, or additional costs that they would incur from green infrastructure and consider ways to decrease the additional costs, if applicable.

Intent: Private developers can be allies for green infrastructure if they are well-informed and supported by the City.

Recommendation: Explore an Integrated Watershed Management approach to allow for more cost-effective investments.

Intent: IWM enables a more comprehensive examination of water quality beyond just the pollutants contributed by CSOs (which may not be the main source of contamination); thereby providing flexibility and guiding investment toward projects with the most cost-effective impact in terms of compliance with the Clean Water Act's goals of producing fishable and swimmable waters.

ATTACHMENT B

Larimer Ave. ECCO Center Stormwater Management Demonstration Garden - David G. Himes, The Penn State Center, Pittsburgh

Maintenance

Challenges

Just as deferred maintenance makes gray infrastructure less effective, it also makes green infrastructure less effective. And because green infrastructure is far more visible, poorly maintained green infrastructure has additional negative effects on the public. Therefore, ensuring that green infrastructure is properly maintained into the future was an area of concern for charrette participants. Their questions were straightforward: Who does it? How do we do it? How do we pay for it?

In other cities, the maintenance of public green infrastructure is generally either done “in-house” by city employees or contracted out to private companies. Of course some green infrastructure will be on private property, so property owners would need to maintain it themselves. Many saw the maintenance of green infrastructure as an opportunity to create new jobs. The role of NGOs and volunteers was also considered, though some were unsure about the ability of those groups to be relied upon for long-term engagement. It was uncertain what combination of these groups would play a role in maintaining green infrastructure in Pittsburgh. Of course the key challenge is whether they are city staff, private contractors, or NGOs, they most likely do not have the specialized training necessary to properly maintain green infrastructure.

The cost of maintaining green infrastructure, how it compares to gray infrastructure, and where that money would come from were other questions posed.

Solutions

Recommendation: Adopt design guidelines that minimize maintenance issues.

Intent: Many maintenance issues can be avoided by choosing appropriate plants, locations, and technologies, which can be documented for the region through a thoughtful set of design guidelines.

Recommendation: Plan and budget for the maintenance of green infrastructure while implementing projects.

Intent: Planning and budgeting for maintenance is critical to ensuring that it happens.

Recommendation: Partner with NGOs and landscape industry stakeholders to identify best practices and train city and private employees.

Intent: Organizations such as the Pittsburgh Parks Conservancy and GTECH are already developing guidance on best practices for maintaining green infrastructure. Furthermore, organizations such as Phipps and the Penn State Center are providing education and training to landscapers. Other organizations, such as Pittsburgh Pipeline and Pittsburgh Green Innovators, were suggested as partners for youth job training partners.

Recommendation: Consider how a stormwater fee could be used to pay for maintenance/ how a utility could assume responsibility for maintenance.

Intent: A utility could provide a consistent and centralized mechanism for overseeing and funding green infrastructure maintenance.

Monitoring

Challenges

In many ways, monitoring itself is less of a challenge and more the solution to other challenges, namely skepticism from community stakeholders about the effectiveness of green infrastructure and the need to demonstrate measurable results for regulators. Though regulators are mainly concerned about the ability of green infrastructure to decrease the number of CSOs, many stakeholders felt that monitoring could be a tool to demonstrate the ability of green infrastructure to improve water quality, as well. However, like maintenance, understanding who monitors, how it's done, and how it's funded remain key questions. There are several green infrastructure projects that have been implemented in the City but there is no standard or source for common reporting and verification of efficacy.

Solutions

Recommendation: Install and monitor early demonstration projects.

Intent: As suggested above, monitoring itself is the solution to addressing skepticism around the effectiveness of green infrastructure. Therefore, monitoring should be a required element of all early demonstration projects, with results being readily accessible by the public.

Recommendation: Gather and consolidate data from existing green infrastructure projects in Pittsburgh.

Intent: Organizations such as the Pittsburgh Parks Conservancy and Local 95 were mentioned as having collected data on their own green infrastructure projects. If this information were available through a central and easy-to-understand resource, it could bolster confidence in the effectiveness of green infrastructure.

Recommendation: Partner with universities to monitor green infrastructure early demonstration projects.

Intent: Universities have the expertise and resources to assist in monitoring.

Recommendation: Provide information and resources for monitoring to community groups and private developers who are implementing green infrastructure.

Intent: Given the public's general lack of knowledge of monitoring protocol and resources to monitoring, support will be needed if PWSA would like to collect data on non-public green infrastructure projects.

Early Demonstration Projects

During the second charrette, participants were asked to identify possible locations for early demonstration projects. The resulting discussion helped identify a number of criteria for what would make a good early demonstration project. According to participants, a successful early demonstration project will:

- Engage multiple sectors and types of stakeholders
- Engage citizens and provide opportunities for education
- Leverage other ongoing projects and initiatives
- Comply with the Urban Forest Master Plan
- Coordinate with utility companies, where applicable
- Identify regulatory barriers
- Be part of a marketing campaign
- Leverage additional funding
- Have a dedicated, long-term maintenance plan and fund
- Have a measurable impact on CSO reduction
- Be scalable or adaptable to other areas
- Engage higher-education partners in monitoring

The following are early demonstration projects that were suggested by participants. These suggestions have not been vetted for their feasibility or accuracy, but can be used as a starting point as PWSA and partners consider projects.

City-wide Catalytic Projects

Implement GI in City right-of-ways

- Great percentage of publicly owned space available for GI
- Streets carry enormous amount of run-off
- Streets = flow corridors
- Develop matrix of ROW sections and green infrastructure opportunities

Enhance existing development projects

- South Side Park
  + Park is currently neglected and has surface water problems
  + Planned ecological restoration of park
  + Connect to plans for 21st Street ecological restoration and stormwater management

- Greenfield Ave and Irvine Street
  + High visibility
  + Connects to park
  + Adjacent to ALMANO site
  + ALCOSAN structure nearby
  + Potential high yield

- Mellon Arena Site
  + Even if they are already putting new storm sewers in, they could put GI in to address water quality
  + High visibility
  + Good opportunity to partner
  + Implementing GI at beginning of project makes good opportunity for monitoring

- Daylight Four Mile Run
  + Reference 3R2N Stream Restoration and Daylighting Report (2001)
  + See examples in other cities, such as Cincinnati

- Heth's Run/Zoo Parking Lot
  + PennDOT bridge reconstruction
  + Opportunity to partner with various groups

A-22 Sewershed (Bloomfield, Friendship, Shadyside)

- Busway/Valley Floor
  - + The topography and soils could be good; could restore surface hydrology and neighboring areas could eventually tie in
  - + Possibility of daylighting stream to 33rd street
  - + Space limited by railroad
  - + Busway creates large impervious surface
  - + Could be severe event retention area
  - + No currently proposed projects
  - + Good opportunity for partnerships

- Shadyside Residential
  - + Residents may have high likelihood of participation
  - + Could implement downspout disconnects and route water to right-of-way project/common bioretention
  - + Could also install infiltration drains in backyards

- Larimer Consensus Group Green Plan
  - + Community driven plan; existing interest in green development
  - + Strong community partners (Kingsley Association, Larimer Green Team)
  - + Availability of publicly owned land

Saw Mill Run

- Plummer's Run Sewer Separation
  - + Stream restoration
  - + Runs length of Saw Mill Road
  - + Need to address flows in two directions
  - + Same cost as Nine Mile Run restoration

- Beechview Ave. Business Area
  - + Very wide street
  - + Need to provide aesthetic improvements for businesses and surrounding area
  - + Pretty Up Beechview could be partner

- Route 88 & 51 Intersection
  - + Intersection reconstruction planning phase
  - + Review ways reconstruction could be used to capture stormwater and to alleviate chronic flooding issues in this area

- Target large impervious areas
  - + Several large parking lots, school properties, auto dealerships
  - + Example: Route 51 & Bausman surface area lots surrounded by Moore Park
  - + Possible mix of porous pavement and community bio-retention zones

ATTACHMENT B


ECCO Center Stormwater Management Demonstration Garden - David G. Himes, The Penn State Center, Pittsburgh

Nine-Mile Run

- Divert storm water into Frick Park
- Stormwater from Wilkinsburg and Swissvale could be channeled into Frick Park
- Enhance existing wetlands using existing outflows
  - \+ Would have to consider existing flooding in Frick Park and wetland management issues
  - \+ Could incorporate under-drain in Regent Square brick streets with Fern Hollow outlet
  - \+ Maybe have a user fee charged to municipalities producing the flow
  - \+ NMR residents are already well-informed, NMRWA is in place

- Green Streets and Alleys
  - \+ In Swisshelm Park neighborhood
  - \+ Some alleys currently barely paved, easy installation
  - \+ Neighborhood could be resistant to change

- Roundabout near Frick Museum
  - \+ Could include bio retention, surrounded by permeable pavement
  - \+ Could be an easy retrofit to the asphalt/mounded curb if no underground utilities; would need extremely salt tolerant plants
  - \+ Museum currently maintains planter/has difficulty irrigating them, but would likely welcome a different solution and partner with other organizations

- Entrance to Frick Environmental Center & Beechwood Blvd.
  - \+ Bioswales, tree pits, bump outs, etc. could be incorporated
  - \+ Will be a hugely visible site when the new Environmental Center opens, and this would complement the theme of a living building
  - \+ Opportunity to partner with Parks Conservancy, DPW

- Bioswales along Forbes
  - \+ Between Homewood Cemetery and Frick Park

- Wilkins Traffic Island
  - \+ Change from a raised planter to depressed bio retention and storage tank—slowly release stormwater back to combined sewer

Conclusion

The Pittsburgh Water and Sewer Authority is incredibly grateful for the time and knowledge contributed by stakeholders throughout this process. All of the information gathered during the charrette process is being used to inform the Green Infrastructure Section of PWSA's Wet Weather Feasibility Study. During the events, a number of the charrette participants pointed out that the USEPA had recently issued guidance on Integrated Watershed Management (IWM). One key element of the Study will be a detailed exploration of IWM, which reflects the fact that most stakeholders viewed green infrastructure as a tool for both improving water quality and decreasing the number of CSOs.

Even before the Study is approved by the Pennsylvania Department of Environmental Protection, PWSA is moving forward with implementing green infrastructure. At the conclusion of the final charrette, Jim Good, Interim Executive Director of PWSA, announced the creation of a Green Infrastructure Technical Advisory Committee and a partnership with the Pittsburgh Parks Conservancy, ALCOSAN, and the City of Pittsburgh DPW for an early demonstration project in Schenley Park. Furthermore, PWSA will continue to provide information and seek input on green infrastructure through their website, www.pittsburghgreeninfrastructure.com. PWSA looks forward to continuing to work with the stakeholders engaged through the charrettes on making green infrastructure an integral component of its Wet Weather Feasibility Study.

Auburn St. ECCO Center Stormwater Management Demonstration Garden - David G. Himes, The Penn State Center, Pittsburgh

ATTACHMENT B

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ATTACHMENT B

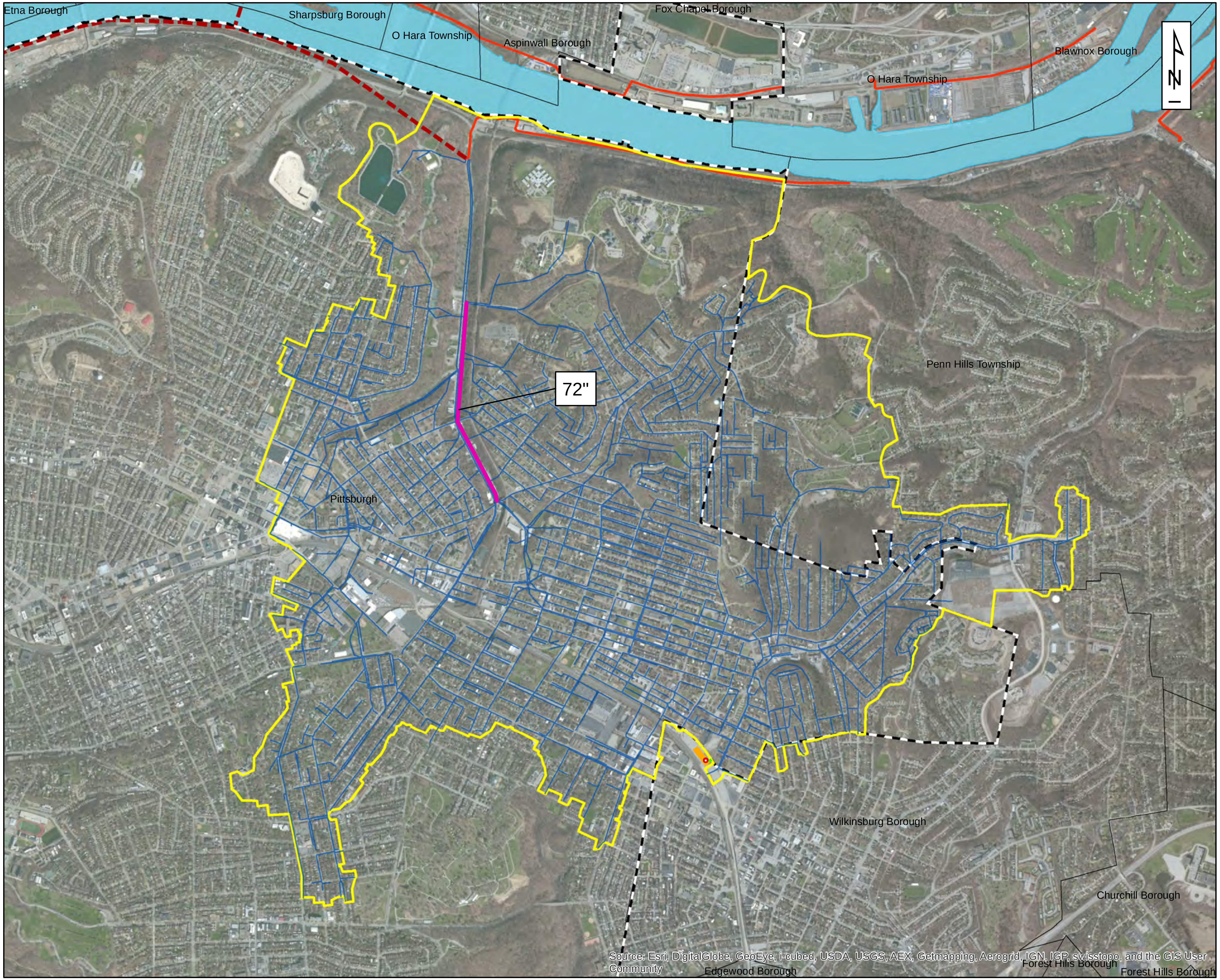
APPENDIX C

WET WEATHER FEASIBILITY STUDY

RECOMMENDED ALTERNATIVE MAPS

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013



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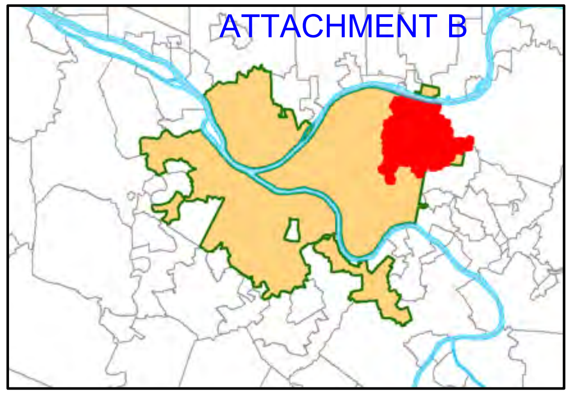


PWSA Service Area Overview

Legend

- ○ PWSA Diversion Structure Modification
- ▬ Washington Blvd. Relief Sewer
- 🟧 2.25 MG Storage Tank
- 🟩 Pumping Station
- ― Collector Sewer
- ☐ A-42 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ‒ ‒ ‒ Deep Tunnel
- ― Shallow Cut

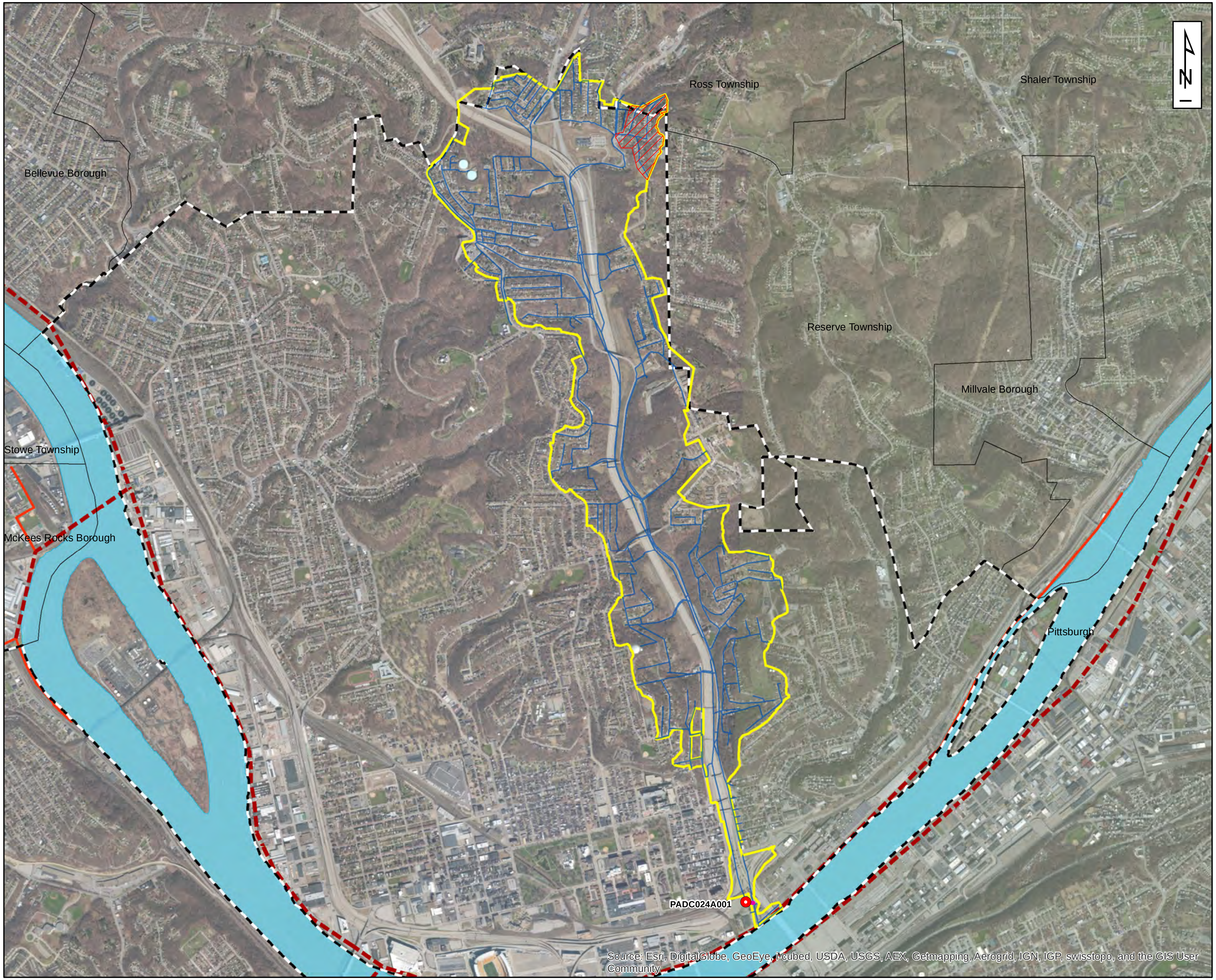
2,000 1,000 0 2,000 Feet

Figure A42-5-1: POC A42-TNK-4 Storage and Conveyance

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\NEGLEY RUN (A-42)\FIGURE 5-1_A_42.mxd



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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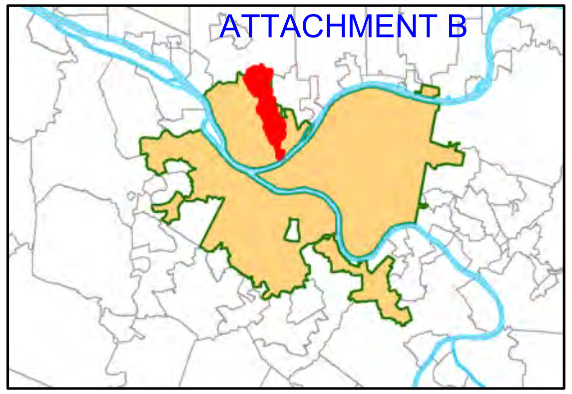


