PWSA

Attachment A

Long-Term Infrastructure Improvement Plan

PITTSBURGH WATER & SEWER AUTHORITY

5-YEAR
LONG-TERM INFRASTRUCTURE
IMPROVEMENT PLAN

SEPTEMBER 28, 2018

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LIST OF ACRONYMS & ABBREVIATIONS

AACE	Association for the Advancement of Cost Engineering
AAOP	Annual Asset Optimization Plan
ACHD	Allegheny County Health Department
ACO	Administrative Consent Order
AL	Lead & Copper Rule Action Limit
ALCOSAN	Allegheny County Sanitary Authority
Authority	The Pittsburgh Water and Sewer Authority (also, PWSA)
BBP	Blood Borne Pathogens
BMP	Best Management Practice
BODR	Basis Of Design Report
CCTV	Closed Circuit Television
Ch.	Chapter
CIP	Capital Improvement Plan; also, Capital Improvement Program
CIPP	Cured-in-place Pipe
City	The City of Pittsburgh
CMI	Compliance Management International
CMMS	Computer Monitoring Maintenance System
CMP	Corrugated Metal Pipe
CoF	Consequence of Failure
COA	Consent Order and Agreement
Commission	Public Utilities Commission
CSO	Combined Sewer Overflow
DOMI	Department Of Mobility and Infrastructure of the City of Pittsburgh
DSIC	Distribution System Improvement Charge
EOC	Equal Opportunity Contract
FIO	Final Implementation Order
FY	Fiscal Year
GI	Green Infrastructure
GIS	Geographic Information System

LIST OF ACRONYMS & ABBREVIATIONS

gpm	Gallons Per Minute
HDP	High Density Polyethylene
IDIQ	Indefinite Delivery/Indefinite Quantity
JSA	Job Safety Analysis
LF	Linear Feet
LOS	Level Of Service
LSL	Lead Service Lines
LSLR	Lead Service Line Replacement
LTIIP	Long Term Infrastructure Improvement Plan
MBE	Minority owned Business Enterprise
MOU	Memorandum of Understanding
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
NASSCO	National Association of Sewer Service Companies
NMCs	Nine Minimum Control Measures
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety & Health Act
P3	Public Private Partnership
PA (or Pa)	Pennsylvania
PACP	Pipeline Assessment Certification Program
PADEP	Pennsylvania Department of Environmental Protection
PAYGO	Pay As You Go
PAWC	Pennsylvania American Water Company
PCCP	Pre-stressed Concrete Cylinder Pipe
PennDOT	Pennsylvania Department of Transportation
PENNVEST	Pennsylvania Infrastructure Investment Authority
PMP	Program Management Plan
PPA	PWSA Project Audit
ppb	Parts Per Billion
PPE	Personal Protective Equipment

LIST OF ACRONYMS & ABBREVIATIONS

psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
PWS	Public Water Suppliers
PWSA	Pittsburgh Water & Sewer Authority (also, Authority)
RCP	Reinforced Concrete Pipe
RFP	Request For Proposal
ROW	Right Of Way
SDWMR	Small Diameter Water Main Replacement
SIP	Safety Improvement Plan
SME	Subject Material Expert
SOW	Scope of Work
SRS	Source Reduction Study
SSO	Sanitary Sewer Overflow
TDH	Total Dynamic Head
TIO	Tentative Implementation Order
TM	Technical Design Memorandum
USEPA	United States Environmental Protection Agency
VCP	Vitrified Clay Pipe
WBE	Women-owned Business Enterprise
WIFIA	Water Infrastructure Finance and Innovation Act of 2014
WWTF	Wastewater Treatment Facility

Plan

1 INTRODUCTION

1.1 Regulatory Background

1.1.1 Overview

On December 21, 2017, Pennsylvania Governor Wolf signed Act 65 of 2017 (Act) into law amending the Pennsylvania (PA or Pa) Public Utility Code which, among other things, added a new Chapter 32 (Sections 3201 – 3209) addressing the Public Utility Commission's (Commission) jurisdiction over the provision of utility water, wastewater, and stormwater service by entities created by Pennsylvania cities of the second class under the Municipality Authorities Act. As the City of Pittsburgh (City) is the only city of the second class in the Commonwealth, the Commission now has jurisdiction over the Pittsburgh Water and Sewer Authority (Authority). The Authority is the first municipal authority to be regulated by the Commission.