PWSA Service Area Overview

Legend

- ◉ PWSA Diversion Structure Modification
- ━ Relief/Consolidation Sewer
- ━ Collector Sewer
- ▨ Drainage Area to be Separated
- ▭ A-51 Sewershed Boundary
- ▭ PWSA Service Area Boundary
- ▭ Municipal Boundary
- 🟦 River

Existing ALCOSAN Interceptor

- ━ ━ Deep Tunnel
- ━ Shallow Cut

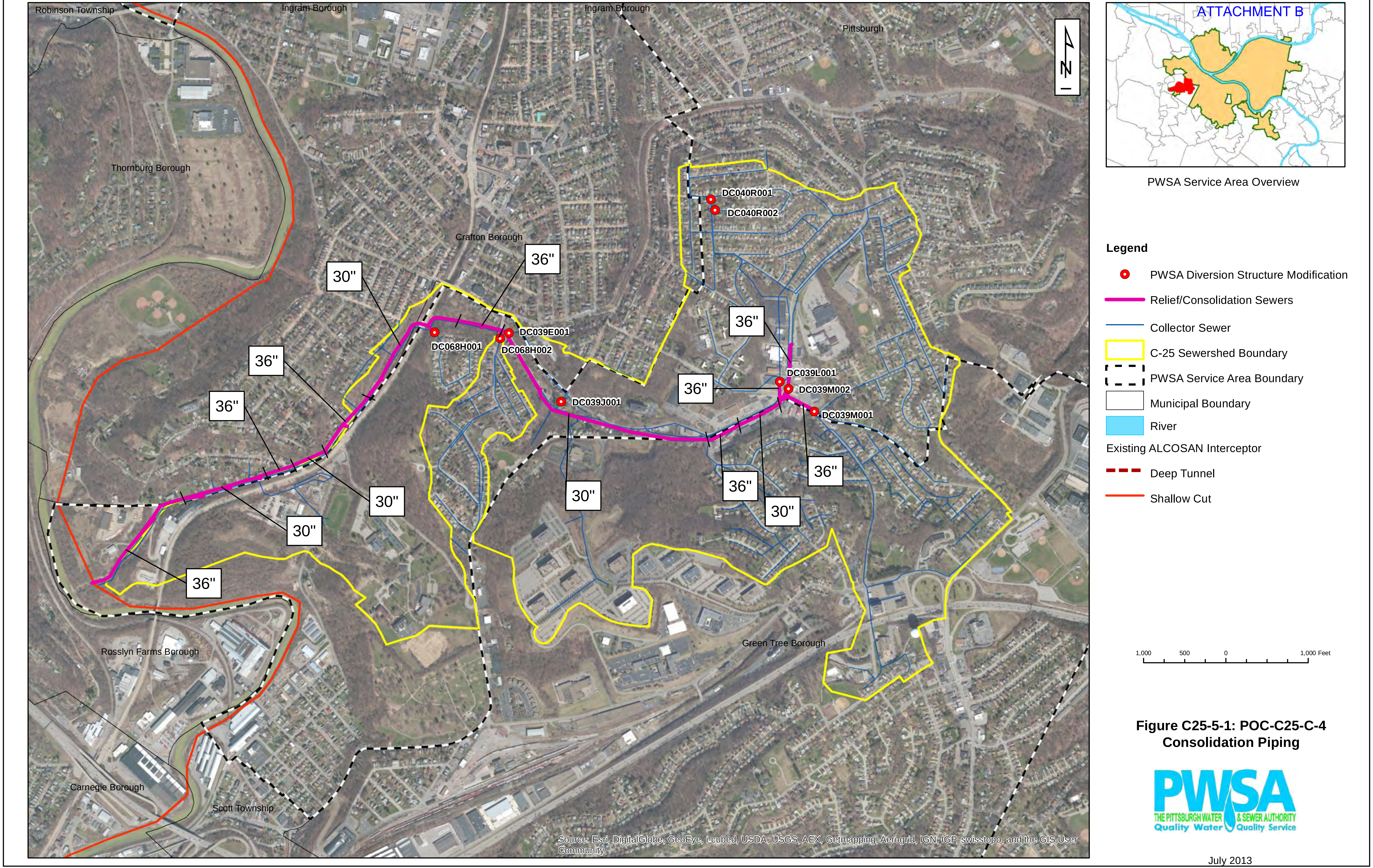
2,000 1,000 0 2,000 Feet

Figure A51-5-1: POC-A51-C-4 Consolidation Piping and Sewer Separation

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\EAST STREET VALLEY (A-51)\FIGURE 5-1_A_51_.mxd



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure C25-5-1: POC-C25-C-4 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

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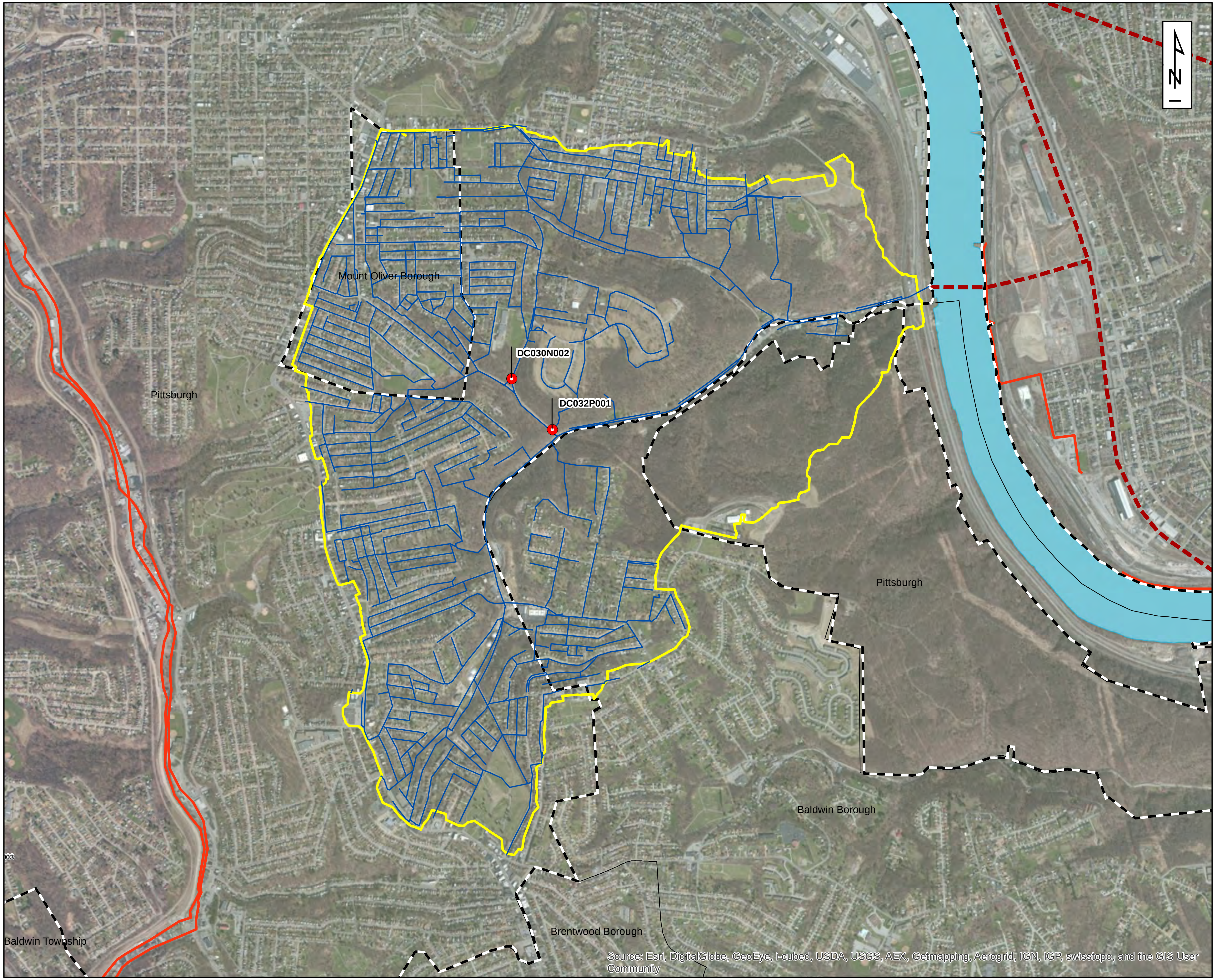
Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\BELLS RUN (C-25)\FIGURE 5-1_C-25.mxd



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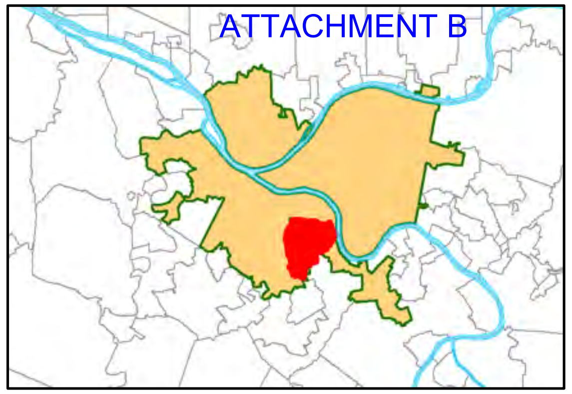

PWSA Service Area Overview

Legend

- ● PWSA Diversion Structure Modification
- ― Collector Sewers
- ☐ M-34 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- ■ River

Existing ALCOSAN Interceptor

- ▬ ▬ Deep Tunnel
- ― Shallow Cut

1,500 750 0 1,500 Feet

Figure M34-5-1: POC-M34-C-4 Diversion Structure Modification

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\BECKS RUN (M-34)\FIGURE 5-1_M_34.mxd

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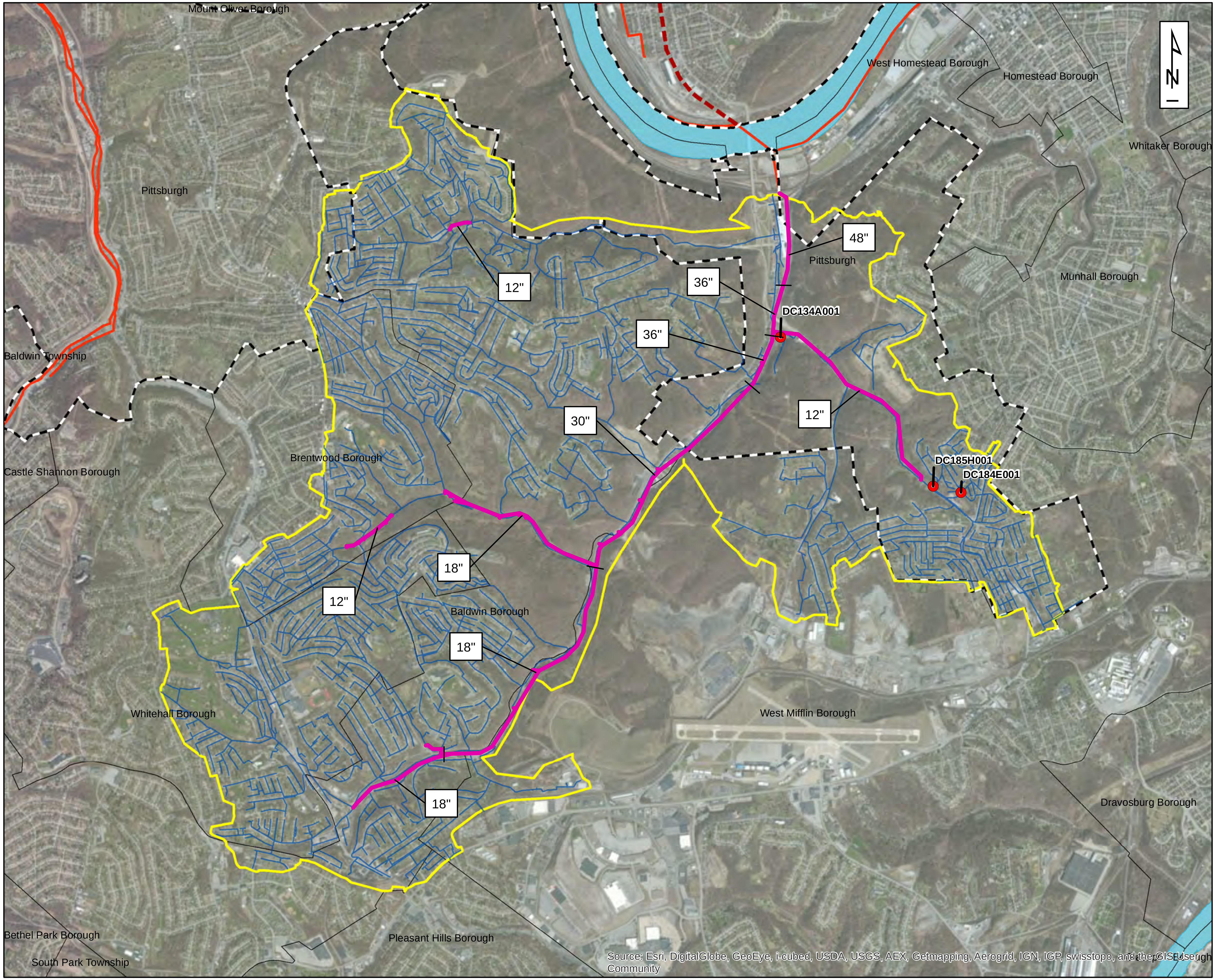
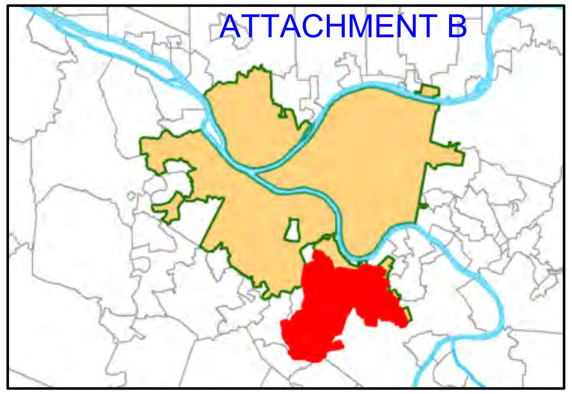


Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



PWSA Service Area Overview

Legend

- ● PWSA Diversion Structure Modification
- Relief/Consolidation Sewers
- Collector Sewer
- M-42 Sewer Boundary
- PWSA Service Area Boundary
- Municipal Boundary
- River

Existing ALCOSAN Interceptor

- Deep Tunnel
- Shallow Cut

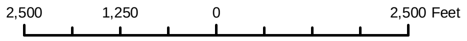


Figure M42-5-1: POC M42-C-4 Consolidation Piping

July 2013

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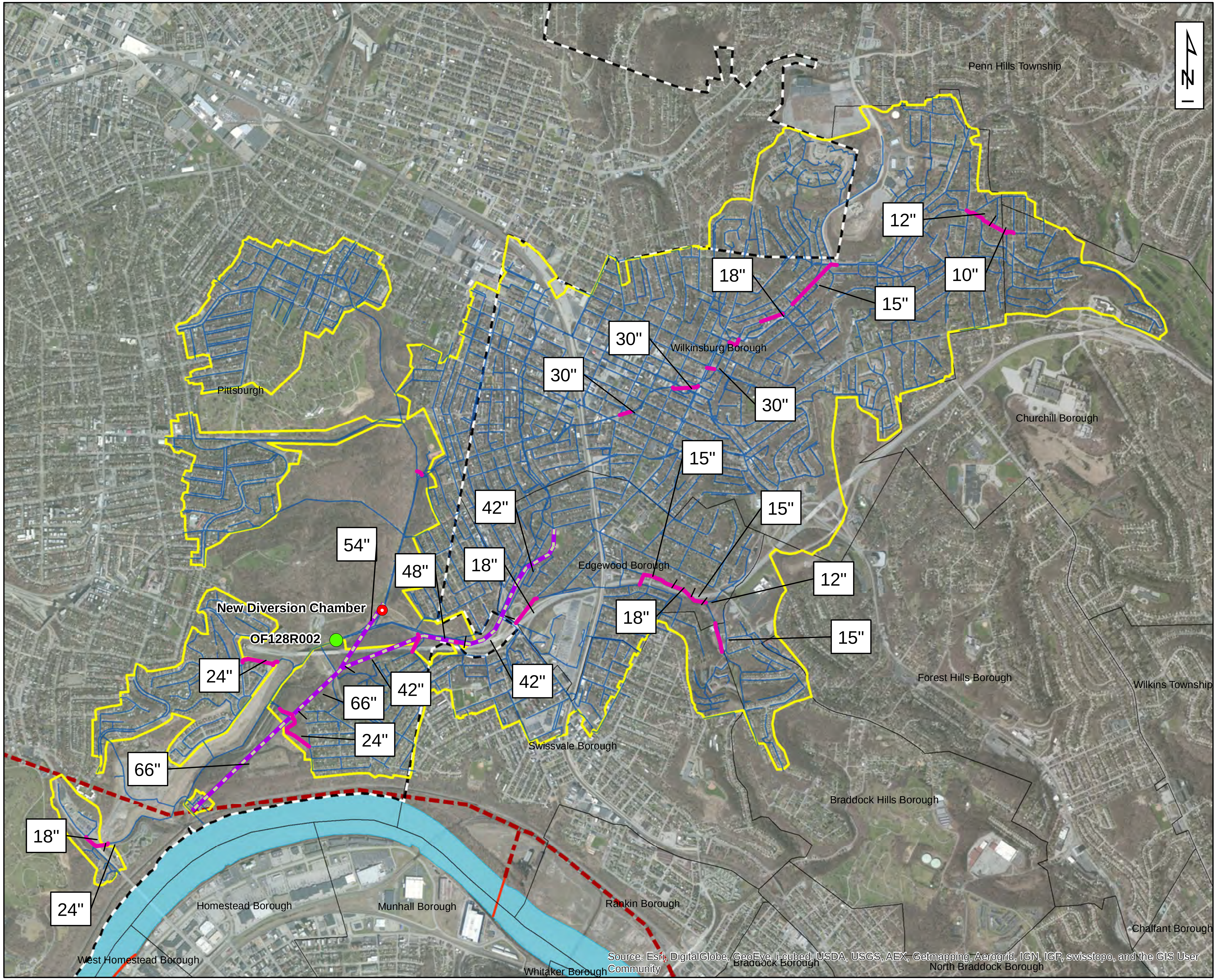

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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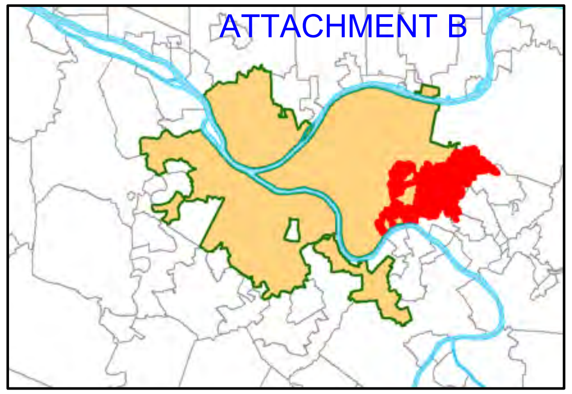


PWSA Service Area Overview

Legend

● PWSA Diversion Structure Modification
● PWSA Sewer Outfall
― Relief/Consolidation Sewers
- - Relief/Consolidation Sewers (Tunneled)
― Collector Sewer
☐ M-47 Sewershed Boundary
☐ PWSA Service Area Boundary
☐ Municipal Boundary
■ River

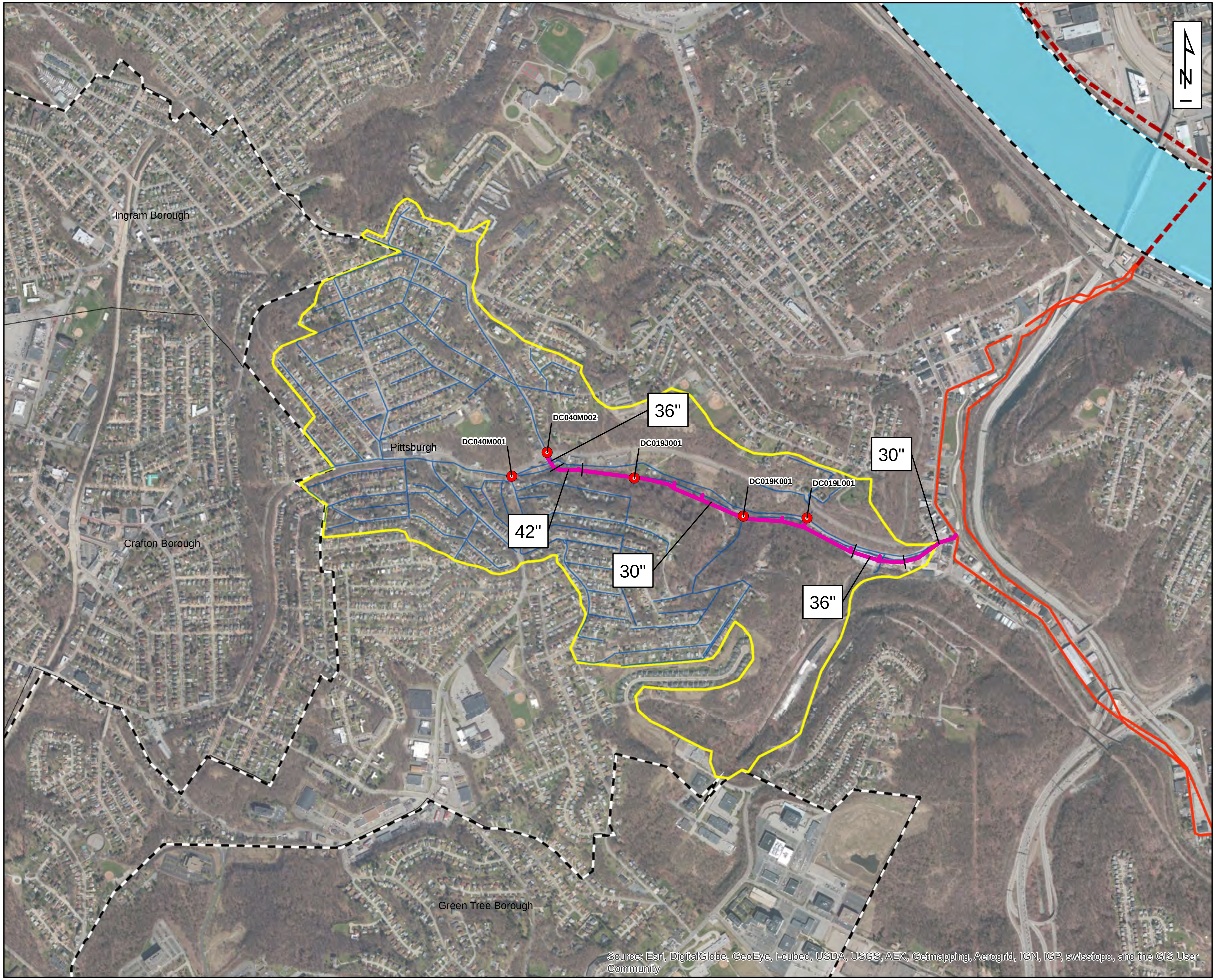
Existing ALCOSAN Interceptor
- - Deep Tunnel
― Shallow Cut

Figure M47-5-1: POC M47-C-4 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\NINE MILE RUN (M-47)\FIGURE 5-1_NMR_47.mxd



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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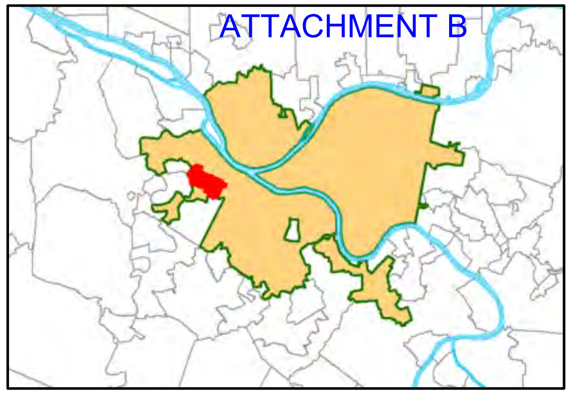

PWSA Service Area Overview

Legend

- ● PWSA Diversion Structure Modification
- ━ Relief/Consolidation Sewer
- ─ Collector Sewer
- ☐ MH-11 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- ▇ River

Existing ALCOSAN Interceptor

- ╍ Deep Tunnel
- ─ Shallow Cut

1,000 500 0 1,000 Feet

Figure MH11-5-1: POC MH11-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\McCARTNEY RUN (MH-11)\FIGURE 5-1_MH_11.mxd

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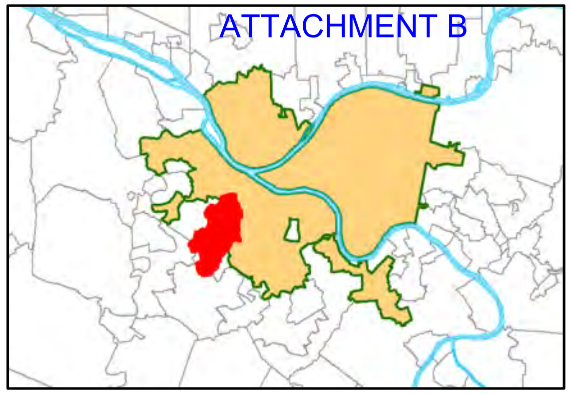
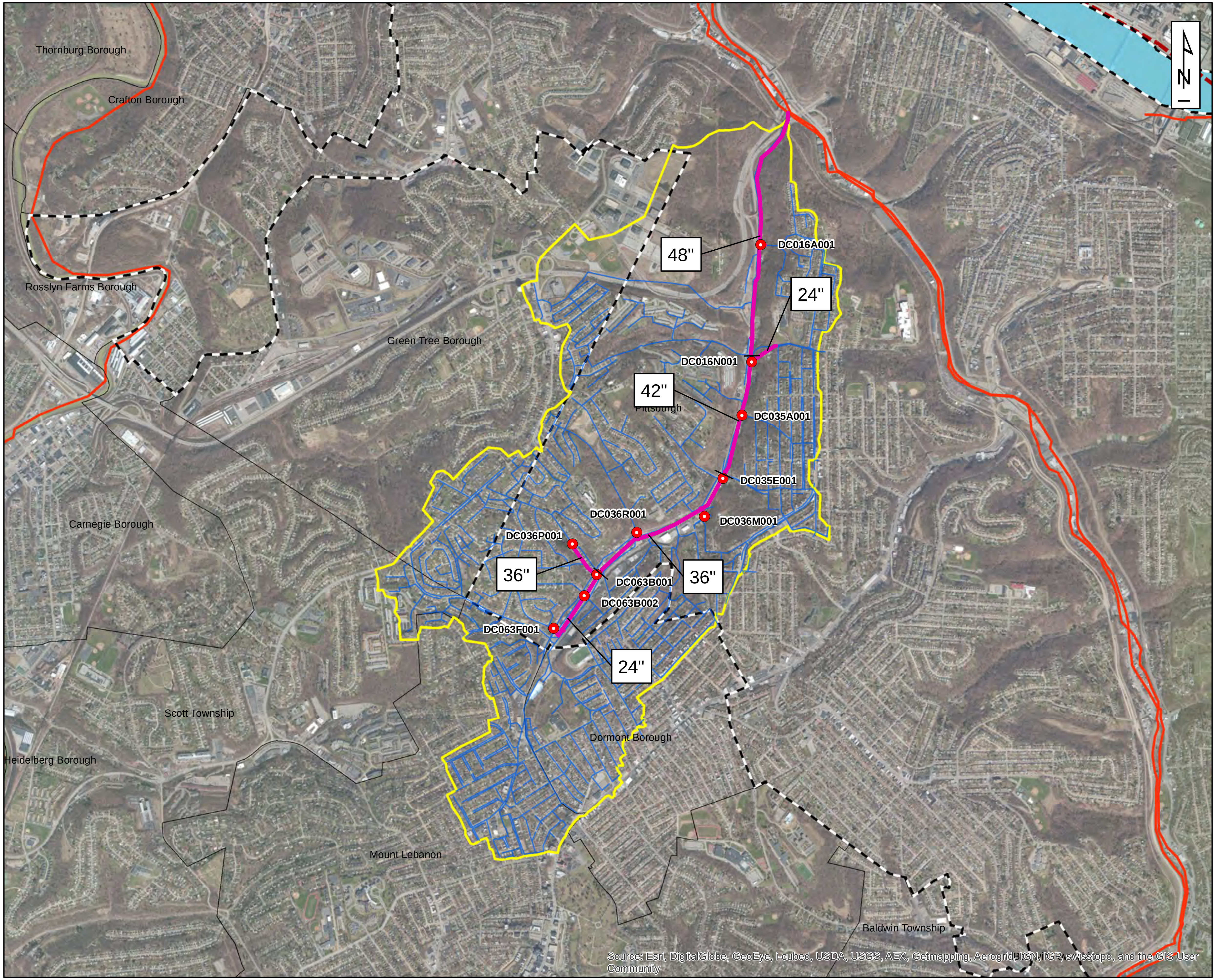


PWSA Service Area Overview



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- ⊙ PWSA Diversion Structure Modification
- ━ Relief/Consolidation Sewers
- ─ Collector Sewer
- ▭ MH-18 Sewershed Boundary
- ▭ PWSA Service Area Boundary
- ▭ Municipal Boundary
- ▭ River

Existing ALCOSAN Interceptor

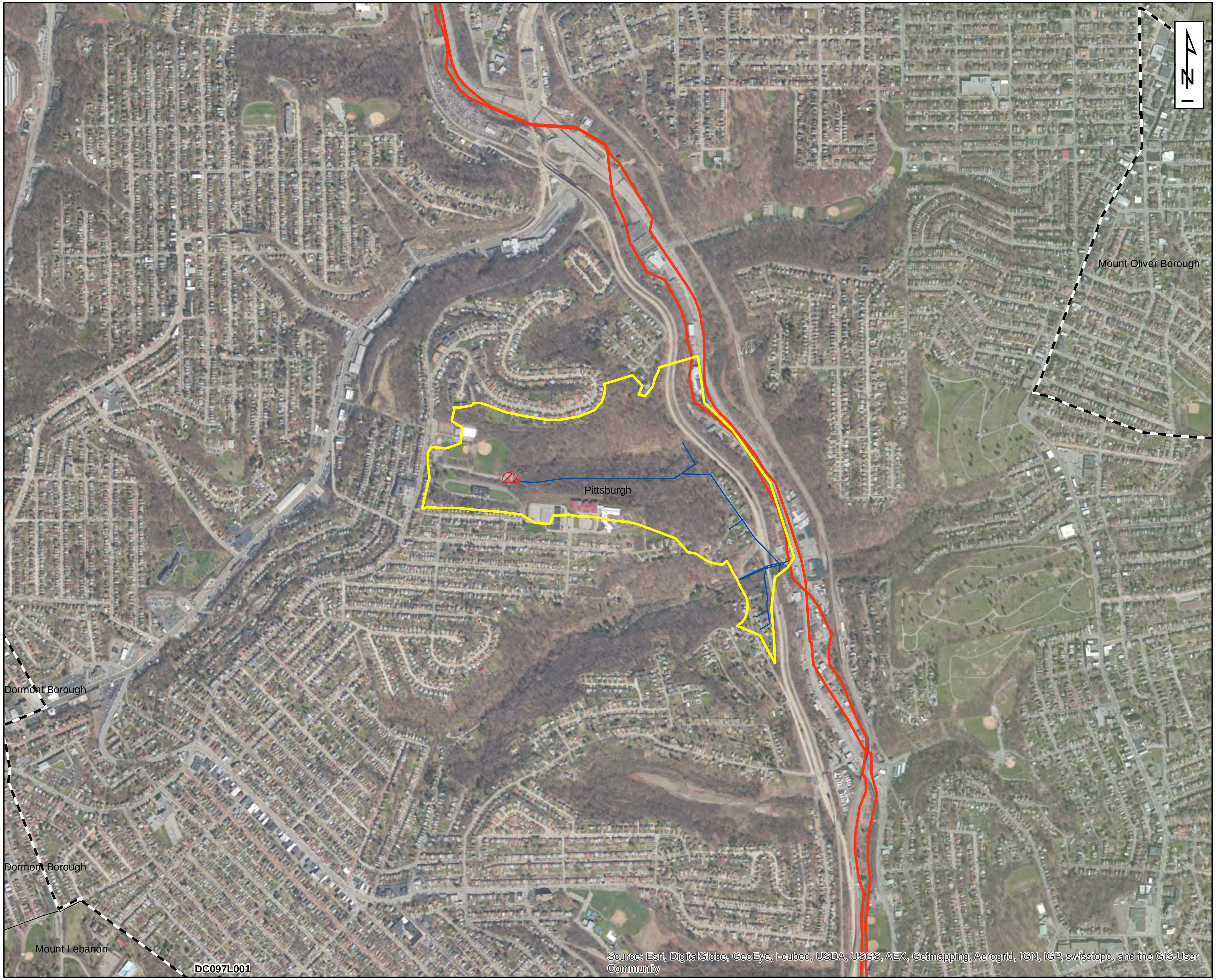
- ╍ Deep Tunnel
- ━ Shallow Cut

2,000 1,000 0 2,000 Feet

Figure MH18-5-1: POC MH18-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013



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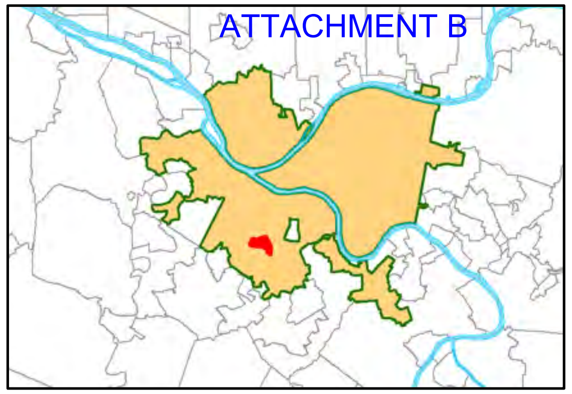


PWSA Service Area Overview

Legend

—	Collector Sewer
▨	Sewer Separation
▭	MH-55 Sewershed Boundary
▭	PWSA Service Area Boundary
▭	Municipal Boundary
■	River

Existing ALCOSAN Interceptor

- - -	Deep Tunnel
—	Shallow Cut

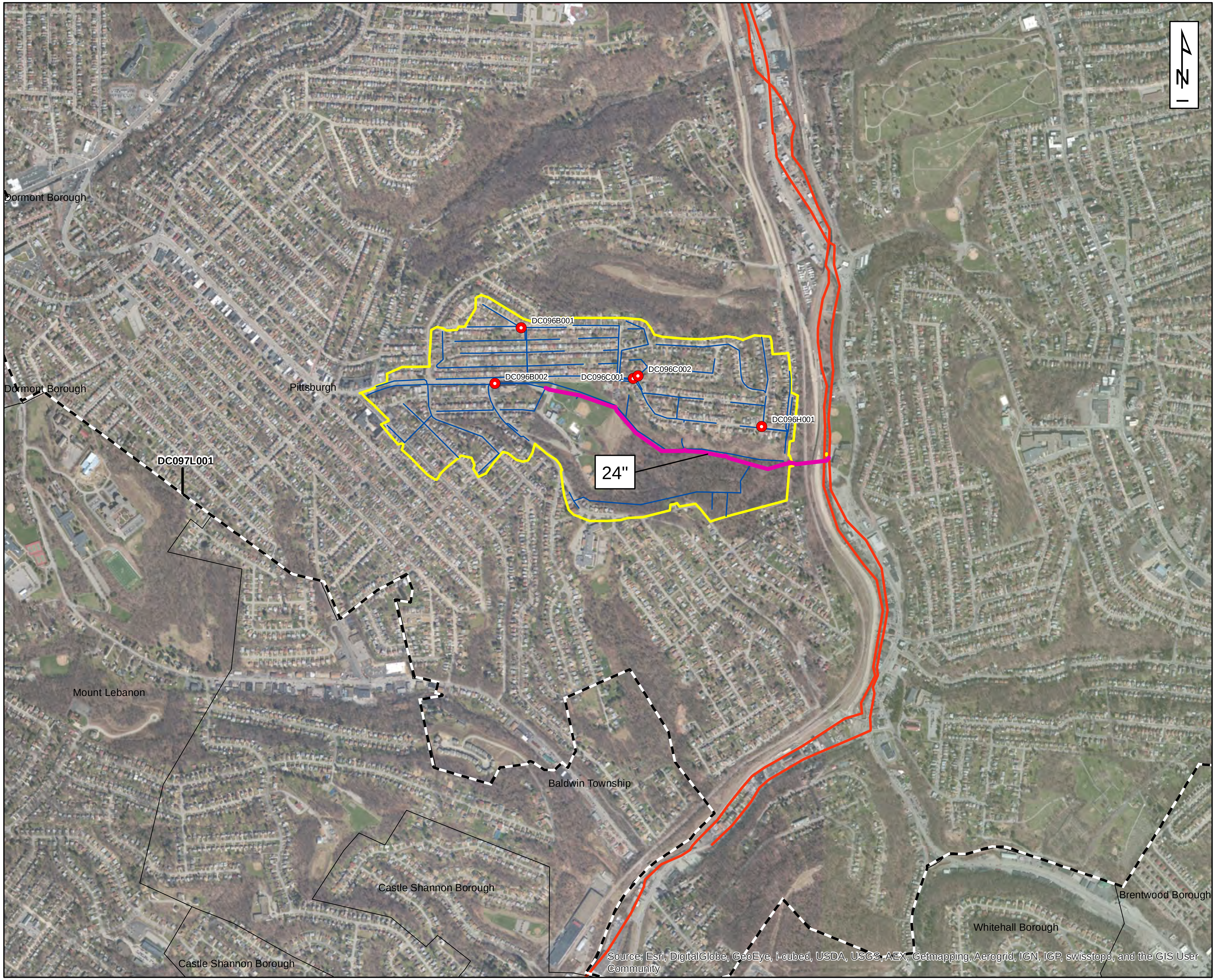
1,000 500 0 1,000 Feet

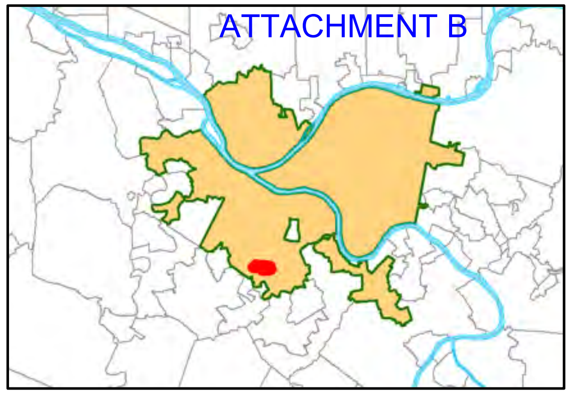
Figure MH55-5-1: POC-MH55-S-0 Sewer Separation

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 5-1_MH55.mxd





PWSA Service Area Overview

Legend

- ● PWSA Diversion Chambers Modififcation
- Relief/Consolidation Sewers
- Collector Sewer
- ☐ MH-77 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- ▨ River

Existing ALCOSAN Interceptor

- Deep Tunnel
- Shallow Cut

1,000 500 0 1,000 Feet

Figure MH77-5-1: POC-MH77-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 5-1_MH77.mxd