On January 18, 2018, the Commission issued a Tentative Implementation Order (TIO) which included methods by which the Commission and affected entities may carry out the tariff approval, ratemaking, compliance plan and assessment provision of Act 65. As part of the tariff approval process, the Authority is required to submit a Compliance Plan to the Commission which addresses how it will achieve full regulatory compliance including provisions to bring the Authority's existing information technology, accounting, billing, collection and other operating systems and procedures into compliance with the requirements applicable to jurisdictional water and wastewater utilities.

On July 2, 2018, the Authority filed a tariff (rate request package) with the Commission and a final determination is anticipated no later than March 2019. The tariff was developed by conducting a comprehensive review of the Authority's operational and infrastructure needs. Under the new Act, the Authority was requested to file a Long-Term Infrastructure Improvement Plan (LTIIP) (66 Pa C.S. §3202 (6). The Commission normally requires that a LTIIP be submitted to support a DSIC. At this time, the Authority has elected not to request a separate DSIC and is proposing to fund the short-term water distribution system and sanitary sewer collection system capital improvements through its current tariffs. However, the Authority will reconsider the need for a DSIC in the future and has prepared this LTIIP to outline its proposed program of renewal and rehabilitation as its initial steps to comply with the Commission's requirements. Should the Authority consider filing a DSIC in the future, an updated LTIIP will be submitted to support the DSIC fees.

As noted, one component of the aforementioned Compliance Plan includes the development and submission of a LTIIP. LTIIP requirements are identified in PA code Chapter 121 §121.3 as follows:

1. Identification of types and age of eligible property owned and operated by the utility
2. An initial schedule for planned repair and replacement of eligible property
3. A general description of location of eligible property
4. A reasonable estimate of quantity of eligible property to be improved or repaired
5. Projected annual expenditures and means to finance the expenditures

6. A description of the manner in which infrastructure replacements will be accelerated and how repair, improvement or replacement will ensure and maintain adequate, efficient, safe, reliable and reasonable service to customers

7. A workforce management and training program designed to ensure that the utility will have access to a qualified workforce to perform work in a cost-effective, safe and reliable manner

8. A description of the utility's outreach and coordination activities with other utilities, Department of Transportation and local governments regarding the planned maintenance/construction projects and roadways that may be impacted by the LTIIP

Financing as in Item #5 is not specifically addressed in this LTIIP since a DSIC is not part of this submission. It should be noted that current planned improvements will be funded through both current rates and future rate increases, as well as through revenue bonds, a capital line of credit, pay-as-you-go (PAYGO) funding, and PennVest low interest loans. The Authority plans to explore the federal funded program called the Water Infrastructure Finance and Innovation Act of 2014 (WIFIA) to help finance certain planned improvements. The WIFIA program offers low, fixed interest rates and flexible financial terms. It is the intention of the Authority to utilize a mix of all funding options to complete planned improvements at the lowest possible cost. The Authority also intends to explore the potential use of public-private partnerships in the future.

"Eligible property" is defined in the code as property that is part of a distribution system and eligible for repair, improvement and replacement as defined in 66 PA C.S. § 1351, as follows:

"(3) For water utilities, eligible property shall include:

(i) Utility service lines, meters and hydrants installed as in-kind replacements for customers.

(ii) Mains and valves installed as replacements for existing facilities that have worn out, are in deteriorated condition or are required to be upgraded to meet under 52 PA Code Ch. 65 (relating to water service).

(iii) Main extensions installed to eliminate dead ends and to implement solutions to regional water supply problems that present a significant health and safety concern for customers currently receiving service from the water utility.

(iv) Main cleaning and relining projects.

(v) Unreimbursed costs related to highway relocation projects where a water utility must relocate its facilities.

(vi) Other related capitalized costs."

And,

"(4) For wastewater utilities, eligible property shall include:

(i) Collection sewers, collecting mains and service laterals, including sewer taps, curb stops and lateral cleanouts installed as in-kind replacements for customers.

(ii) Collection mains and valves for gravity and pressure systems and related facilities such as manholes, grinder pumps, air and vacuum release chambers, cleanouts, main line flow meters, valve vaults and lift stations installed as replacements or upgrades for existing facilities that have worn out, are in deteriorated condition or are required to be upgraded by law, regulation or order.

(iii) Collection main extensions installed to implement solutions to wastewater problems that present a significant health and safety concern for customers currently receiving service from the wastewater utility.

(iv) Collection main rehabilitation including inflow and infiltration projects.

(v) Unreimbursed costs related to highway relocation projects where a wastewater utility must relocate its facilities.

(vi) Other related capitalized costs."

In general, "vertical" assets such as treatment plants, storage facilities, pump stations, etc. are not considered eligible property under the DCIS program. For the purposes of this LTIIP, the term "sewers" refers to the sewers under the responsibility of the Authority which include separate sanitary sewers and "combined sewers" which convey sanitary sewage and precipitation diverted to the sewer system.

1.1.2 LTIIP Requirements in the TIO

The TIO required that the Authority, in the LTIIP, provide the following:

- Details on how the Authority intends to replace or upgrade targeted eligible property, how aging infrastructure replacement will be accelerated, and how that activity will improve reliability and safety;
- Any metrics that the Authority uses to trace and evaluate the effectiveness of infrastructure improvements, e.g., lost or unaccounted for water, main breaks, or non-revenue water;
- Detail on how the programs and property eligible for LTIIP consideration were determined and targeted, e.g., a risk-based approach, age, material type, lost or unaccounted for water, non-revenue water, regulatory directive, or audit findings.
- A schedule for eligible property repair and replacement by class and category for each year the LTIIP will remain in effect;
- A projection of annual capital expenses to ensure that the LTIIP is cost-effective;
- A description of its workforce management and training program; and,
- A description of any outreach and coordination with other utilities, Pennsylvania Department of Transportation (PennDOT), and local governments on planned maintenance or construction projects.

In addition to the LTIIP, the TIO states that the Commission will request that the Authority provide it with an Annual Asset Optimization Plan (AAOP) which will include expenditure information for completed LTIIP work for the reporting year and the projected year.

1.1.3 Final Implementation Order

A Final Implementation Order (FIO) was issued by the Commission on March 15, 2018 wherein the conclusions of the TIO were adopted or modified. The FIO confirmed the TIO's requirement that the Authority provide significant detail regarding the LTIIP. It was also left to the discretion of the Authority to file an individual or unified LTIIP, and if the latter, the FIO requires that the Authority segregate its discrete services and operations (e.g., water and sewer) as they exist at the time of the LTIIP filing. This LTIIP reflects asset and project data for water system distribution services and sewer services separately. For the purpose of this LTIIP, the three major categories of infrastructure projects addressed are Water, Sewer, and Water/Sewer (Hybrid). Hybrid projects are those which contain elements of both water and sewer which are not easily separable from a cost standpoint. In the next few years, the Authority intends to file a LTIIP which includes stormwater projects.

1.2 Pittsburgh Water and Sewer Authority History and System Overview

The Authority was formed by the City to oversee a significant capital improvement program focused on the City of Pittsburgh water treatment and distribution systems to meet various requirements mandated by Federal and State regulations pertaining to safe drinking water. The Authority was formed under the provisions of the Pennsylvania Municipality Authorities Act, 53 Pa. C.S.A. §5601 et. seq. The Authority's Articles of Incorporation were originally approved on February 17, 1984, by the Commonwealth of Pennsylvania. Pursuant to a Lease and Management Agreement dated March 29, 1984, between the Authority and the City, the water and sewer system was leased to the Authority. Under the Lease and Management Agreement, the Authority was authorized to operate and maintain the water and sewer systems, construct all necessary improvements, establish and collect rates and charges for its service, and finance its operations and improvements through revenue collections and sale of bonds and notes payable solely from the Authority's revenues. The Authority appointed and designated the City as the Authority's agent to manage, operate, and maintain the water and sewer systems for the term of the lease, subject to the general supervision, direction, and the control of the Authority. The City provided the services necessary to operate the water and sewer systems to the Authority with the Authority reimbursing the City for all expenses actually incurred and expended by the City.