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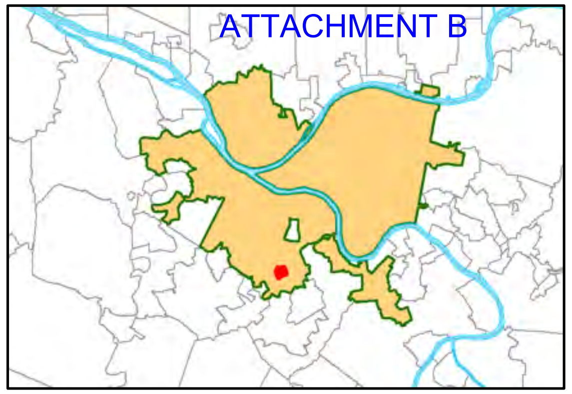
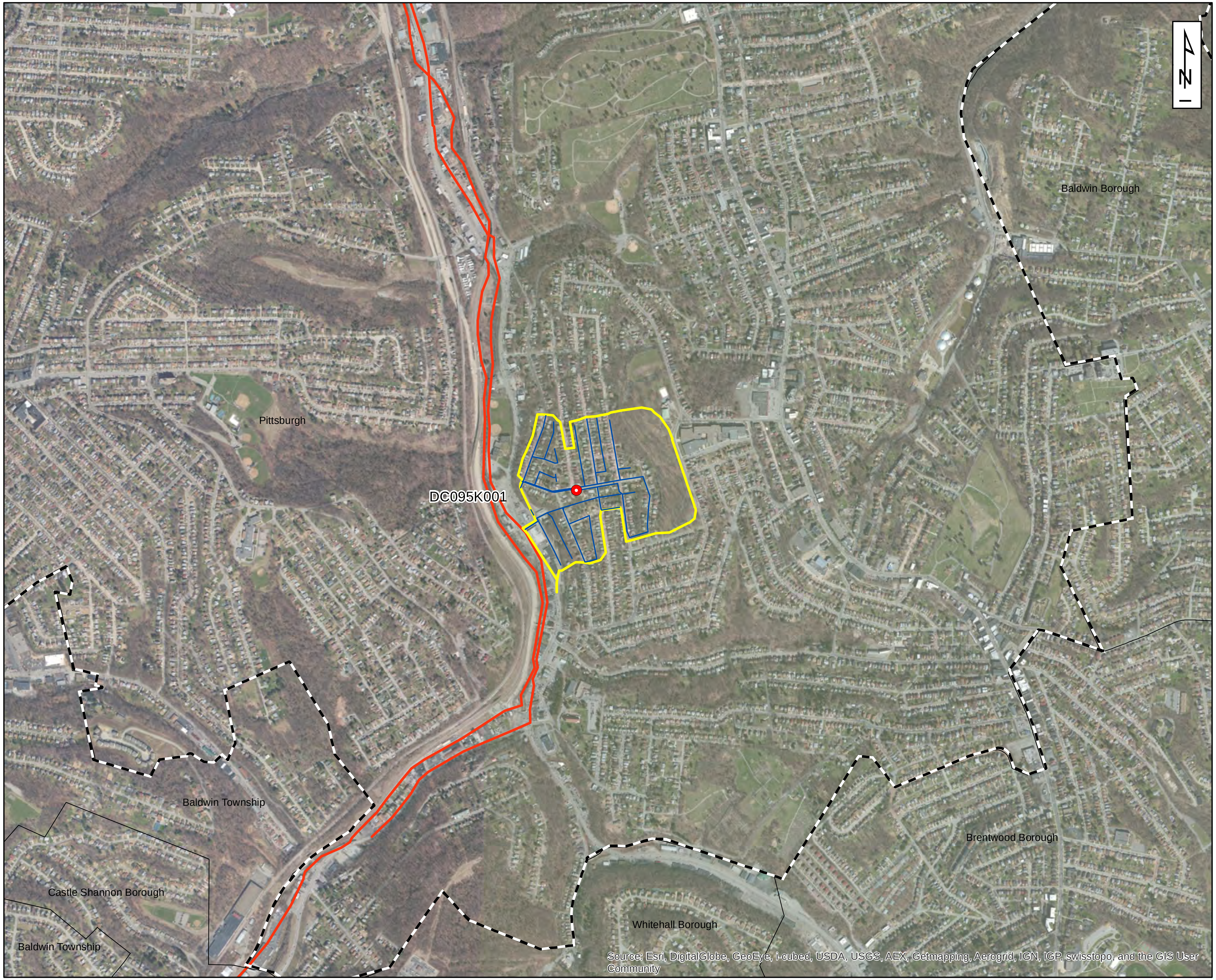


PWSA Service Area Overview



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- ● PWSA Diversion Structure Modification
- — Collector Sewer selection
- ☐ MH-80 Sewershed Boundary
- ☐ PWSA Service Area Boundary
- ☐ Municipal Boundary
- ▨ River

Existing ALCOSAN Interceptor

- - - - Deep Tunnel
- — Shallow Cut

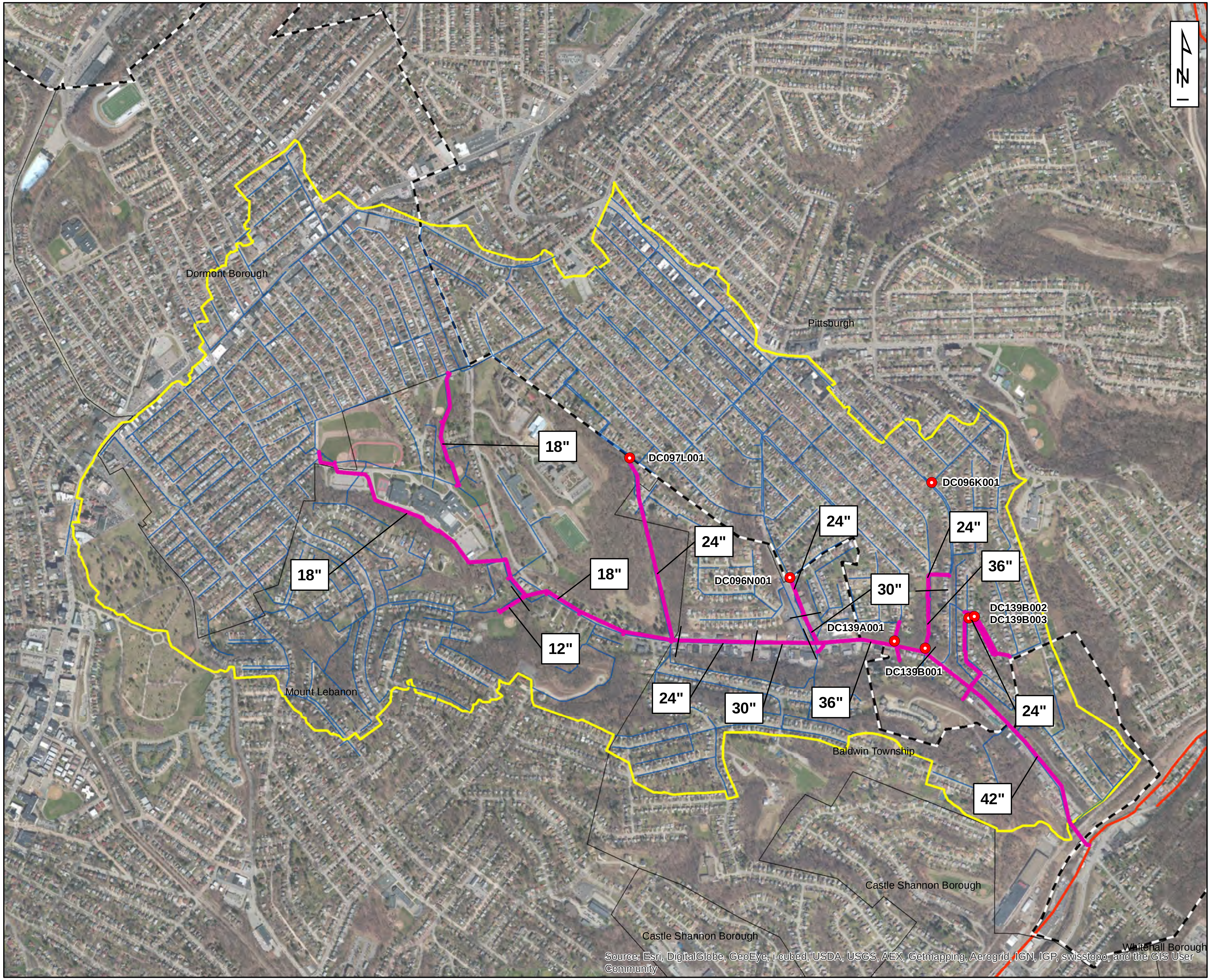
1,000 500 0 1,000 Feet

Figure MH80-5-1: POC MH-80-C-0 Diversion Structure Modification

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 5-1_MH80.mxd



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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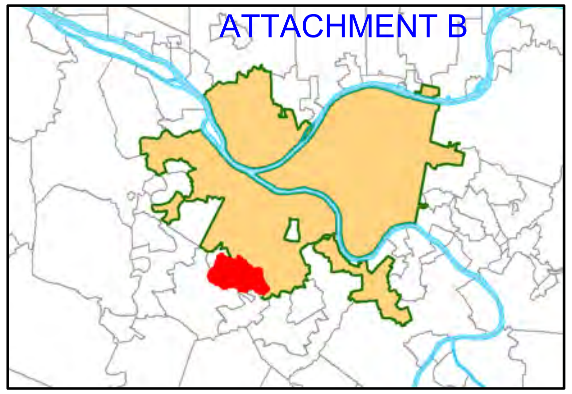


PWSA Service Area Overview

Legend

- ◉ PWSA Diversion Structures Modification
- ━ Relief/Consolidaion Sewers
- — Collector Sewer
- ▭ S-15 Sewershed Boundary
- ▭ PWSA Service Area Boundary
- ▭ Municipal Boundary
- ▭ River

Existing ALCOSAN Interceptor

- ╍ Deep Tunnel
- — Shallow Cut

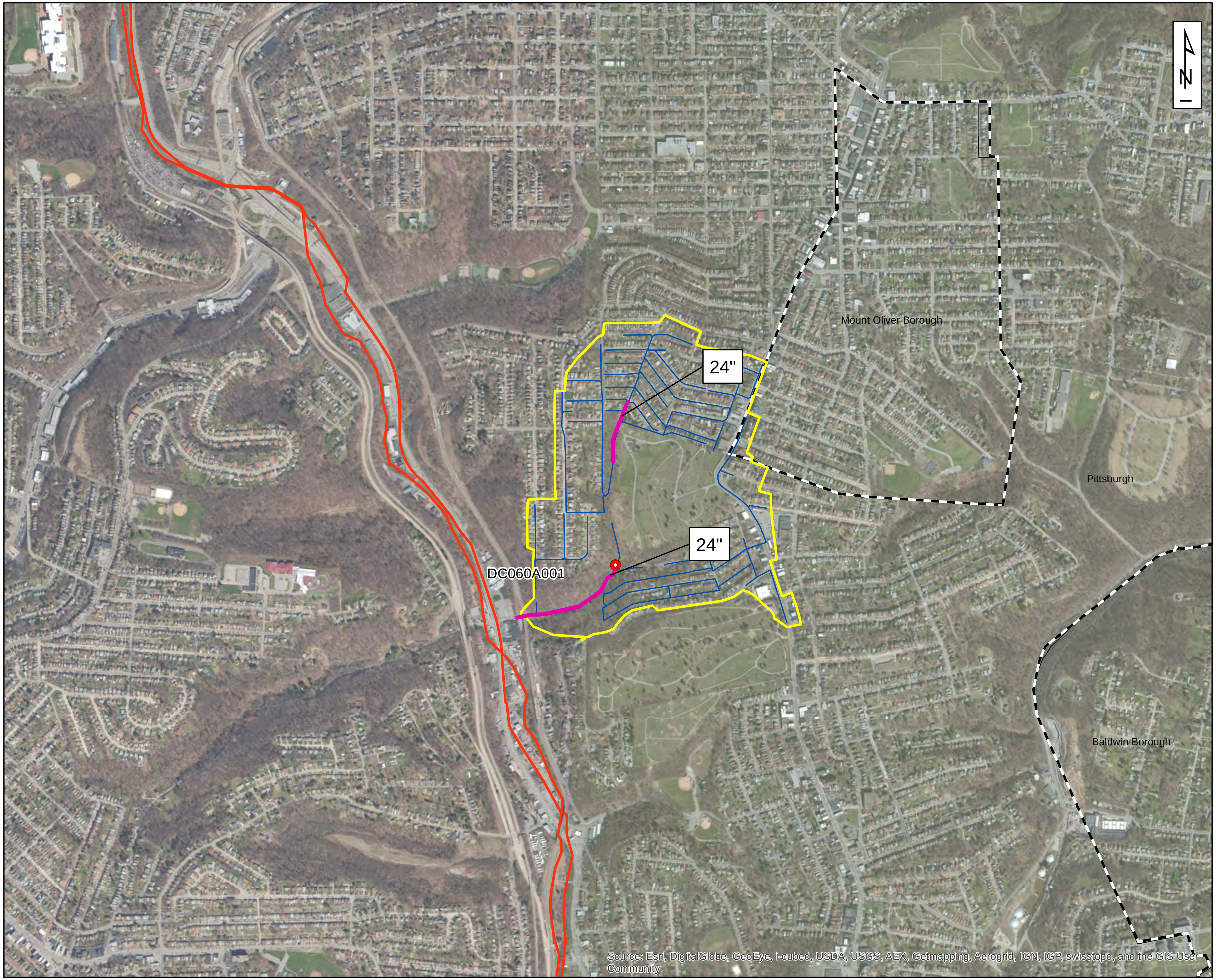
1,000 500 0 1,000 Feet

Figure S15-5-1: POC-S15-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\McDONOUGHS NUM (S-15)\FIGURE 5-1_S_15.mxd



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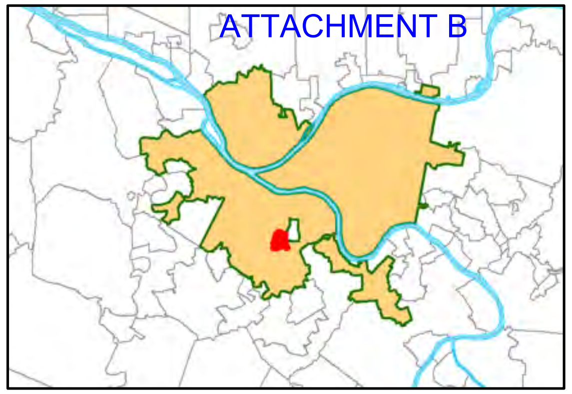
ATTACHMENT B



PWSA Service Area Overview

Legend

- ● PWSA Diversion Structure Modification
- ▬ Relief/Consolidation Sewers
- — Collector Sewer selection
- ▭ S-23 Sewershed Boundary
- ▭ PWSA Service Area Boundary
- ▭ Municipal Boundary
- ▭ River

Existing ALCOSAN Interceptor

- ▬ Deep Tunnel
- — Shallow Cut

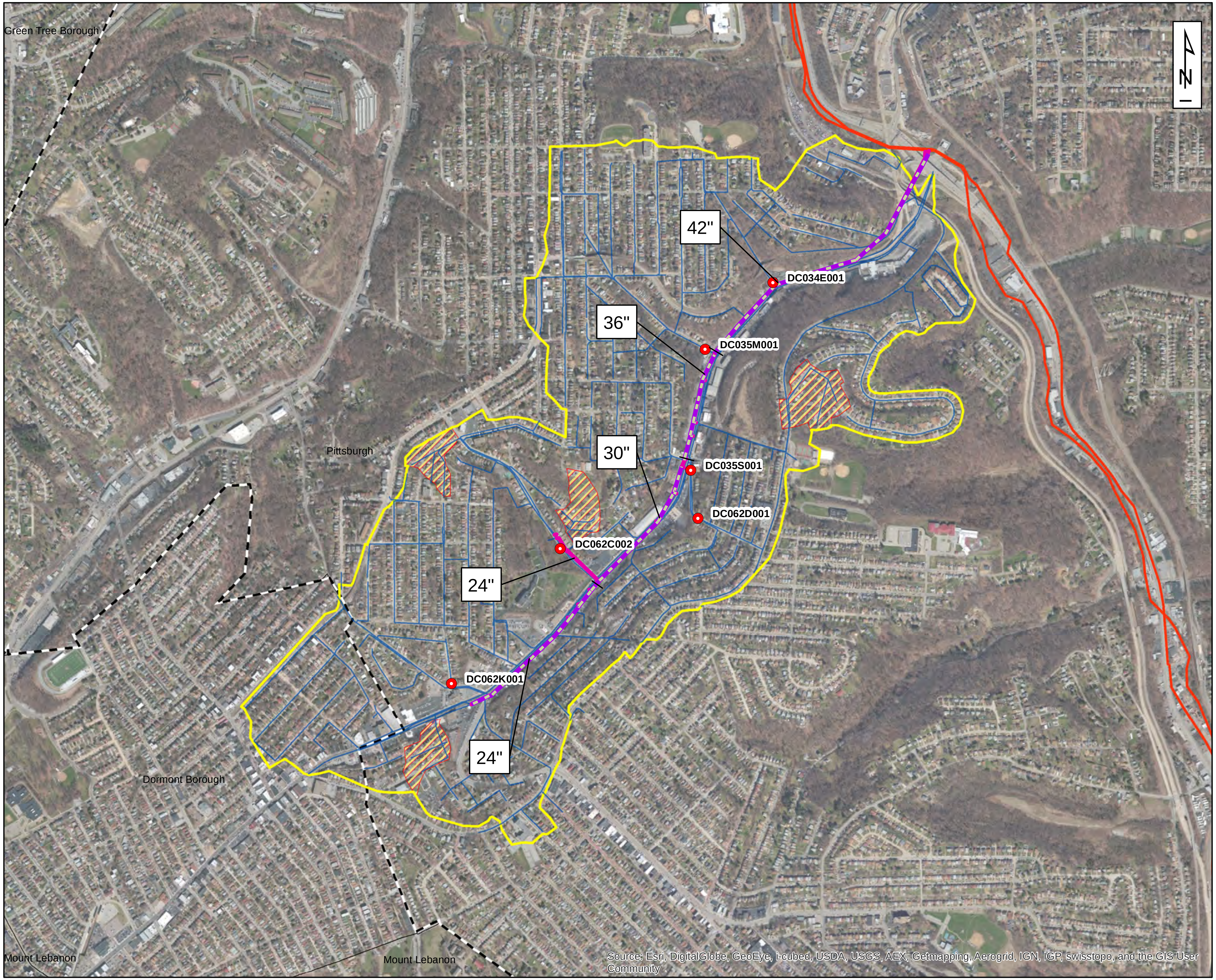
1,000 500 0 1,000 Feet

Figure S23-5-1: POC-S23-C-0 Consolidation Piping

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

Path: P:\Water\PWSA FS\Working\400 Technical\GIS FILES\MISC. SEWERSHEDS (S-23, MH-77, MH-80 AND MH-55)\FIGURE 5-1_S-23.mxd



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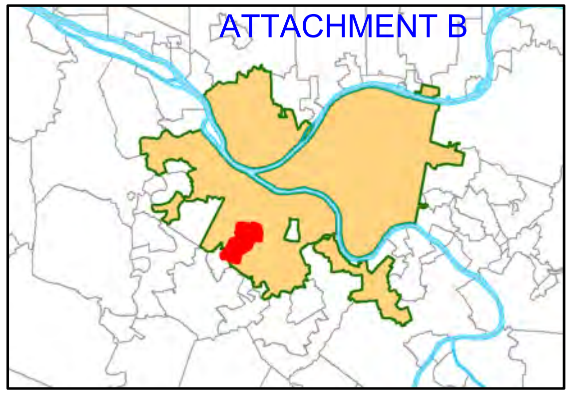

PWSA Service Area Overview

Legend

- ● PWSA Diversion Structure Modification
- Relief/Consolidation Sewers (Tunneled)
- Relief/Consolidation Sewers
- Collector Sewer
- SMRE-40 Sewershed Boundary
- ▨ Sewer Separation
- PWSA Service Area Boundary
- Municipal Boundary
- River

Existing ALCOSAN Interceptor

- Deep Tunnel
- Shallow Cut

1,000 500 0 1,000 Feet

Figure SMRE40-5-1: POC SMRE40-C-0 Consolidation Piping and Sewer Separation

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

July 2013

ATTACHMENT B

APPENDIX D

WET WEATHER FEASIBILITY STUDY

CONCEPTUAL GREEN INFRASTRUCTURE DESIGN IN THE POINT BREEZE NEIGHBORHOOD, CITY OF PITTSBURGH

PITTSBURGH WATER AND SEWER AUTHORITY

July 2013

ATTACHMENT B

2012 GREEN INFRASTRUCTURE COMMUNITY PARTNERS

3 Rivers Wet Weather
Pittsburgh, Pennsylvania

Photo by Richard Prescott, Keller Williams

Conceptual Green Infrastructure Design in the Point Breeze Neighborhood, City of Pittsburgh

DRAFT REPORT

JUNE 20, 2013

EPA EP-C-11-009

ATTACHMENT B

About Green Infrastructure

Stormwater runoff is a major cause of water pollution in urban areas. When rain falls in undeveloped areas, the water is absorbed and filtered by soil and plants. When rain falls on our roofs, streets, and parking lots, however, the water cannot soak into the ground. In most urban areas, stormwater is drained through engineered collection systems and discharged into nearby waterbodies. The stormwater carries trash, bacteria, heavy metals, and other pollutants from the urban landscape, degrading the quality of the receiving waters. Higher flows also can cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure.

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water. These neighborhood or site-scale green infrastructure approaches are often referred to as *low impact development*.

EPA encourages the use of green infrastructure to help manage stormwater runoff. In April 2011, EPA renewed its commitment to green infrastructure with the release of the *Strategic Agenda to Protect Waters and Build More Livable Communities through Green Infrastructure*. The agenda identifies community partnerships as one of five key activities that EPA will pursue to accelerate the implementation of green infrastructure.

EPA announced partnerships with 10 *model communities* in April 2011. These communities have demonstrated how green infrastructure can supplement or substitute for single-purpose *gray* infrastructure investments such as storm sewers and detention ponds.

In February 2012, EPA announced the availability of $950,000 in technical assistance to a second set of partner communities to help overcome some of the most common barriers to green infrastructure. EPA received letters of interest from over 150 communities across the country. EPA selected 17 of these communities, which included Pittsburgh, Pennsylvania to receive assistance with code review, green infrastructure design, and cost-benefit assessments. This report was prepared as part of the 2012 Green Infrastructure Community Partners Program.

For more information, visit http://water.epa.gov/infrastructure/greeninfrastructure/gi_support.cfm.

Acknowledgements

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Contents

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Introduction

The Greater Pittsburgh Area is located on the Allegheny Plateau, where the confluence of the Allegheny River from the northeast and the Monongahela River from the southeast form the Ohio River. The rivers and mountains form the backdrop for the area's economy and livelihood. In addition to being used for swimming, boating, and fishing, the three rivers provides the source of drinking water for the community.

The City of Pittsburgh and surrounding municipalities developed with a combined sewer system serving its older urban core areas. Combined sewers convey sewage and stormwater flows in a single pipe sewer system, allowing combined sewer overflows (CSOs) to Pittsburgh waterways during wet weather. Correcting the sewage overflow problems is a priority for the region, including the Allegheny County Sanitary Authority (ALCOSAN), which provides wastewater (combined sewer) treatment services to 83 municipalities in the County.

In January 2008, ALCOSAN entered into an agreement (Consent Decree) with the United States Environmental Protection Agency (US EPA), Pennsylvania Department of Environmental Protection (DEP), and the Allegheny County Health Department (ACHD). The Consent Decree (CD) is a legal, binding document that requires ALCOSAN to meet a series of requirements for planning, design and construction, operation and permitting with the purpose of improving water quality in receiving waters and protecting designated waterway uses that include drinking water, recreation, aquatic life, and others. The CD requires that ALCOSAN control the amount of CSOs being discharged into the Ohio, Allegheny, and Monongahela Rivers, and their tributary streams of Chartiers Creek, Saw Mill Run, and Turtle Creek.

This commitment to reduce CSOs and improve water quality and recreation has led the municipalities to consider the use of green infrastructure (GI) for stormwater management and CSO reduction.

3 Rivers Wet Weather (3RWW) was created to help Allegheny County municipalities address the region's wet weather overflow problem. As part of their mission, 3RWW created the RainWays® tool to aid residents and engineers in determining the effects a proposed GI project would have on the CSO issues. This tool is publically accessible at http://www.3riverswetweather.org/green-infrastructure.

Using RainWays® and USEPA's System for Urban Stormwater Treatment and Analysis INtegration (SUSTAIN) best management practice (BMP) siting tool, 3RWW conducted a study assessing the feasibility of using green infrastructure within the City of Pittsburgh, Borough of West View, and Borough of Millvale. The characteristics of these areas are typical of the greater Pittsburgh area with moderate slopes and a constrained urban setting. Both residential neighborhoods and commercial properties were evaluated for potential green infrastructure projects on municipal, commercial, and residential properties. 3 Rivers Wet Weather developed a planning-level methodology to identify potential locations for green infrastructure projects with SUSTAIN, then used the RainWays tool to analyze flow reduction and costs for implementation. From this study, 12 candidate sites were chosen for further analysis, which was the basis for the subsequent work described in this report.

Based on investigations conducted in early March 2013 of the 12 candidate sites, three of the sites were selected as green infrastructure conceptual design projects as part of the 2012 EPA Green Infrastructure Community Partners Project. The goal was to determine model sites which would have the highest likelihood of success in managing stormwater and contributing toward the reduction of combined sewer overflows within the ALCOSAN system. The selection process weighed long-term as well as near-term considerations. The considerations included the following:

Long-Term Considerations

- Probability of neighborhood acceptance
- Maintainability
- Visibility
- Contribution toward reduced combined sewer overflows
- Potential for excessive/debilitating pollutant loads from tributary area (e.g. hot spots and unpaved driveways)
- Frequent flooding

Near-Term Considerations

- Constructability and functionality
- Relative cost compared to other GI practices
- Existing pavement conditions – Pavement needing resurfacing gets priority among equals.

One of the selected project sites, the topic of this report, is the Frick Museum and Surrounding Area within the Nine Mile Run Watershed (City of Pittsburgh, Point Breeze Neighborhood). Refer to Figure 1 for the project location.

This project will enhance the space in the Point Breeze Neighborhood by providing stormwater treatment facilities, a “green” amenity, and an educational opportunity. The project will serve as a model for other existing urban neighborhoods in the greater Pittsburgh area and will provide a range of appropriate green infrastructure tools that can be implemented within the region.

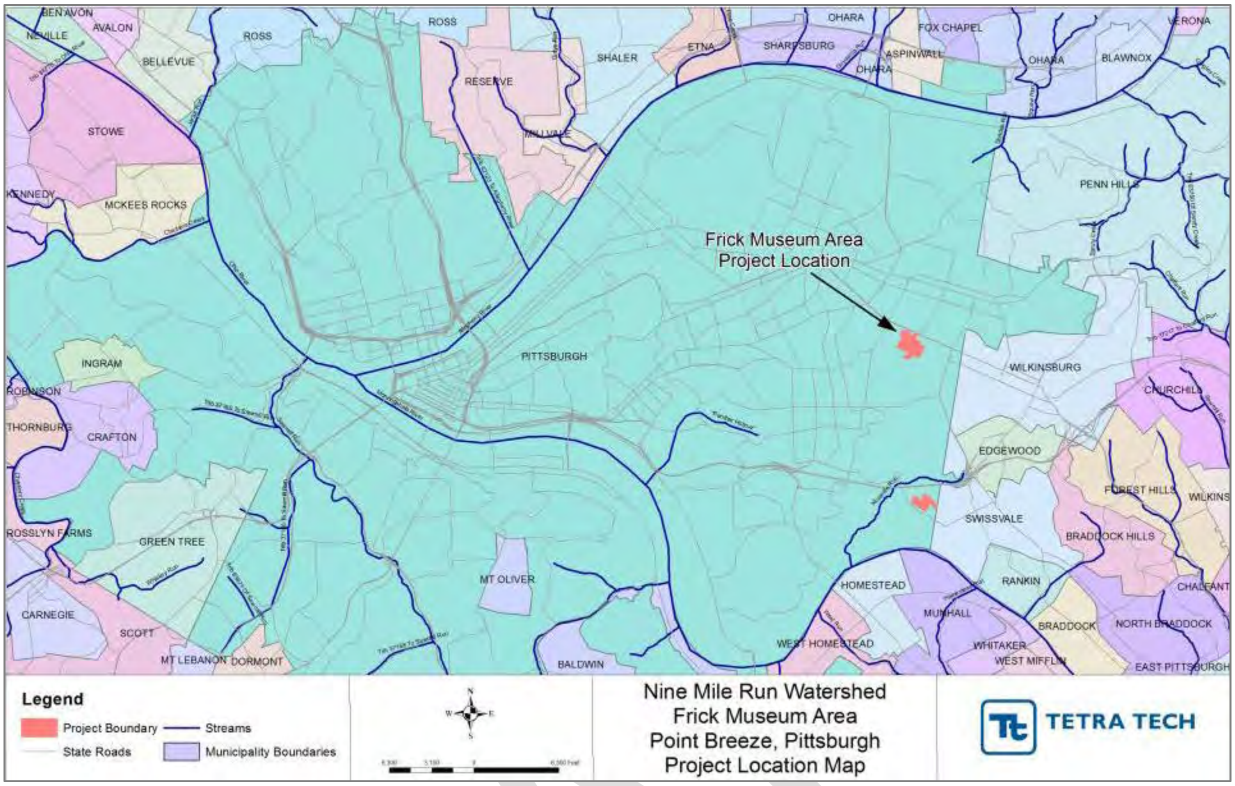

Figure 1. Site Location Map

Benefits of Green Infrastructure

Green infrastructure restores the natural hydrologic processes of infiltration, percolation, and evapotranspiration to reduce the adverse effects of urban stormwater runoff on receiving water bodies. Green infrastructure practices have been shown to cost-effectively reduce the impacts of stormwater runoff; reduce maintenance requirements; and provide multiple environmental, social and economic benefits (Kloss 2006). Some of the additional environmental, social, and economic benefits of green infrastructure include:

Increased enjoyment of surroundings: A large study of inner-city Chicago found that one-third of the residents surveyed said they would use their courtyard more if trees were planted (Kuo 2003). Residents living in greener, high-rise apartment buildings reported significantly more use of the area just outside their building than did residents living in buildings with less vegetation (Hastie 2003; Kuo 2003). Research has found that people in greener neighborhoods judge distances to be shorter and make more walking trips (Wolf 2008). Implementing green infrastructure practices that enhance vegetation within the neighborhood will help to create a more pedestrian-friendly environment that encourages walking and physical activity.

Increased safety and reduced crime: Researchers examined the relationship between vegetation and crime for 98 apartment buildings in an inner city neighborhood. The study found the greener a building's surroundings are, the fewer total crimes (including violent crimes and property crimes), and that levels of nearby vegetation explained 7 to 8 percent of the variance in crimes reported by building (Kuo 2001a). In investigating the link between green space and its effect on aggression and violence, 145 adult women were randomly assigned to architecturally identical apartment buildings but with differing degrees of green space. The levels of aggression and violence were significantly lower among the women who had some natural areas outside their apartments than those who lived with no green space (Kuo 2001b). The stress-reducing and traffic-calming effects of trees are also likely to reduce road rage and improve the attention of drivers. Green streets can also increase safety. Generally, if properly designed, narrower green streets decrease vehicle speeds and make neighborhoods safer for pedestrians (Wolf 1998; Kuo 2001a).

Increased sense of well-being: There is a large body of literature indicating that green space makes places more inviting and attractive and enhances people's sense of well-being. People living and working with a view of natural landscapes appreciate the various textures, colors, and shapes of native plants, and the progression of hues throughout the seasons (Northeastern Illinois Planning Commission 2004). Birds, butterflies, and other wildlife attracted to the plants add to the aesthetic beauty and appeal of green spaces and natural landscaping. "Attention restorative theory" suggests that exposure to nature reduces mental fatigue, with the rejuvenating effects coming from a variety of natural settings, including community parks and views of nature through windows. In fact, desk workers who can see nature from their desks experience 23 percent less time off sick than those who cannot see any nature, and desk workers who can see nature also report a greater job satisfaction (Wolf 1998).

Increased property values: Many aspects of green infrastructure can potentially increase property values by improving aesthetics, drainage, and recreation opportunities. These in turn can help restore, revitalize, and encourage growth in the economically distressed areas around Pittsburgh. Table 1 summarizes the recent studies that have estimated the effect that green infrastructure or related practices have on property values. The majority of these studies addressed urban areas, although some suburban studies are also included. The studies used statistical methods for estimating property value trends from observed data.

Table 1. Studies Estimating Percent Increase in Property Value from Green Infrastructure

Source	Percent increase in Property Value	Notes
Ward et al. (2008)	3.5 to 5%	Estimated effect of green infrastructure on adjacent properties relative to those farther away in King County (Seattle), WA.
Shultz and Schmitz (2008)	0.7 to 2.7%	Referred to effect of clustered open spaces, greenways and similar practices in Omaha, NE.
Wachter and Wong (2006)	2%	Estimated the effect of tree plantings on property values for select neighborhoods in Philadelphia.
Anderson and Cordell (1988)	3.5 to 4.5%	Estimated value of trees on residential property (differences between houses with five or more front yard trees and those that have fewer), Athens-Clarke County (GA).
Voicu and Been (2008)	9.4%	Refers to property within 1,000 feet of a park or garden and within 5 years of park opening; effect increases over time
Espey and Owasu-Edusei (2001)	11%	Refers to small, attractive parks with playgrounds within 600 feet of houses
Pincetl et al. (2003)	1.5%	Refers to the effect of an 11% increase in the amount of greenery (equivalent to a one-third acre garden or park) within a radius of 200 to 500 feet from the house

Source	Percent increase in Property Value	Notes
Hobden, Laughton and Morgan (2004)	6.9%	Refers to greenway adjacent to property
New Yorkers for Parks and Ernst & Young (2003)	8 to 30%	Refers to homes within a general proximity to parks

Nine Mile Run Watershed:
Frick Museum and Surrounding Area Project Site

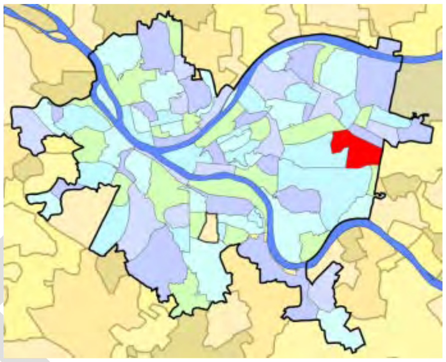

Figure 2. Point Breeze Neighborhood within the City of Pittsburgh

The project site is located in the Point Breeze neighborhood within the Nine Mile Run Watershed. The neighborhood is located in the central east part of the City of Pittsburgh and it situated between the Allegheny River and the Monongahela River. The project site is comprised of a historic residential neighborhood featuring the Frick Museum, which is part of the Frick Art & Historical Center, a 5-acre complex of lawns, gardens, museums, and the Frick mansion. The project site is also adjacent to Frick Park, a 561-acre municipal park providing an extensive wildlife habitat accessible through its network of trails. Drainage from the project site would naturally flow to Frick Park, as would most of the Nine Mile Run Watershed, but presently most stormwater is captured by the upstream combined sewer system resulting in diminished flows to the park and its streams.

Using green infrastructure concepts at the block scale will help improve water quality, increase flow to Frick Park, and help decrease combined sewer overflows by decreasing the peak flow rate and stormwater volume to the combined sewer system. In addition, the community could experience several other benefits often associated with green infrastructure, including increased property values, enhanced enjoyment of surroundings, a greater sense of well-being and reduced crime. Information gained from this project will help promote similar projects throughout the greater Pittsburgh area.

Figure 3. Frick Museum and Surrounding Area Project Boundary

Existing Site Conditions

The project site is a mixture of single-family residential (~1/8-acre lots) and institutional uses and is highly visible due to the presence of the Frick museum. The neighborhood has a medium density configuration with houses that are situated close to the street typically with small front yards such that minimal stormwater retention on a residential lot is expected. The project site elevations range from approximately 970 to 994 feet with several steep roads and topographic depressions. The likelihood of neighborhood acceptance is high as many of the residents are expected to have some understanding of green infrastructure due to the education and outreach efforts of the local Nine Mile Run Watershed Association and field observations of rain barrels on several residential properties. Refer to the Appendix for a copy of the completed site reconnaissance checklist and accompanying map for this area.

The majority of the streets have curb and gutter and a few alleys are present. Stormwater typically sheet flows off the ground surface into stormwater catch basins that tie directly into a combined sewer system. During small rain events, the stormwater is directed to the Allegheny County Sanitary Authority (ALCOSAN) wastewater treatment plant before being released to the Ohio River. During larger rain events, the sewer drainage system is overwhelmed and a mixture of sanitary sewage and stormwater are discharged untreated to the local waterways within Frick Park and the Monongahela River. Pollutants from the area are anticipated to include bacteria, nutrients, and heavy metals, typical of urban areas.

The Frick museum parking lot is well-maintained. Sediment sources are minimal. The perimeter of the lot is landscaped and manicured.

An analysis of the site topography indicates that surface water generally flows northeast to southwest on the site. The existing stormwater drainage network currently outfalls to Nine Mile Run, flowing within and downstream of Frick Park. The predominant soil type is a hydrologic soil group classification of Type B indicating well-draining soil with great potential for removing stormwater from the combined sewer system. There are no known potential soil contamination issues (including leaking underground storage tanks) within the project contributing area. The area is not designated as a groundwater recharge area, and there are no environmentally sensitive areas within the project limits.

All road and alley rights-of-way are owned and maintained by the City of Pittsburgh. Maintenance of the Frick museum parking lot is the responsibility of Frick Art & Historical Center, Inc. Coordination with Frick Art & Historical Center, Inc. is needed for further implementation of the proposed conceptual design. Preliminary conversations with staff have indicated that they are very interested in retrofitting the parking lot with green infrastructure in the future.

Figure 4. South Homewood Avenue adjacent to Frick Park

Figure 5. Le Roi Road

Proposed Site Design

The goal of the field reconnaissance was to 1) verify the feasibility of implementing the proposed GI practices from the 3RWW RainWays and SUSTAIN study, 2) generate additional ideas for incorporating GI as practical, and 3) further assess the drainage area based on catch basin locations. A variety of green infrastructure practices were feasible throughout the area within the right-of-way as well as on institutional property.

Proposed GI practices for the area include a mixture of permeable pavement and bioretention within the street/alley right-of-way, as well as on the Frick museum property. GI practices on residential properties were not considered for this demonstration effort. As much of the potential area within the right-of-way has typical urban constraints including buried utilities and narrow right-of-way, it is important to choose GI practices that can demonstrate success within this environment. As this is a demonstration project, the practices applied need to translate fairly easily to other locations within the Pittsburgh area, recognizing any lessons-learned as well as special design techniques for constructing on moderate slopes (5 to 10 percent). See “Green Infrastructure Conceptual Design” for placement and design of the proposed GI practices.

Goals

3 Rivers Wet Weather (3RWW) is providing direct assistance to 83 municipalities to coordinate the development of their consent order-required “Feasibility Studies,” which are the analysis of alternatives for reduction, conveyance, or storage of wet weather flows within the communities. These feasibility studies specify the proposed actions (including both gray and green infrastructure) that municipalities served by ALCOSAN will implement to mitigate sewer overflows. As these studies are the voices of the municipalities to be integrated into the ALCOSAN Long-Term Wet Weather Control Plan (LTCP), the vision is to ensure that GI is evaluated and included in the municipal plans where cost-effective and appropriate. There is a sense of urgency in the timing of implementation of GI as the Wet Weather Plan is well under development and will be the blueprint for the construction of a system that will be required to mitigate sewer overflows in the ALCOSAN service area by 2026. 3RWW will work directly with the municipalities through the existing Feasibility Study Working Group of about 25 municipal engineers who represent more than 70 of the 83 communities. GI demonstration projects are one of the mechanisms being used to reiterate the importance of GI and at the same time bring familiarity to those likely to plan for and design GI to mitigate sewer overflows.

Project Goals

Green infrastructure concepts and practices are intended to approximate the hydrologic conditions of the site prior to development through infiltration, evaporation, and detention of stormwater runoff. Furthermore, the GI planned for this project is intended to assist in reducing combined sewer overflows while also improving drainage and water quality in the neighborhood. Secondary goals of the project are to improve the aesthetic appeal of the neighborhood while maintaining the historic character of the area. These goals will be accomplished through implementation of permeable pavement and bioretention on S. Homewood Avenue, Le Roi Road, Roycrest Place, Osage Lane, Card Lane, Lang Court, and the Frick museum parking lot within the project area.

Design Goals

ALCOSAN is working toward a target of no more than four overflows per regulator per year. This is based on the Consent Decree agreement. Modeling efforts during a previous study of the ALCOSAN system calculated overflow volumes for each event and ranked them from largest to smallest.

The project site is upstream of regulator M-47-OF. The model information was analyzed at this overflow point, and it was found that the fifth largest overflow event had a rainfall depth of 1.41 inches. The allowable peak flow rate from the regulator drainage area to comply with this overflow event is 0.0019 cfs per acre (i.e. 164 cubic feet per day per acre). This is essentially the capacity at the regulator, normalized over the drainage area, when the hydraulic grade line is at the crest of the overflow weir. For a GI practice to assist in meeting the overflow limit, the allowable release rate from the practice is 0.0019 cfs per acre of drainage area. Since this is such a slow release rate, it is likely that the 72-hour facility dewatering requirement will govern the release rate of the practice.

For purposes of the conceptual design, the GI practices are sized to store the runoff resulting from 1.41 inches of rainfall from the tributary drainage area discounting release rates. This will result in a slightly over-sized system.

Green Infrastructure Toolbox

Green infrastructure typically incorporates multiple practices utilizing the natural features of the site in conjunction with the goal of the site development. Multiple controls can be incorporated into the development of the site to complement and enhance the proposed layout while also providing water quality treatment and volume reduction. Green infrastructure practices are those methods that provide control and/or treatment of stormwater runoff on or near locations where the runoff initiates, thus providing water quality improvement and volume reduction. Typical large-scale practices include approaches such as vegetated infiltration basins and stormwater wetlands. Smaller scale practices typically include approaches such as permeable pavement and bioretention facilities. The green infrastructure practices identified as appropriate for the project area include vegetated green infrastructure practices (i.e. bioretention) and permeable pavement. To assist planners and designers in going forward with these conceptual designs, the following discussion addresses constraints and opportunities associated with each applicable green infrastructure practice.