The Capital Lease Agreement and Cooperation Agreement, each between the Authority and City, as authorized in Resolution No. 47 of 1995, terminated the aforementioned Lease and Management Agreement. The Cooperation Agreement provided that the City render certain services to the Authority as set forth in the agreement and provided the basis of payment for such services to be rendered by the City. As of January 1, 1995, all positions in the City Water Department and certain positions in the Water and Sewer Division of the Department of Engineering and Construction were eliminated from the City's budget and similar positions were created and filled by the Authority. The Authority absorbed the water department at that time, and became the sole proprietor of the sewer system in 1999.

In 2008, the Commonwealth approved an Amendment to the Articles of Incorporation as adopted by the City and the Authority to extend its term of existence to 2045 in order to ensure that its term covers the duration of certain bond obligations.

Under the terms of the Capital Lease Agreement, the Authority will own the water and sewer systems on September 1, 2025 upon payment of $1.00. The Authority is currently evaluating ownership and control of the City's storm sewer system as well. The Authority is in the final stages of negotiating a Memorandum of Understanding (MOU) for full responsibility for stormwater assets in the City.

1.2.1 Water System Overview

The Authority, through its water supply and distribution system, provides water service to more than 300,000 people throughout the City and surrounding areas (see Figure 1-1 in Appendix A). The system consists of a 117 million gallons per day (MGD) rapid sand type water treatment plant, one 26 MGD microfiltration water treatment plant, approximately 964 miles of mains, 24,900 valves, and 7,450 fire hydrants (not including private), one raw water pump station located along the Allegheny River, two finished water pump stations, eight distribution pump stations, three covered finished water reservoirs, one uncovered source water reservoir, and ten distribution storage tanks/reservoirs. The total storage capacity of the reservoirs and the tanks is approximately 455 million gallons when fully operational. The useable storage capacity within the reservoir and tank system provides adequate volume and pressure and is sufficient to provide storage equivalent to approximately two days of normal water usage. The average day demand for 2015, 2016, and 2017 was 64.5 MGD, 64.7 MGD, and 69.7 MGD, respectively. The maximum day demand for 2015, 2016, and 2017 was 80.6 MGD, 94.4 MGD, and 93.5 MGD, respectively.

The sole source of water for the water system is the Allegheny River. The Pennsylvania Department of Environmental Resources, now the Department of Environmental Protection (PADEP), issued a 50-year Water Allocation Permit to the Authority in March 1989, which allows for water withdrawal of up to 100 MGD from the river. The PADEP has advised the Authority that the permitted allocation would be re-evaluated in the future if the Authority's demand increases as a result of growth within the City or through the sale of water to surrounding municipalities.

The Authority's water system currently has over 80,000 service line connections from residential, commercial, industrial, and public customers for potable water and water for fire protection within the geographic boundaries of the City.

In addition to providing water to the City of Pittsburgh, the Authority also owns and operates the water system for the City of Millvale and provides bulk water to the town of Reserve and Fox Chapel. In addition, through interconnections with other systems, the Authority provides water for supply and/or emergency use to several adjacent municipalities: Blawnox, portions of the Pennsylvania American Water Company (PAWC) system, and intermittent provisions to a number of other neighboring communities.

The PAWC supplies water to approximately 27,000 customers in the southern and western sections of the City (the Authority provides sewer conveyance to these customers). The City entered into an arrangement (City Ordinance No. 675; "South Hills Water Subsidy" Agreement December 28, 1973) with PAWC that offsets PAWC's water rates for these customers. The subsidy limits water charges for Pittsburghers served by PAWC, so their out-of-pocket rates match the Authority's rates.

Two additional small areas, one in the eastern part and the other in the western end of the City, are served by the Wilkinsburg-Penn Joint Water Authority and the West View Water Authority, respectively. In each of these areas, the distribution system elements (waterlines, valves, hydrants, etc.) are owned and maintained by the respective independent water purveyor.

In April 2016, the Authority received an Administrative Order from PADEP for violations under the Pennsylvania Safe Drinking Water Act and regulations related to a modification of corrosion control treatment chemical in 2014. The Authority reinstituted the original corrosion control chemical in early 2016 and is fully cooperating with PADEP and the components of the Order. The Authority began a corrosion control study in 2017 as part of this effort. The lead issue is discussed in more detail in Section 2 of this LTIIP.

1.2.2 Sewer System Overview

The Authority's sewer collection system is comprised of a network of approximately 1,213 miles of sanitary, storm, and combined sewers (see Figure 1-2 in Appendix A). The system includes 29,000 manholes (which includes flow dividers and diversion chambers), approximately 30,000 inlets (which includes catch basins and storm inlets), 38 combined sewer overflow (CSO) outfalls, 185 storm sewer outfalls, four wastewater pump stations, and ancillary facilities. Approximately 77% of the sewer system is combined sewers, designed so that during wet weather events, a portion of the collected stormwater and diluted wastewater that exceeds the Allegheny County Sanitary Authority (ALCOSAN) conveyance and treatment capacity is discharged into natural watercourses through 98 CSO diversion chambers. Approximately 23% of the sewer system consists of separate sewers that are dedicated separate sanitary and dedicated storm sewer pipelines. The Authority's combined sewer system conveys wastewater collected from 24 neighboring suburban municipalities and sewage generated within the City boundaries to the ALCOSAN interceptors located along the rivers and tributaries for conveyance to ALCOSAN's wastewater treatment facility (WWTF) for treatment prior to discharge into the Ohio River. The ALCOSAN WWTF is operating under the National Pollutant Discharge Elimination System (NPDES) under Permit No. 0025984. In total, the ALCOSAN WWTF receives wastewater flows from 83 municipalities and authorities.

The 24 neighboring municipalities' sewer system connections were established pursuant to agreements with the City to convey their wastewater to the ALCOSAN WWTF. Many of these agreements with these municipalities do not provide for cost sharing of sewer system maintenance and reconstruction.

The sewer system has adequate capacity to convey dry weather wastewater flows; however, during wet weather events, the system often exceeds its capacity and the capacity of the ALCOSAN conveyance system, which results in overflows, bypassing, and flooding.

The United States Environmental Protection Agency (USEPA) had adopted regulations regarding overflows from combined sewer outfalls during events that result in the discharge of untreated sanitary sewage into receiving waters in 1994. The USEPA regulations require owners of any sewer system having CSOs to acquire NPDES discharge permits for each overflow site. In January 1997, the owners of these systems were required to implement the USEPA's "Nine Minimum Control Measures" (NMCs). The NMCs define the basic steps for maintaining the combined sewer system in proper operational order and identifying potential areas requiring updates and repairs.

During dry weather conditions, the ALCOSAN interceptor system is designed to convey wastewater flows from the City and surrounding municipalities to the ALCOSAN WWTF. ALCOSAN's interceptor system includes shallow-cut pipes, deep tunnels, and diversion structures. During wet weather conditions, the flow diversion structures, which are maintained by ALCOSAN, the Authority, and other municipalities, limit or "regulate" the amount of combined sewage that enters trunk sewers and ALCOSAN's interceptor system. In addition, there are regulator points in the sanitary sewer system that relieve or overflow untreated sewage (Sanitary Sewer Overflows or SSOs) to the nearest water body.

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 ALCOSAN. The Orders directed compliance with the Pennsylvania Clean Streams Law of 1937 and the Federal Clean Water Act, to eliminate SSOs, and fulfill the Pennsylvania and USEPA CSO Policy obligations. 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 PADEP. The initial COA among the Authority, the City of Pittsburgh, PADEP, and the ACHD was entered into on January 29, 2004, and later amended in July 2007. The original Orders required communities to complete the following activities:

- Assess and map the sewer collection system
- Clean and televise the sewer collection system
- Make critical repairs
- Conduct flow monitoring
- Develop a long-term wet weather control plan in conjunction with ALCOSAN

Since 2004, the Authority has worked to complete the consent order's compliance requirements, including the preparation and submission of a Wet Weather Feasibility Study on July 31, 2013.