Vegetated Green Infrastructure Practices

Vegetated green infrastructure practices are vegetated, depressed areas with a fill soil (often engineered soil media) that infiltrate stormwater and remove pollutants through a variety of physical, biological, and chemical treatment processes. Vegetated green infrastructure practices can be large-scale controls treating several acres or small-scale controls placed in parking medians, rights-of-way, and other locations within impervious areas. The following section discusses bioretention as a small-scale control for this project.

Bioretention: Bioretention typically consists of vegetation, a ponding area, mulch layer, and planting or engineered soil media. The depressed area is planted with small- to medium-sized vegetation including trees, shrubs, grasses and perennials and may incorporate a vegetated groundcover or mulch that can withstand urban environments and tolerate periodic inundation and dry periods. Runoff intercepted by the practice is temporarily captured in the depression and then filtered through the soil (often engineered soil) media. Pollutants are removed through a variety of physical, biological, and chemical treatment processes. Pretreatment of stormwater flowing into the bioretention area is recommended to remove large debris, trash, and larger particulates. Pretreatment may include a grass filter strip, sediment forebay, or grass swale. Ponding areas can be designed to increase flow retention and provide flood control.

Bioretention is well suited for removing stormwater pollutants from runoff, particularly for smaller (water quality) storm events. Bioretention can be used to partially or completely meet stormwater management requirements on smaller sites. Bioretention areas are best suited for areas that would typically be dedicated to landscaping and can be designed to capture roof runoff, parking lot runoff, or sidewalk and street runoff (as shown in Figure 6 and Figure 7). Bioretention is especially useful in this project area to encourage walkability and “green” within the right-of-way and museum parking lot.

Figure 6. Bioretention in Median
Source: Aaron Volkening

Figure 7. Curb-extension Bioretention
Source: www.saltdistrict.com

Permeable Pavement

Conventional pavement results in increased surface runoff rates and volumes relative to pre-developed conditions. Permeable pavements, in contrast, work by allowing streets, parking lots, sidewalks, and other impervious surfaces to utilize the underlying soil's natural infiltration capacity while maintaining the structural and functional features of the materials they replace. Permeable pavements contain small voids that allow water to drain through the pavement to an aggregate reservoir and then infiltrate into the soil. If the native soils below the permeable pavements do not have enough percolation capacity, underdrains can be included to direct the stormwater to other downstream stormwater control systems. Permeable pavement can be developed using modular paving systems (e.g., concrete pavers, grid pavers, grass-pave, or gravel-pave) or poured-in-place solutions (e.g., pervious concrete or pervious asphalt).

Permeable pavement reduces the volume of stormwater runoff by converting an impervious area to a treatment unit. The aggregate sub-base can provide water quality improvements through filtering and enhance additional chemical and biological processes. The volume reduction and water treatment capabilities of permeable pavements are effective at reducing stormwater pollutant loads.

Permeable pavement can be used to replace traditional impervious pavement for most pedestrian and vehicular applications. Composite designs that use conventional asphalt or concrete in high-traffic areas adjacent to permeable pavements along shoulders or in parking areas can be implemented to provide a cost-effective solution to meet both transportation and stormwater management requirements. Permeable pavements are most often used in constructing pedestrian walkways, sidewalks, driveways, low-volume roadways, and parking areas of office buildings, recreational facilities, and shopping centers (Figure 8 and Figure 9). Permeable pavement is a suitable GI choice within the project area because it can be used without decreasing street parking or pedestrian walkways in narrow rights-of-way, such as alleys. It is also a convenient choice for parking lot pavement as it does not cause a reduction in parking capacity.

Figure 8. Permeable Interlocking Concrete Paver Parking Lane

Figure 9. Permeable Interlocking Concrete Paver Parking Stalls

Green Infrastructure Conceptual Design

This section addresses the selection, layout, and design of the green infrastructure practices for the project site. The selection and proposed layout of the controls within the project area are based on the 3RWW RainWays and SUSTAIN study, determining the effects of GI on CSO volume reduction, and a field reconnaissance to verify feasibility and identify additional opportunities. The design method is described in "Design Elements" conceptual layout and sizing of green infrastructure practices to meet the CSO volume reduction objectives are discussed in section "Recommended Sizing and Layout." Details on design information are summarized and presented in section "Green Infrastructure Practice Technical Specifications" to assist with final design of the green infrastructure practices.

Design Elements

The GI siting was based on multiple factors including 1) effectiveness as a demonstration site, 2) multi-use asset for the surrounding neighborhood, 3) potential for volume reduction for CSO issues, and 4) ancillary benefits such as aesthetic improvement. The potential for green infrastructure practice demonstration was evaluated based on the proximity to parks, schools, museums, or other GI practices that would attract the public and acceptability in the neighborhood. It also considered the potential for applying the GI design similarly throughout the greater Pittsburgh area.

The conceptual design of the practices takes into account approximated soil infiltration rate, drainage area size and runoff coefficient, and allowable peak flow rates based on the downstream combined sewer regulator. Additional design parameters for bioretention include the surface storage depth, planting soil depth, aggregate storage depth, and void space ratios of the soil and aggregate. Permeable pavement design parameters include pavement thickness, aggregate storage depth, and the applicable void space ratios. As this project moves into final design other considerations will include buried utilities, connection to the combined sewer system, and topography based on a survey.

Analytical Methods

As a primary goal of this project is to alleviate CSO issues, the design of the GI practices focuses on retaining on-site a runoff volume, indicated by modeling at the downstream regulator M-47-OF, such that ALCOSAN can limit the number of CSO events to no more than four overflows/regulator per year. The GI practices are sized to store the runoff resulting from 1.41 inches of rainfall from the tributary drainage area disregarding release rates. The runoff curve number method is used to calculate runoff. Required storage volumes from the tributary drainage areas to the GI practices are presented in Table 2.

The subcatchment areas for the proposed GI practices were derived from topographic data (provided by 3RWW) and field visits. Note that these data will need to be validated as part of the final design. The soil was represented as medium-infiltrating soil (Hydrologic Soil Group B) per the Natural Resources Conservation Service Soil Survey data provided by 3RWW. Actual soil infiltration rates will need to be determined as part of the final design (See "Green Infrastructure Practice Technical Specifications" later in this document.)

The final conceptual sizing of the green infrastructure practices was based on available surface area and an assumed cross-section for the design while ensuring that the practice, at a minimum, could capture the required storage volume for the regulator capacity. Storage within the practice took into account void space within the soil media and aggregate storage layer but not the required 72-hour dewatering time, infiltration, and evapotranspiration. Therefore, during final design, these parameters should be taken into account which would help decrease the practice sizes. It was also assumed that perforated underdrains that are included in the conceptual designs would have a downstream valve at the outlet, which would be regulated to meet dewatering requirements as needed. With HSG B soils, an underdrain is not imperative but is useful for future flow monitoring or as a failsafe should underlying soils become clogged.

Table 2. Subcatchment Delineations and Required Storage Volume

Subcatchment	Subcatchment Drainage Area (acres)	Required Storage Volume for Regulator Capacity (cu ft)
Frick museum parking lot - bioretention	0.36	1,272
Frick museum parking lot - permeable parking stalls	0.89	2,228
S. Homewood Avenue curb-extension bioretention	0.19	702
S. Homewood Avenue - traffic island bioretention	2.18	4,563
Le Roi Road - bioretention median	0.15	474
Le Roi Road - permeable parking strips	0.24	446
Osage Lane - permeable alley	0.09	404
Roycrest Place - permeable parking strips	1.00	2,505
Card Lane - permeable parking strips	0.54	1,591
Lang Court - permeable parking strips	0.46	1,533

Recommended Sizing and Layout

The conceptual layout and sizing of the green infrastructure practices within the project area are discussed in this section. The cross-section designs used for the sizing of the practices are in section "Green Infrastructure Practice Technical Specifications."

Within the discussion below, note that the water storage volume is the product of the surface area of the practice and the equivalent storage depth. Equivalent storage depth is the sum of the surface ponding depth and the product of the void space and applicable underlying layers. The soil layer, bedding layer, and aggregate storage layer void space are 20 percent, 30 percent, and 40 percent, respectively. Storage volume indicates the GI practice volume, discounting the underlying soil infiltration rate, required to meet the design criteria. The cross-section of the final design can vary from the conceptual design cross-section as long as the water storage volume capacity is maintained.

Proposed GI practices within the parking lot include a combination of permeable pavement and bioretention to provide storage capacity as well as aesthetically-pleasing vegetation. Permeable pavement is proposed in the parking stalls adjacent to the landscape island. This alignment of permeable pavement would capture the sheet flow from the majority of the parking lot. Permeable interlocking concrete pavers, pervious asphalt, or pervious concrete would be the best options for this application. Based on the available area of 3,600 square feet within the parking stalls and an equivalent water storage depth of 0.8 feet, the available storage volume is 2,880 cubic feet. This is enough storage to capture and treat 0.90 inches of runoff from the fifth largest storm event (1.41 inches) over the drainage area. The equivalent water storage depth assumes 24 inches of aggregate storage.

Bioretention is proposed adjacent to the sidewalk on the southeast side of the museum building and should be sized to capture runoff from the drive lane and parallel parking on northwest side of the island. The bioretention area would provide a dual-function landscaped area and stormwater management system in a highly visible location. The available surface area is 750 square feet (5 feet wide by 150 feet long). The equivalent water storage depth is 1.7 feet based on a cross-section with 6 inches of surface storage, 24 inches of engineered soil, and 24 inches of aggregate storage. This provides 1,275 cubic feet of storage. This is enough storage to capture and treat 0.98 inches of runoff from the fifth largest storm event (1.41 inches) over the drainage area. Refer to Table 3, Table 4, and Figure 21 for available storage capacity, cross-section depths, and placement of the GI practices.

Figure 10. Permeable Pavement Proposed in Parking Stalls on Left.

Figure 11. Bioretention Proposed Behind Curb on Left.

1. S. Homewood Avenue

GI practices proposed for S. Homewood Avenue include a curb-extension bioretention practice adjacent to Frick Park and bioretention within the traffic circle. The curb-extension bioretention would collect runoff from a portion of S. Homewood Avenue near the entrance to the cemetery. The traffic circle bioretention would collect flow from the front yards and road of the 200 block of S. Homewood. The gutter flow would need to be directed to the bioretention circle most likely by providing a shallow trench drain directing flow to the bioretention area. An overflow catch basin would be required within the traffic circle.

The curb-extension bioretention is designed to be 240 SF (6 feet wide by 40 feet long) and will not impede street side parking or the flow of traffic. The practice can capture and treat 1.1 inches of runoff from the fifth largest storm event (1.41 inches) over the drainage area with 6 inches of surface storage, 24 inches of engineered soil, 24 inches of aggregate storage under the practice, and 36 inches of aggregate storage under the adjacent sidewalk.

The traffic circle bioretention will be able to accommodate the design criteria for the regulator with a capture and treatment runoff depth of 0.6 inch in a cross-section including 12 inches of surface storage, 36 inches of engineered soil, and 42 inches of aggregate. This cross-section is fairly deep due to the large tributary drainage area relative to the available surface area of the practice. To reduce the depth of the practice, the aggregate storage could extend under the road. Refer to Table 3, Table 4, and Figure 21 for available storage capacity, cross-section depths, and placement of the GI practices.

Figure 12. Bioretention Proposed as Curb-Extension on S. Homewood Avenue

Figure 13. Bioretention Proposed in Traffic Circle at S. Homewood Avenue and Reynolds Street

2. Le Roi Road

Proposed GI practices along Le Roi Road include a combination of permeable pavement and bioretention. Permeable pavement parking strips are proposed along the outside curb in the parking lane (opposite from the center median). This configuration of permeable pavement would capture the sheet flow from the center line of Le Roi Road to the outside curb line. Permeable interlocking concrete pavers would be the best option for this application. Based on the available area of 1,920 square feet within the parking lane and an equivalent water storage depth of 0.55 feet, the available storage volume is 1,050 cubic feet. This is enough storage to capture and treat 1.2 inches over the drainage area, well beyond the depth required by the design criteria. Twelve inches of aggregate storage was assumed as a minimum to represent the requirement for structural support of the road. During design, the structural requirement may vary from this assumption. The equivalent water storage depth assumes 6 inches of bedding layer and 12 inches of aggregate storage.

Bioretention is proposed in the center median in the section with no mature street trees and captures sheet flow from the center line of Le Roi Road to the inside curb line. The bioretention area would provide an opportunity to incorporate native plants and flowers in a mixed-use neighborhood. Based on the available area of 400 square feet (10 feet wide by 40 feet long) and an equivalent water storage depth of 1.3 feet, the available storage volume is 520 cubic feet. This is enough storage to capture and treat 0.95 inch of runoff from the fifth largest storm event (1.41 inches) over the drainage area. The equivalent water storage depth assumes 6 inches of surface storage, 24 inches of engineered soil, and 12 inches of aggregate storage. Refer to Table 3, Table 4, and Figure 21 for available storage capacity, cross-section depths, and placement of the GI practices.

The permeable pavement and bioretention could be installed together or just the permeable pavement or just the bioretention. If only one project is selected, bioretention provides similar benefits in terms of storage capacity but includes more "green" in the design.

Figure 14. Bioretention Proposed in Median on Le Roi Road

Figure 15. Permeable Parking Strips Proposed on Le Roi Road

3. Osage Lane and Roycrest Place

Roycrest Place is a short residential street that dead ends into Osage Lane (alley) with a small vegetated median separating the two streets. Proposed GI practices for these streets include permeable pavement parking strips along Roycrest Place and permeable pavement along Osage Lane. Since Osage Lane is configured as a narrow alley, concrete pervious pavement is proposed to replace the entire width of the alley.

Based on the alley dimension (15 feet wide by 370 feet long) and an equivalent water storage depth of 0.4 feet, the available water storage volume is 2,220 cubic feet. This is enough storage to capture and treat 6.5 inches of runoff from the drainage area, well beyond the depth required by the design criteria. Twelve inches of aggregate storage was assumed as a minimum to represent the requirement for structural support of the permeable concrete road. During design, the structural requirement may vary from this assumption.

Permeable interlocking concrete pavers are proposed along the curb of Roycrest Place and will capture street runoff. An available surface area of 3,600 square feet (6 feet wide on each side of the road by 300 feet long) and an equivalent water storage depth of 0.75 feet can store a volume of 2,700 cubic feet. This GI practice can capture and treat 0.75 inch of runoff from the fifth largest storm event (1.41 inches) over the drainage area. Refer to Table 3, Table 4, and Figure 20 for available storage capacity and placement of the GI practices. The equivalent water storage depth is based on 6 inches of bedding layer and 18 inches of aggregate storage.

Figure 16. Permeable Pavement Proposed along Roycrest Place

Figure 17. Permeable Pavement Proposed across Osage Lane

4. Card Lane and Lang Court

Card Lane and Lang Court are short residential streets where permeable pavement is proposed as permeable parking strips along the curb line. This configuration of permeable pavement would capture sheet flow from the roadway and a small amount from front yards. Permeable interlocking concrete pavers would be the best option for this application. Based on the available area along Card Lane of 2,350 square feet (390 feet by 6 feet; 3 feet on each side of the road) within the parking lane and an equivalent water storage depth of 0.75 feet, the available storage volume is 1,755 cubic feet. This is enough storage to capture and treat 0.89 inch of runoff from the fifth largest storm event (1.41 inches) over the drainage area. The equivalent water storage depth assumes 6 inches bedding layer and 18 inches of aggregate storage.

The available area along Lang Court is 1,740 square feet (290 feet by 6 feet; 3 feet on each side of the road) within the parking lanes with an equivalent water storage depth of 0.95 feet based on 6 inches of bedding layer and 24 inches of aggregate storage. This equates to an available storage volume of 1,653 cubic feet. This is enough storage to capture and treat 0.6 inch of runoff from the fifth largest storm event (1.41 inches) over the drainage area. Refer to Table 3, Table 4, and Figure 20 for available storage capacity and placement of the GI practices.

Figure 18. Permeable Pavement Parking Strips Proposed along Lang Court

Figure 19. Permeable Pavement Parking Strips Proposed along Card Lane

Table 3. Green Infrastructure Practice Sizing and Storage

Green Infrastructure Practice	Location Description	Location	Width (ft)	Length (ft)	Surface Area (sq ft)	Equivalent Water Storage Depth (ft)[3]	Available Water Storage Volume (cu ft)[4]	Runoff Depth Stored (in)[5]
Bioretention	Frick Museum	Private parking lot	5	150	750	1.7	1,275	1.0
Permeable Pavement - parking stalls	Frick Museum	Private parking lot	15	240	3,600	0.8	2,880	0.9
Curb-Extension Bioretention	S. Homewood Ave	Right-of-way	6	40	240	3.2	770	1.1
Bioretention	S. Homewood Ave	Traffic Island	45 [1]	NA	1,590	3.0	4,770	0.6
Bioretention	Le Roi Road	Center Median	10	40	400	1.3	520	1.0
Permeable Pavement - parking strips	Le Roi Road	Right-of-way	6	320	1,920	0.55	1,050	1.2
Permeable Pavement - Alley	Osage Lane	Right-of-way	15	370	5,550	0.4	2,220	6.5
Permeable Pavement – Parking Strips	Roycrest Place	Right-of-way	12	300	3,600	0.75	2,700	0.75
Permeable Pavement - Parking Strips	Card Lane	Right-of-way	6	390	2,340	0.75	1,760	0.9
Permeable	Lang Court	Right-of-way	6	290	1,740	0.95	1,650	1.0

Green Infrastructure Practice	Location Description	Location	Width (ft)	Length (ft)	Surface Area (sq ft)	Equivalent Water Storage Depth (ft)[3]	Available Water Storage Volume (cu ft)[4]	Runoff Depth Stored (in)[5]
Pavement - Parking Strips								

[1]The assumed width of the traffic island bioretention is the diameter of the island.

[2]Equivalent water storage depth for the curb-extension bioretention takes into account the cube storage under the sidewalk that is not included in the surface area square footage.

[3]Equivalent Water Storage Depth: Ponding Depth x void space + Engineered Soil Depth x void space + Bedding Depth x void space + Aggregate Storage Depth x void space [Example Calculation: (0.5’ x 1.0) + (1.5’ x 0.2) + (0 x 0.4) + (0 x 0.3) = 0.8 feet equivalent depth]

[4]Available Water Storage Volume: Surface Area x Equivalent Water Storage Depth

[5]Runoff Depth Stored: Based on the available water storage volume/surface area and converted to inches

Table 4. Green Infrastructure Practice Cross-Sections

Green Infrastructure Practice	Location Description	Location	Ponding Depth (inch)	Engineered Soil Depth (inch)	Bedding Depth (inch)	Aggregate Storage Depth (inch)
Bioretention	Frick Museum	Private parking lot	6	24	NA	24
Permeable Pavement - parking stalls	Frick Museum	Private parking lot	0	0	0	24
Curb-Extension Bioretention	S. Homewood Ave	Right-of-way	6	24	NA	24 plus 36 in. under sidewalk
Bioretention[1]	S. Homewood Ave	Traffic Island	12	36	NA	42
Bioretention	Le Roi Road	Center Median	6	24	NA	12
Permeable Pavement - parking strips	Le Roi Road	Right-of-way	0	0	6	12
Permeable Pavement - Alley	Osage Lane	Right-of-way	0	0	0	12
Permeable Pavement – Parking Strips	Roycrest Place	Right-of-way	0	0	6	18
Permeable Pavement - Parking Strips	Card Lane	Right-of-way	0	0	6	18
Permeable Pavement - Parking Strips	Lang Court	Right-of-way	0	0	6	24

[1] To meet the design criteria, the traffic island facility would need to be unusually deep due to the constraints of the circular median. Alternatively, aggregate storage could be placed under the road in addition to the circular median to reduce the facility depth.

Figure 20. Proposed Green Infrastructure Practice Placement – North Project Area

Figure 21. Proposed Green Infrastructure Practice Placement – South Project Area

Green Infrastructure Practice Technical Specifications

The purpose of this section is to present the design of the green infrastructure practices as proposed in section "Recommended Sizing and Layout." The Pennsylvania Stormwater Best Management Practices Manual includes design guidance for many GI practices and should be referenced. The following is additional information, which may be helpful in the design of bioretention and permeable pavement.