On December 1, 2017, the Authority (with the City as co-permittee) submitted a response to the January 21, 2016 EPA 308 Information Requirement which consisted of a Source Reduction Study (SRS) report for the combined sewer system and sanitary sewer system. The SRS concluded that improvements to the combined portion of the collection system were predicted to have the greatest impacts on mitigating collection system overflows. Further, it was concluded that 85% combined sewage capture could be accomplished through the implementation of defined system improvements, which included managing thousands of impervious acres using Green Infrastructure (GI) techniques in priority combined sewersheds, selected stream inflow removal, and regional conveyance and treatment system improvements. These integrated improvements were estimated to result in an annual overflow reduction of over five billion gallons. The City's Green First strategy, which is a regional CSO and SSO reduction implementation plan for the City and other communities, addresses multiple issues including regulatory requirements, outreach programs, stream separation and daylighting, CSO and SSO mitigation, flood hazard and basement sewage backup mitigation, and triple bottom line (economic, social, and environmental) benefits. The Authority recognizes the importance and continues to embrace partnerships with neighboring municipalities and other key stakeholders to strategically address reduction of CSO, SSO, surface flooding, and basement sewage backups. Since CSO and SSO are hydraulically connected across the regional service area and storm inflows to the combined system are influenced beyond the City boundaries, partnerships with ALCOSAN during the implementation of their

wet weather improvements program, with the connected municipalities, and with organizations such as the Saw Mill Run Watershed Association, will continue to create opportunities for significant source reduction and leverage capital investments to implement multi-problem focused solutions.

The majority of the Authority's sewers are combined and by virtue of these combined sewers and the broader mission of stormwater management within the Authority's service area, the Authority has been engaged in stormwater management since its formation in 1984. Historically, stormwater management services have been shared with the City of Pittsburgh because of the interconnected network of separate stormwater conveyances, combined sewers, street-related infrastructure like curbs and gutters, inlets, and natural channels. As mentioned above, the Authority is currently in the process of negotiating an agreement with the City to more clearly define stormwater asset and management responsibilities through the execution of a MOU with the City.

Despite this ongoing effort and substantial expenditures, drainage and infrastructure problems are numerous, with surface flooding and sewer system basement backups the most visible and vexing issues. The Authority is developing a plan to address these most significant stormwater issues, focused on two primary goals:

- Evaluate, rebuild and maintain parts of the City's stormwater management system; and,
- Evaluate, design, build and maintain projects that keep as much stormwater out of the sewer system as possible, so the existing infrastructure can carry flows most effectively and reduce sewer system basement backups and surface flooding.

1.3 The 40-Year Plan

"The Pittsburgh Water and Sewer Authority 40-Year Plan" dated September, 2012 (known as "The 40-Year Plan") estimated the resources needed for capital improvements to the Authority's system. The 40-Year Plan identified upgrades to maintain and enhance the performance of the water and sewer systems. It contained an estimated system inventory (including pumping and treatment) but only in terms of future replacement requirements (not existing system condition assessments, etc.) and addressed potential acquisitions, system valuations, future water needs, sewer system needs, a waterline risk-based analysis, leak detection and repair, and cost estimates. Cost estimates were developed for distribution system improvements, pumping and storage facilities, treatment facilities, sewers, and Geographic Information System (GIS) improvements based upon regional cost information available at that time. Much of the information originally contained in the 40-Year Plan, including more recent capital costs, has been revised and updated since its release.

1.4 The 2019 – 2023 Capital Improvement Plan

The Authority's overall 5-year Capital Improvement Plan (CIP) includes significant investment in the water, sewer and stormwater systems to address aging infrastructure, improvements necessary to meet regulatory requirements, and improve infrastructure reliability and performance.

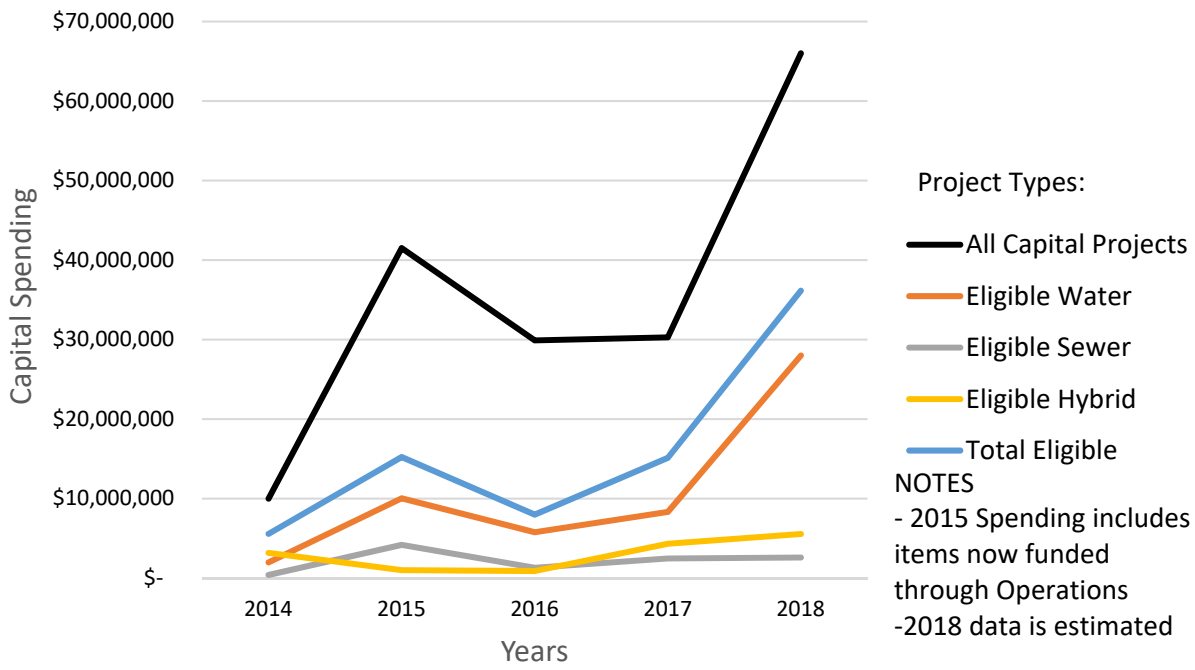
Water system renewal priorities within the CIP include improvements to the Aspinwall Water Treatment Plant, replacement or rehabilitation of the two major finished water pumping stations, upgrades of storage facilities; replacement of critical transmission mains; continuation of the lead service line

replacement program; and acceleration of the small diameter water main replacement program with an overall 5-year budget of approximately $775 million.

The wastewater system renewal priorities include relocation of sewers under structures to reduce failure (including consequential damages) and risk and improve performance; projects to remove stormwater from the existing sanitary sewer system; and general sewer rehabilitation of the sewer system to improve the structural condition of the assets. The 5-year budget for these areas is approximately $155 million.

The CIP also includes stormwater system priorities as well. The highlights include stormwater projects like 4-Mile Run stream separation project; separate stormwater sewer upgrades including water quality management systems; and GI projects to help mitigate stormwater impacts on the combined sewer systems. The stormwater impacts include basement sewage backups and localized street flooding. Approximately $245 million has been allocated to address priority issues. Figure 1-3 shows the historical levels of capital spending for all projects and for eligible properties only, not including stormwater projects.

Figure 1-3
PWSA Capital Spending History



1.5 Organization of This LTIIP

This LTIIP is organized to address two of the three categories of services and infrastructure systems provided and maintained by the Authority: water and sewers (sanitary and combined). The third category of service is stormwater, which will be addressed in a subsequent LTIIP if necessary. Items 1-6 of the LTIIP requirements in PA Code Chapter 121 §121.3 identified above are described for each

category, followed by separate sections on cost-effectiveness and evaluation metrics, workforce management, training, and outreach activities.

Water and sewer system maps and other over-size figures referred to in this LTIIP are located in Appendix A and are noted as such in the text. Other figures are embedded in the text. In addition, the capital projects tables containing project descriptions, schedules, costs, and other information and other oversize tables are similarly noted and are located in Appendix B. Smaller tables are embedded in the text.

The Lead Service Line Replacement (LSLR) program is a significant part of the capital improvements being undertaken by the Authority over the next several years. This program is described in section 2.2 of this LTIIP.