Common Design Elements

1. Site Evaluation and Soil Infiltration Testing

Site evaluation and soil infiltration testing is necessary to determine the suitability of a site for infiltration and gather data for the design of the infiltration practice. The Pennsylvania Stormwater Best Management Practices Manual, Appendix C – Site Evaluation and Soil Testing, should be referenced for evaluation and testing methods.

Expansive soils with a high shrink-swell potential are not prevalent in the Pittsburgh area, but if these soils are found at the site, the GI practice design should include underdrains and impermeable barriers where the controls are adjacent to infrastructure such as roads and buildings. Drainage should always be directed away from building foundations and road subgrades.

2. Underdrain

If the native soils underneath a GI practice are low-permeability soils, an underdrain may be required and should meet the following criteria:

- The type of perforated pipe is not critical to the function of the green infrastructure practice as long as the total opening area exceeds the expected flow capacity of the underdrain and does not limit infiltration through the soil media. The perforations can be placed closest to the invert of the pipe to achieve maximum potential for draining the facility. If an anaerobic zone is intended, the perforation can be placed at the top of the pipe.
- Place the underdrain within a pocket of drainage stone a minimum of 4 inches thick on all sides.
- The underdrain should drain freely and discharge to the existing sewer infrastructure. Alternatively, the underdrain outlet can be upturned to provide an internal sump (internal water storage) to improve infiltration and water quality. The optimal elevation of the underdrain invert should be no less than 1.5 feet from the surface of the basin to provide an aerobic root zone for plants and to prevent previously-sorbed pollutants from mobilizing.
- Install a valve at the downstream end of the underdrain, where the system connects back to the sewer system. The valve may be used as a passive device to adjust the allowable release rate.

Bioretention

Bioretention areas should have the following design features:

- For unlined systems, maintain a minimum of 5 feet between the green infrastructure practice and any adjacent buildings and at least 10-15 feet between the green infrastructure practice and any adjacent basement.
- The design of the practice should consider the allowable release rate back to the combined sewer as dicated by the regulator capacity (refer to section "Design Goals") and also the recommended maximum facility dewater time of 72 hours. Both flow rates should be calculated, but one will ultimately dictate the design of the practice. Dewatering mechanisms include infiltration through

underlying soils as well as flow through an underdrain system. Use of an underdrain system is very effective in areas with low infiltration capacity soils.

- Plant with native and noninvasive plant species tolerant of urban environments, salt, and frequent inundation, and place a maximum of 3 inches of mulch on the surface of the soil.
- For the aggregate storage layer, use clean coarse aggregate AASHTO #4, #5, or equivalent.
- The filter layer placed between the soil media and the storage layer is recommended to be 2 to 4 inches of clean medium sand (ASTM c-33) over 2 to 3 inches of #8 or #78 washed stone.
- Inclusion of an overflow structure with a non-erosive overflow channel to safely pass flows that exceed the capacity of the facility or design the facility as an off-line system where only the design volume enters the bioretention area.
- Inclusion of a pretreatment mechanism such as a grass filter strip, sediment forebay, or grass swale upstream of the practice to enhance the treatment capacity of the unit.

1. Soil Media

A minimum of 18 inches of engineered soil mixture is recommended for bioretention practices. This may be either an engineered soil mixture to replace the existing soil or a compost amendment to the existing soil. The soil media is typically specified to meet the growth requirements of the selected vegetation while still meeting the hydraulic requirements of the system.

Engineered Soil Mixture: Recognizing that there are many possible variations in soil media, the following is one example:

The engineered soil mixture is a blend of loamy soil, sand, and compost that is 30-40 percent compost (by volume). The expected infiltration rate should range from 1 to 2-inches per hour.

A particle gradation analysis of the blended material, including compost, should be conducted in conformance with ASTM C117/C136 (AASHTO T11/T27). The gradation of the blended material should meet the following gradation criteria:

Sieve Size	Percent Passing
1 inch	100
#4	75-100
#10	40-100
#40	15-50
#100	5-25
#200	5-15

- Soil media must have an appropriate amount of organic material to support plant growth. Organic matter is considered an additive to help vegetation establish and contributes to sorption of pollutants and should be between 5-10 percent. Additional organic matter can be added to the soil to increase the water holding capacity. Organic materials will oxidize over time, causing an increase in ponding that could adversely affect the performance of the bioretention area. Organic material should consist of aged bark fines, or similar organic material. Organic material should not consist of manure or animal compost. Newspaper mulch has been shown to be an acceptable additive.
- pH should be between 5–8, cation exchange capacity (CEC) should be greater than 5 milliequivalent (meq)/100 g soil.

- High phosphorus concentrations are common in compost and when applied to a bioretention area, can result in leaching of phosphorus. When an overabundance of phosphorus enters waterways, it can cause unhealthy balances of aquatic life. All bioretention media should be analyzed for background levels of nutrients. Total phosphorus should not exceed 15 ppm.

Compost Amendment: It may be possible to restore the surface soils by adding approximately 2.5 inches of compost over the surface of the site (King County, 2005) and breaking up the soil with a subsoiler or ripper attached to a tow vehicle (Kees, 2008). It may also be beneficial to amend the existing subsurface soil with compost to enhance the infiltration rate. This practice increases infiltration rates and also helps reduce cations and toxicants in the water. The disadvantage is that nutrient leaching occurs for a period of time (Pitt et al., 1999). Establishing native plants with extensive root systems will also help provide channels to promote infiltration in the subsurface soil.

2. Plant Selection

For the green infrastructure practice to function properly as stormwater treatment and be attractive, vegetation selection is crucial. Appropriate vegetation will have the following characteristics:

- Plant materials must be tolerant of drought, ponding fluctuations, salt, and saturated soil conditions for 10 to 48 hours.
- Native plant species or hardy cultivars that are not invasive and do not require chemical inputs are recommended to be used to the maximum extent practicable.
- For native plant species, refer to the Pennsylvania Stormwater Best Management Practices Manual; Appendix B (http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-76385/363-0300-002%20Appendix%20B.pdf).

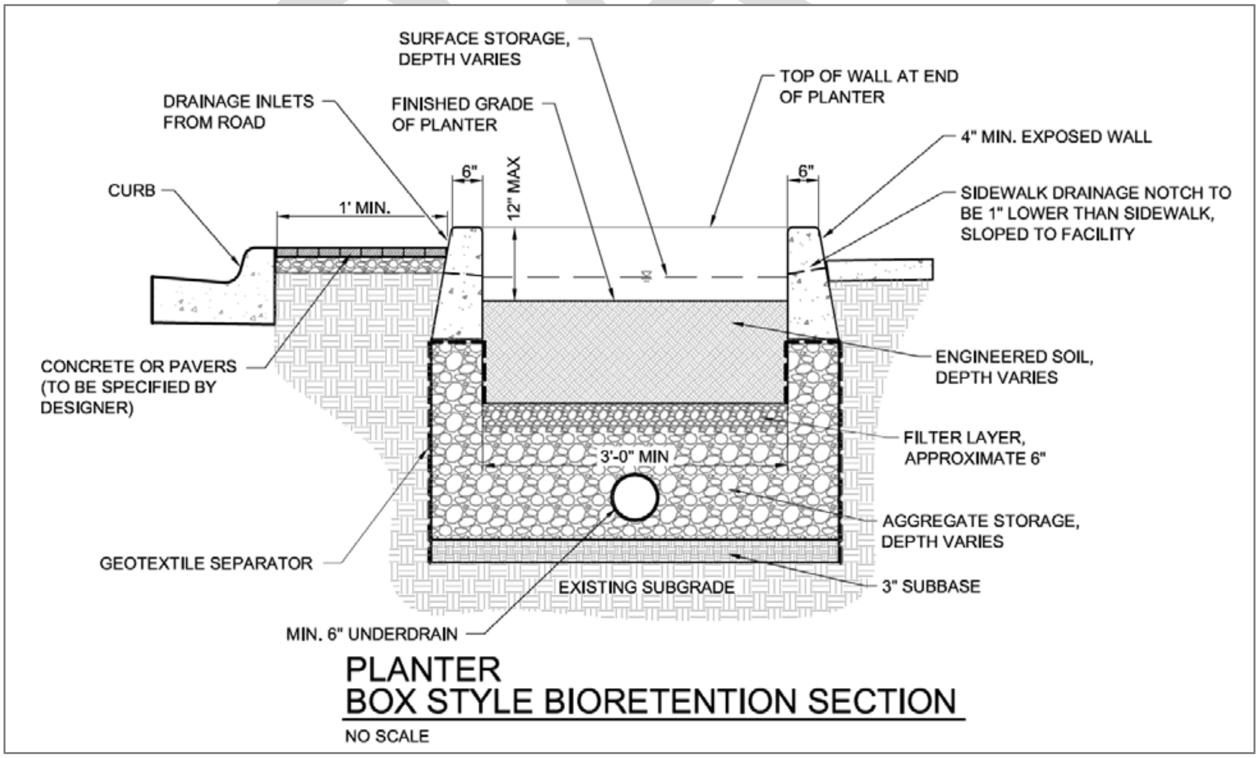

Figure 22. Planter Box Style Bioretention Cross-Section

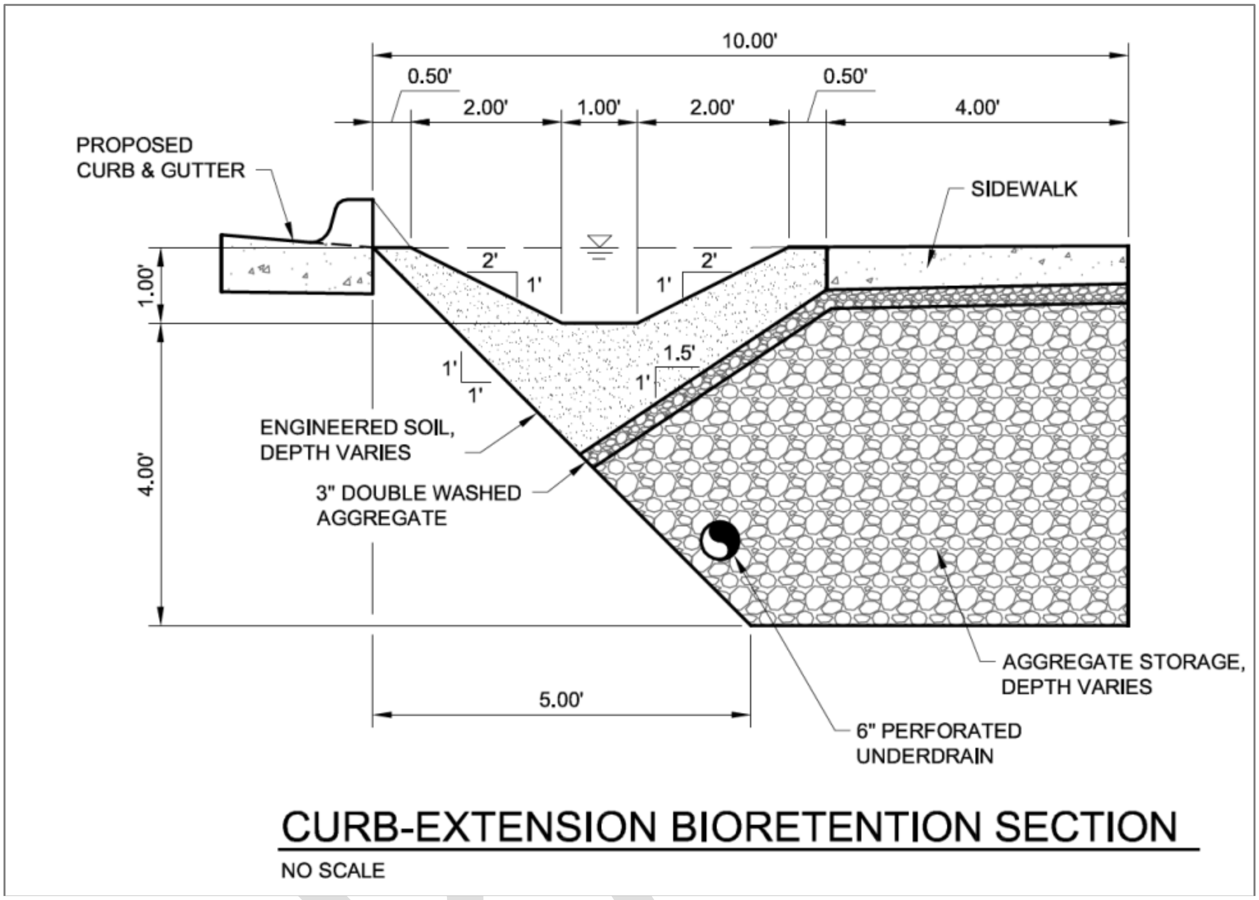

Figure 23. Curb-extension Bioretention Cross-Section

Permeable Pavement

General guidelines for applying permeable pavement are as follows:

- Permeable pavement can be developed using modular systems (e.g., concrete pavers, grid pavers, grass-pave, or gravel-pave) or poured-in-place solutions (e.g., pervious concrete or pervious asphalt).
- Permeable pavements can be substituted for conventional pavements in parking areas, low-volume/low-speed roadways, pedestrian areas, and driveways if the grades, native soils, drainage characteristics, and groundwater conditions of the paved areas are suitable.
- Permeable pavement is not appropriate for stormwater hotspots where hazardous materials are loaded, unloaded, or stored, unless the sub-base layers are completely enclosed by an impermeable liner.
- The bedding layer and sub-base structural layers should provide an adequate construction platform and base for the overlying pavement layers.
- If permeable pavement is installed over low-permeability soils or temporary surface flooding is a concern, an underdrain should be installed to ensure water removal from the sub-base reservoir and pavement.
- The infiltration rate of the soils or an installed underdrain should drain the sub-base within 72 hours.
- An impermeable liner can be installed between the sub-base and the native soil to prevent water infiltration when clay soils have a high shrink-swell potential or if a high water table or bedrock layer exists.
- Measures should be taken to protect permeable pavements from high sediment loads, particularly fine sediment, to reduce maintenance. Typical maintenance includes removing sediment with a vacuum truck.
- A reinforced concrete transition (width 12 -18 inches) is required where permeable pavement meets adjacent non-concrete pavement or soil.
- For interlocking or grid-type pavers use fine aggregate, coarse sand, or top soil & grass in openings
- Bedding layer immediately beneath the permeable pavement:
    - Permeable Interlocking Concrete Pavers: 1.5 to 3 inches of #8 or #78 washed stone
    - Concrete and Plastic Grid Pavers: 1 to 1.5 inches of bedding sand
    - Pervious Concrete and Asphalt: None
- Structural layer or aggregate layer beneath the bedding layer:
    - 12 to 30 in. of clean aggregate AASHTO #56 or equivalent; thickness depends on strength/storage needed; install 30 mil geotextile liner or filter layer where aggregate meets soil
- Design for projected traffic loads using AASHTO methods.
- When evaluating the potential placement of permeable pavement, avoid areas adjacent to mature trees as their root systems may be impacted when excavating for the structural/aggregate and subbase layers (min.-12”)

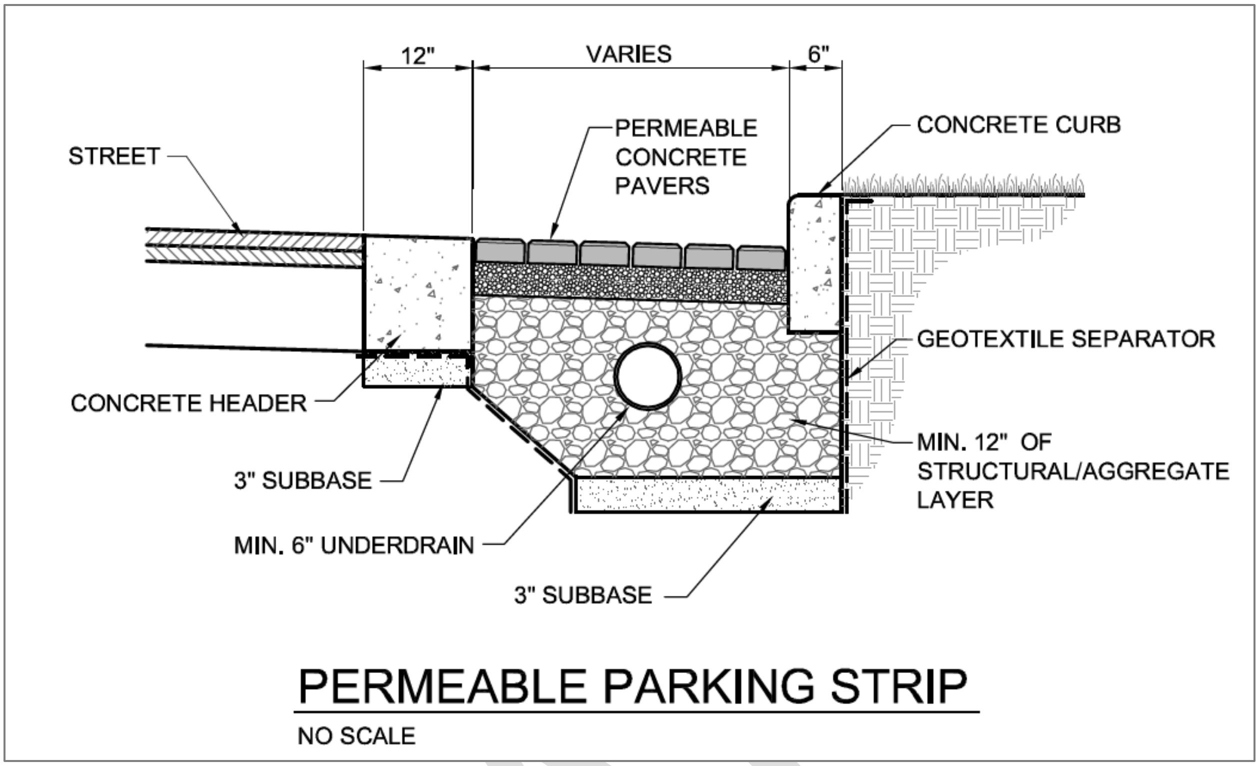

Figure 24. Permeable Parking Strip Cross-Section.

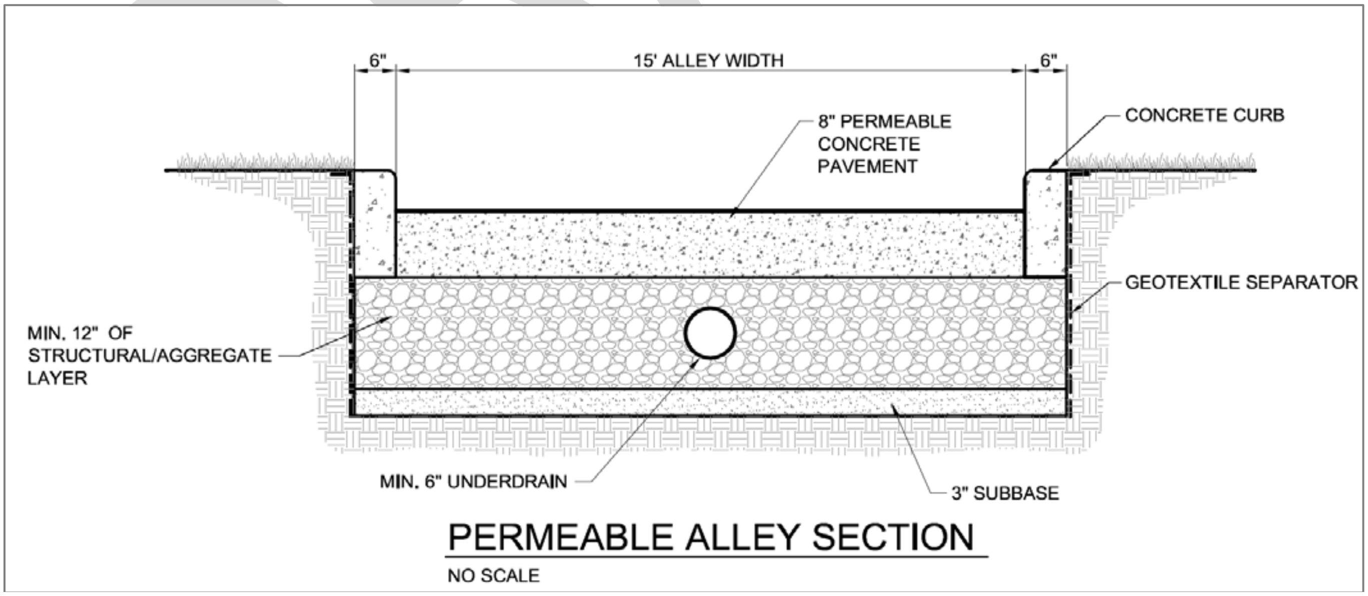

Figure 25. Permeable Alley Cross-Section

Operations and Maintenance

Maintenance activities for landscaped practices, such as bioretention, are generally similar to maintenance activities for any garden. The focus is to remove trash and monitor the health of the plants, replacing or thinning plants as needed. Over time, a natural soil horizon should develop which will assist in plant and root growth. An established plant and soil system will help in improving water quality and keeping the practice drained. The biological and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance.

The primary maintenance requirement for permeable pavement consists of regular inspection for clogging and vacuuming with a vacuum sweeper or equivalent.

The following tables outline the required maintenance tasks, their associated frequency, and notes to expand upon the requirements of each task.

Table 5. Bioretention Operations and Maintenance Considerations.

Task	Frequency	Maintenance notes
Monitor infiltration and drainage	1 time/year	Measure infiltration rate after construction to establish a baseline for future comparison. Inspect drainage time (< 72 hours). Might have to determine infiltration rate (every 2–3 years). Turning over or replacing the media (top 2–3 inches) might be necessary to improve infiltration (at least 0.5 in/hr).
Pruning	1–2 times/year	Nutrients in runoff often cause bioretention vegetation to flourish.
Mowing	As needed	Frequency depends on the location, plant selection, and desired aesthetic appeal.
Mulching	1–2 times/year	Recommend maintaining 1”–3” uniform mulch layer by replacement or moving around plant bed.
Mulch removal	1 time/2–3 years	Mulch accumulation reduces available water storage volume. Removal of mulch also increases surface infiltration rate of fill soil.
Watering	1 time/2–3 days for first 1–2 months; as needed after establishment	If drought conditions exist, watering after the initial year might be required.
Fertilization	1 time initially	One-time spot fertilization for first year vegetation.
Remove and replace dead plants	1 time/year	Within the first year, 30% of plants can die. Survival rates increase with time.
Inlet inspection	Once after first rain of the season, then monthly during the rainy season	Check for sediment accumulation to ensure that flow into the retention area is as designed. Remove any accumulated sediment.

Task	Frequency	Maintenance notes
Outlet inspection	Once after first rain of the season, then monthly during the rainy season	Check for erosion at the outlet and remove any accumulated mulch or sediment. May need to rooter underdrain.
Miscellaneous upkeep	12 times/year	Tasks include trash collection, plant health, spot weeding, and removing mulch from the overflow device.

Table 6. Permeable Pavement Operations and Maintenance Considerations.

Task	Frequency	Maintenance notes
Impervious to Pervious interface	Once after first rain of the season, then monthly during the rainy season	Check for sediment and debris accumulation to ensure that sediment loads are not flowing onto permeable pavement. Remove any accumulated sediment, vegetative debris, or trash. Stabilize any exposed soil.
Vacuum-assisted sweeping	Twice per year as needed	Portions of pavement should be swept with a vacuum-assisted street sweeper, or equivalent, at least twice per year or as needed to maintain infiltration rates. Recommended times of the year include in the spring shortly after the last snowmelt to clean up debris left from snow piles and in the late fall after the majority of the leaves have fallen. Perform ASTM 1701 Standard Test Method for Infiltration Rate of In-Place Pervious Concrete as needed. *Equipment Costs:* *Vacuum truck attachment (Bunyan Infiltration Restoration Device [BIRD]* *$7,300 - $11,200* *Walk-behind vacuum sweeper* *$5,000 to $12,000* *Vacuum-assisted street sweeper vehicle* *$170,000 to $220,000*
Replace fill materials (applies to pervious pavers only)	1-2 times per year (and after any vacuum truck sweeping)	Fill materials will need to be replaced after each sweeping and as needed to keep voids with the paver surface.
Miscellaneous upkeep	4 times per year or as needed for aesthetics	Tasks include trash collection, sweeping, and spot weeding.

Green Infrastructure Practice Cost Estimates

The cost estimates for constructing the green infrastructure practices at each of the sites are found in the tables below. Cost information was derived from bid tab data published by various public agencies (ODOT, MDOT, etc) and compared against projects constructed in the Pittsburgh area. All cost estimates assume retrofit of the GI practices and are based on the sizing denoted in Table 3. As a retrofit, costs take into account pavement removal and subsequent pavement replacement or patching. A 30 percent contingency has been added to all costs. Costs do not include engineering fees, legal fees, soil erosion control, or construction management.

Table 7. Frick Museum Private Parking Lot – Bioretention Planter Box

Item	Unit	Unit Cost	Qty	Cost
Curb and Gutter, Remove	LF	$4.50	160	$720.00
Pavement, Remove	Syd	$5.00	20	$100.00
Earth Excavation	Cyd	$10.00	185	$1,850.00
Subbase	Cyd	$12.00	8	$100.00
Aggregate Base, 3 inch	Syd	$3.00	125	$375.00
Aggregate Base, 8 inch	Syd	$7.00	35	$245.00
Hot Mix Asphalt, Hand Patching	Tn	$150.00	7	$1,050.00
Curb and Gutter	LF	$12.00	150	$1,800.00
Concrete Header	LF	$20.00	310	$6,200.00
Concrete Spillway	Ea	$75.00	5	$375.00
4" Concrete Sidewalk	Sft	$3.00	17	$51.00
Stone Drainage Course	Cyd	$25.00	56	$1,400.00
Engineered Soil Mixture	Cyd	$38.00	56	$2,128.00
Geotextile Separator	Syd	$8.00	333	$2,664.00
Plantings	Sft	$5.00	750	$3,750.00
6" Perforated Underdrain w/sock	LF	$3.50	150	$525.00
6" PVC Drain Pipe	LF	$45.00	40	$1,800.00
6" Storm Sewer Tap	Ea	$400.00	2	$800.00
Ball Valve	Ea	$1,400.00	2	$2,800.00
Notes:			Sub-Total	$28,733.00
			30% Contingency	$8,700.00
			Total	$37,433.00
				$ 50/SF

Table 8. Frick Museum Private Parking Lot – Permeable Pavement Parking Stalls

Item	Unit	Unit Cost	Qty	Cost
Pavement, Remove	Syd	$5.00	490	$2,450.00
Earth Excavation	Cyd	$10.00	400	$4,000.00
Subbase	Cyd	$12.00	461	$5,532.00
Aggregate Base, 8 inch	Syd	$7.00	29	$203.00
Hot Mix Asphalt, Hand Patching	Tn	$150.00	6	$900.00
Concrete Header	LF	$17.00	556	$9,452.00
Interlocking Concrete Pavers	Sft	$20.00	3600	$72,000.00
Stone Drainage Course	Cyd	$25.00	267	$6,675.00
Geotextile Separator	Syd	$8.00	488	$3,904.00
6" Perforated Underdrain w/sock	LF	$3.50	240	$840.00
6" PVC Drain Pipe	LF	$45.00	50	$2,250.00
6" Storm Sewer Tap	Ea	$400.00	2	$800.00
Ball Valve	Ea	$1,400.00	2	$2,800.00
Notes:			Sub-Total	$111,806.00
			30% Contingency	$33,600.00
			Total	$145,406.00
				$ 40/SF

Table 9. S. Homewood Avenue – Curb Extension Bioretention

Item	Unit	Unit Cost	Qty	Cost
Curb and Gutter, Remove	LF	$4.50	50	$225.00
Sidewalk, Remove	Syd	$5.00	28	$140.00
Pavement Remove	Syd	$5.00	45	$225.00
Earth Excavation	Cyd	$10.00	61	$608.00
Subbase	Cyd	$12.00	4	$45.00
Aggregate Base, 3 inch	Syd	$3.00	262	$786.00
Aggregate Base, 8 inch	Syd	$7.00	25	$175.00
Hot Mix Asphalt, Hand Patching	Tn	$150.00	5	$750.00
Curb and Gutter, Concrete	LF	$12.00	56	$672.00
Concrete Spillway	Ea	$75.00	2	$150.00
4" Concrete Sidewalk	Sft	$3.00	250	$750.00
Stone Drainage Course	Cyd	$25.00	36	$889.00
Engineered Soil Mixture	Cyd	$38.00	20	$760.00
Plantings	Sft	$5.00	240	$1,200.00
Parkway Restoration	Syd	$8.00	10	$80.00
6" Perforated Underdrain w/sock	LF	$3.50	40	$140.00
6" PVC Drain Pipe	LF	$45.00	25	$1,125.00
6" Storm Sewer Tap	Ea	$400.00	1	$400.00
Ball Valve	Ea	$1,400.00	1	$1,400.00
Notes: Assume 3' existing parkway and replacement of existing sidewalk for installation. Includes underdrain with one outlet.		Sub-Total		$10,520.00
		30% Contingency		$3,156.00
		Total		$13,676.00
				$ 58/SF

Table 10. S. Homewood Avenue – Traffic Island Bioretention

Item	Unit	Unit Cost	Qty	Cost
Curb and Gutter, Remove	Lf	$4.50	10	$45.00
Pavement, Remove	Syd	$5.00	67	$335.00
Earth Excavation	Cyd	$10.00	486	$4,860.00
Subbase	Cyd	$12.00	15	$177.00
Aggregate Base, 3 inch	Syd	$3.00	1	$3.00
Aggregate Base, 8 inch	Syd	$7.00	28	$196.00
Hot Mix Asphalt, Hand Patching	Tn	$150.00	6	$825.00
Curb and Gutter, Concrete	Lf	$12.00	10	$120.00
Concrete Spillway	Ea	$75.00	2	$150.00
Concrete Encased Corrugated Metal Pipe (CMP) Slotted Trench Drain, 15"	LF	$100.00	60	$6,000.00
Stone Drainage Course	Cyd	$25.00	206	$5,155.00
Engineered Soil Mixture	Cyd	$38.00	177	$6,716.00
Plantings	Sft	$5.00	1590	$7,953.00
6" Perforated Underdrain w/sock	LF	$3.50	45	$158.00
6" PVC Drain Pipe	LF	$45.00	100	$4,500.00
6" Storm Sewer Tap	Ea	$400.00	2	$800.00
Ball Valve	Ea	$1,400.00	2	$2,800.00
Notes: Assume two underdrain outlets to catch basins. Install curb inlets where underdrain leaves to outlet. No curb removal except for underdrain outlets, all excavation within island. Trench drains to discharge to island adjacent to spillways utilizing same curb cuts.		Sub-Total		$40,793.00
		30% Contingency		$12,237.90
		Total		$53,030.90
				$ 33/SF

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Table 11. Le Roi Road - Center Median Bioretention

Item	Unit	Unit Cost	Qty	Cost
Curb and Gutter, Sawcut	Lf	$50.00	8	$400.00
Earth Excavation	Cyd	$10.00	59	$593.00
Subbase	Cyd	$12.00	4	$45.00
Concrete Spillway	Ea	$75.00	2	$150.00
Stone Drainage Course	Cyd	$25.00	15	$371.00
Engineered Soil Mixture	Cyd	$38.00	30	$1,126.00
Plantings	Sft	$5.00	400.0	$2,000.00
Parkway Restoration	Syd	$8.00	15	$120.00
6" Perforated Underdrain w/sock	LF	$3.50	20	$70.00
6" Storm Sewer Tap	Ea	$400.00	1	$400.00
Ball Valve	Ea	$1,400.00	1	$1,400.00
Notes: Bioretention to be confined completely within the center median. Curb heads cut for spillways. Underdrain to connect to catch basins.			Sub-Total	$6,675.00
			30% Contingency	$2,100.00
			Total	$8,775.00
				$ 22/SF

Table 12. Le Roi Road – Permeable Pavement Parking Strips

Item	Unit	Unit Cost	Qty	Cost
Curb and Gutter, Remove	Lf	$4.50	644.0	$2,898.00
Pavement, Remove	Syd	$5.00	178	$890.00
Earth Excavation	Cyd	$10.00	142	$1,423.00
Subbase	Cyd	$12.00	36	$429.00
Concrete Curb, 6" Straight Header	Lf	$11.00	640	$7,040.00
Concrete Header 12" x 12"	LF	$17.00	654	$11,118.00
Interlocking Concrete Pavers	Sft	$20.00	1920	$38,400.00
Stone Drainage Course	Cyd	$25.00	71	$1,778.00
Geotextile Separator	Syd	$8.00	427	$3,416.00
6" Perforated Underdrain w/sock	LF	$3.50	320	$1,120.00
Catch Basin Adjust	Ea	$275.00	2	$550.00
6" Storm Sewer Tap	Ea	$400.00	2	$800.00
Ball Valve	Ea	$1,400.00	2	$2,800.00
Notes: Concrete header poured against existing pavement; no Hot Mix Asphalt costs along roadside of header. Assume two underdrains connect to catch basins within the work limits.		Sub-Total		$72,662.00
		30% Contingency		$21,800.00
		Total		$94,462.00
				$ 49/SF

Table 13. Osage Lane - Permeable Alley

Item	Unit	Unit Cost	Qty	Cost
Curb and Gutter, Remove	Lf	$4.50	740.0	$3,330.00
Pavement, Remove	Syd	$5.00	617	$3,084.00
Earth Excavation	Cyd	$10.00	411	$4,112.00
Subbase	Cyd	$12.00	51	$617.00
Concrete Curb, 6" Straight Header	Lf	$11.00	740	$8,140.00
8" Concrete Pervious Pavement	Sft	$15.00	5550	$83,250.00
Stone Drainage Course	Cyd	$25.00	206	$5,139.00
Geotextile Separator	Syd	$8.00	843	$6,744.00
Parkway Restoration	Syd	$8.00	165	$1,320.00
6" Perforated Underdrain w/sock	LF	$3.50	370	$1,295.00
Catch Basin Adjust	Ea	$275.00	2	$550.00
Manhole Adjust	Ea	$275.00	2	$550.00
6" Storm Sewer Tap	Ea	$400.00	2	$800.00
Ball Valve	Ea	$1,400.00	2	$2,800.00
Notes:		Sub-Total		$121,731.00
		30% Contingency		$36,600.00
		Total		$158,331.00
				$ 29/SF

Table 14. Roycrest Place – Permeable Pavement Parking Strips

Item	Unit	Unit Cost	Qty	Cost
Curb and Gutter, Remove	Lf	$4.50	600	$2,700.00
Pavement, Remove	Syd	$5.00	400	$2,000.00
Earth Excavation	Cyd	$10.00	333	$3,334.00
Subbase	Cyd	$12.00	50	$600.00
Concrete Curb, 6" Straight Header	Lf	$11.00	600	$6,600.00
Concrete Header 12" x 12"	LF	$17.00	600	$10,200.00
Interlocking Concrete Pavers	Sft	$20.00	3600	$72,000.00
Stone Drainage Course	Cyd	$25.00	200	$5,000.00
Geotextile Separator	Syd	$8.00	400	$3,200.00
6" Perforated Underdrain w/sock	LF	$3.50	600	$2,100.00
Catch Basin Adjust	Ea	$275.00	4	$1,100.00
6" Storm Sewer Tap	Ea	$400.00	4	$1,600.00
Ball Valve	Ea	$1,400.00	4	$5,600.00
Notes: Concrete header poured against existing pavement; no Hot Mix Asphalt costs along roadside of header. Assume two underdrains connect to catch basins within the work limits.		Sub-Total		$116,034.00
		30% Contingency		$34,900.00
		Total		$150,934.00
				$ 42/SF

Table 15. Card Lane – Permeable Pavement Parking Strips

Item	Unit	Unit Cost	Qty	Cost
Curb and Gutter, Remove	Lf	$4.50	780	$3,510.00
Pavement, Remove	Syd	$5.00	217	$1,085.00
Earth Excavation	Cyd	$10.00	217	$2,167.00
Subbase	Cyd	$12.00	43	$522.00
Concrete Curb, 6" Straight Header	Lf	$11.00	780	$8,580.00
Concrete Header 12" x 12"	LF	$17.00	796	$13,532.00
Interlocking Concrete Pavers	Sft	$20.00	2340	$46,800.00
Stone Drainage Course	Cyd	$25.00	130	$3,250.00
Geotextile Separator	Syd	$8.00	520	$4,160.00
6" Perforated Underdrain w/sock	LF	$3.50	780	$2,730.00
Catch Basin Adjust	Ea	$275.00	4	$1,100.00
6" Storm Sewer Tap	Ea	$400.00	4	$1,600.00
Ball Valve	Ea	$1,400.00	4	$5,600.00
Notes:		Sub-Total		$94,636.00
		30% Contingency		$28,400.00
		Total		$123,036.00
				$ 53/SF

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Table 16. Lang Court – Permeable Pavement Parking Strips

Item	Unit	Unit Cost	Qty	Cost
Curb and Gutter, Remove	Lf	$4.50	580.0	$2,610.00
Pavement, Remove	Syd	$5.00	161	$805.00
Earth Excavation	Cyd	$10.00	193	$1,933.33
Subbase	Cyd	$12.00	32	$388.44
Concrete Curb, 6" Straight Header	Lf	$11.00	580	$6,380.00
Concrete Header 12" x 12"	LF	$17.00	596	$10,132.00
Interlocking Concrete Pavers	Sft	$20.00	1740	$34,800.00
Stone Drainage Course	Cyd	$25.00	129	$3,222.22
Geotextile Separator	Syd	$8.00	387	$3,096.00
6" Perforated Underdrain w/sock	LF	$3.50	580	$2,030.00
Catch Basin Adjust	Ea	$275.00	4	$1,100.00
6" Storm Sewer Tap	Ea	$400.00	4	$1,600.00
Ball Valve	Ea	$1,400.00	4	$5,600.00
Notes:		Sub-Total		$ 68,848.00
		30% Contingency		$ 20,700.00
		Total		$ 89,600.00
				$ 55/SF

Typical annual routine maintenance costs are included in Table 16. Costs were adapted from WERF estimates to account for the scale of the green infrastructure practice (WERF 2009). Typical routine maintenance is similar to maintenance for landscape areas, parks, or standard asphalt streets. Maintenance activities for the proposed green infrastructure practices may already be accounted for in existing budgets for current maintenance and upkeep activities.

Table 17. Annual Maintenance Cost Estimate

Green Infrastructure Practice	Location Description	Surface Area (SF)	Unit Cost (per SF)	Routine Maintenance (monthly to 2 years)
Bioretention	Frick Museum	750	$2.28	$1,700
Permeable Pavement - parking stalls	Frick Museum	3,600	$0.67	$2,400
Curb-Extension Bioretention	S. Homewood Ave	240	$2.28	$550
Bioretention	S. Homewood Ave	2,040	$2.28	$4,700
Bioretention	Le Roi Road	400	$2.28	$900
Permeable Pavement - Parking Strips	Le Roi Road	1,920	$0.67	$1,300
Permeable Pavement - Alley	Osage Lane	5,550	$0.67	$3,700
Permeable Pavement – Parking Strips	Roycrest Place	3,600	$0.67	$2,400
Permeable Pavement - Parking Strips	Card Lane	2,340	$0.67	$1,600
Permeable Pavement - Parking Strips	Lang Court	1,740	$0.67	$1,200

Conclusions

The conceptual stormwater management design developed for the project site demonstrates how GI approaches can be retrofitted into urban neighborhoods to assist in reducing combined sewer overflows.

The Frick Museum and Surrounding Area site is a historic residential neighborhood featuring the Frick Museum, which is part of the Frick Art & Historical Center, a 5-acre complex of lawns, gardens, museums, and the Frick mansion. The site is adjacent to Frick Park, a 561-acre municipal park providing an extensive wildlife habitat accessible through its network of trails. Recognizing the opportunity to achieve multiple environmental and livability goals by addressing green infrastructure early in the Wet Weather Plan planning process, 3 Rivers Wet Weather sought technical assistance from EPA. Based on the project and design goals, an EPA team developed a conceptual stormwater management design that would complement and enhance the Wet Weather Plan to reduce CSO's in the Pittsburgh area.

The final conceptual design achieved the project goals of restoring the hydrologic conditions of the site prior to development, and reducing CSO's while improving drainage and water quality with a combination of bioretention and permeable pavement. The design also achieves aesthetic appeal while maintaining the overall character of the area. The conceptual design includes:

- Permeable pavement and bioretention in the Frick museum parking lot
- Curb-extension bioretention and traffic circle bioretention on S. Homewood Avenue
- Bioretention in the median and permeable parking strips on Le Roi Road
- Permeable parking strips on Roycrest Place
- Permeable alley on Osage Lane
- Permeable parking strips on Card Lane
- Permeable parking strips on Lang Court

As municipalities seek to reduce combined sewer overflows, green infrastructure can be incorporated as a stormwater management strategy to do so, particularly as a retrofit. In addition to meeting stormwater management goals, this conceptual design illustrates how green infrastructure can help create a more attractive and livable landscape that weaves functional natural elements into the built environment.

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