2 WATER SYSTEM

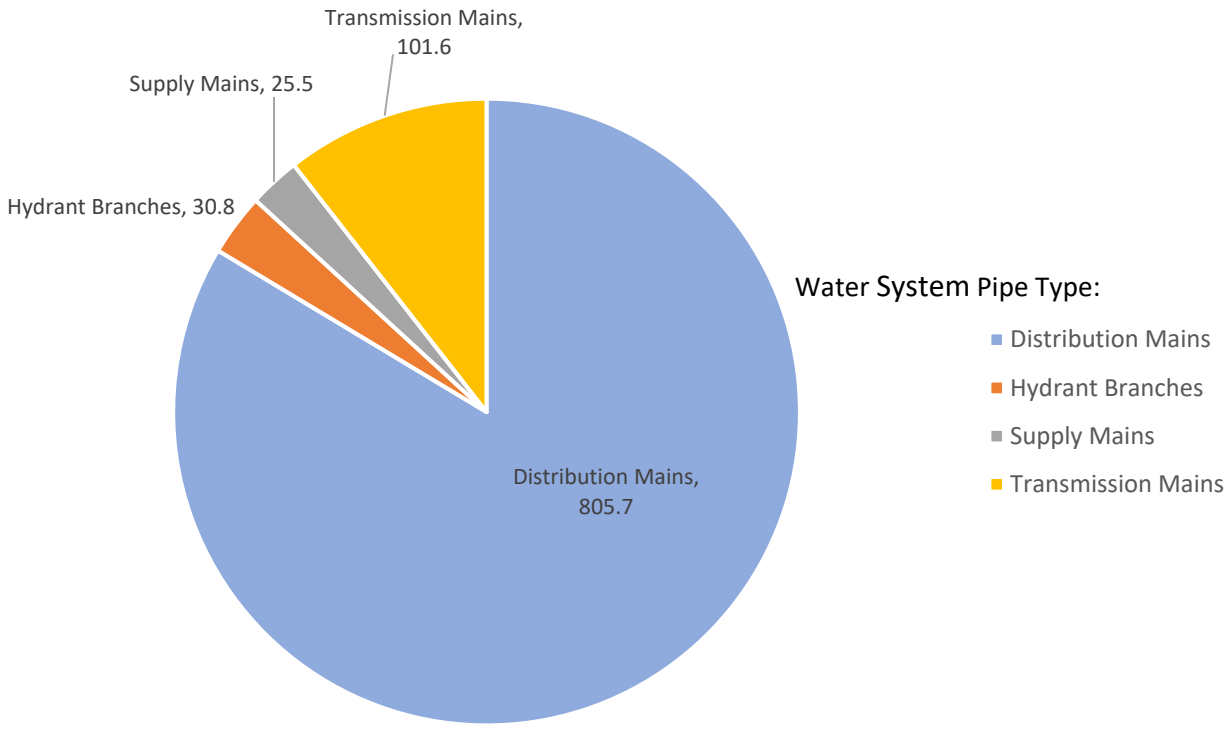
2.1 General Description of Eligible Water System Property

The eligible property associated with the Authority's water supply and distribution system consists of approximately 964 miles of mains, 24,900 valves, and 7,450 fire hydrants. According to the 40-Year Plan, the water pipes average more than 80 years old, with more than 40% installed prior to 1920, and 86% built prior to 1970.

The Authority's Geographic Information System (GIS) database is being updated constantly, and not all eligible property is currently updated in the system. The data input into GIS is an on-going effort, and statistics change with the on-going system updates, reorganization of data, and updates to the features within the system. The Authority's objective is to ultimately expand the GIS to support a mobile workforce. As one of the key systems for managing and tracking data within the Authority's water, sanitary sewer and storm sewer systems, the GIS will be the repository of critical data that can be used to manage day-to-day operations as well as a valuable tool for analyzing future capital improvement needs.

Figure 2-1 shows the length of water lines identified by service type and diameters, a total length of 964 miles. Materials of construction include cast iron, riveted steel, wrought iron, ductile iron, and small quantities of High Density Polyethylene (HDPE) and Pre-stressed Concrete Cylinder Pipe (PCCP).

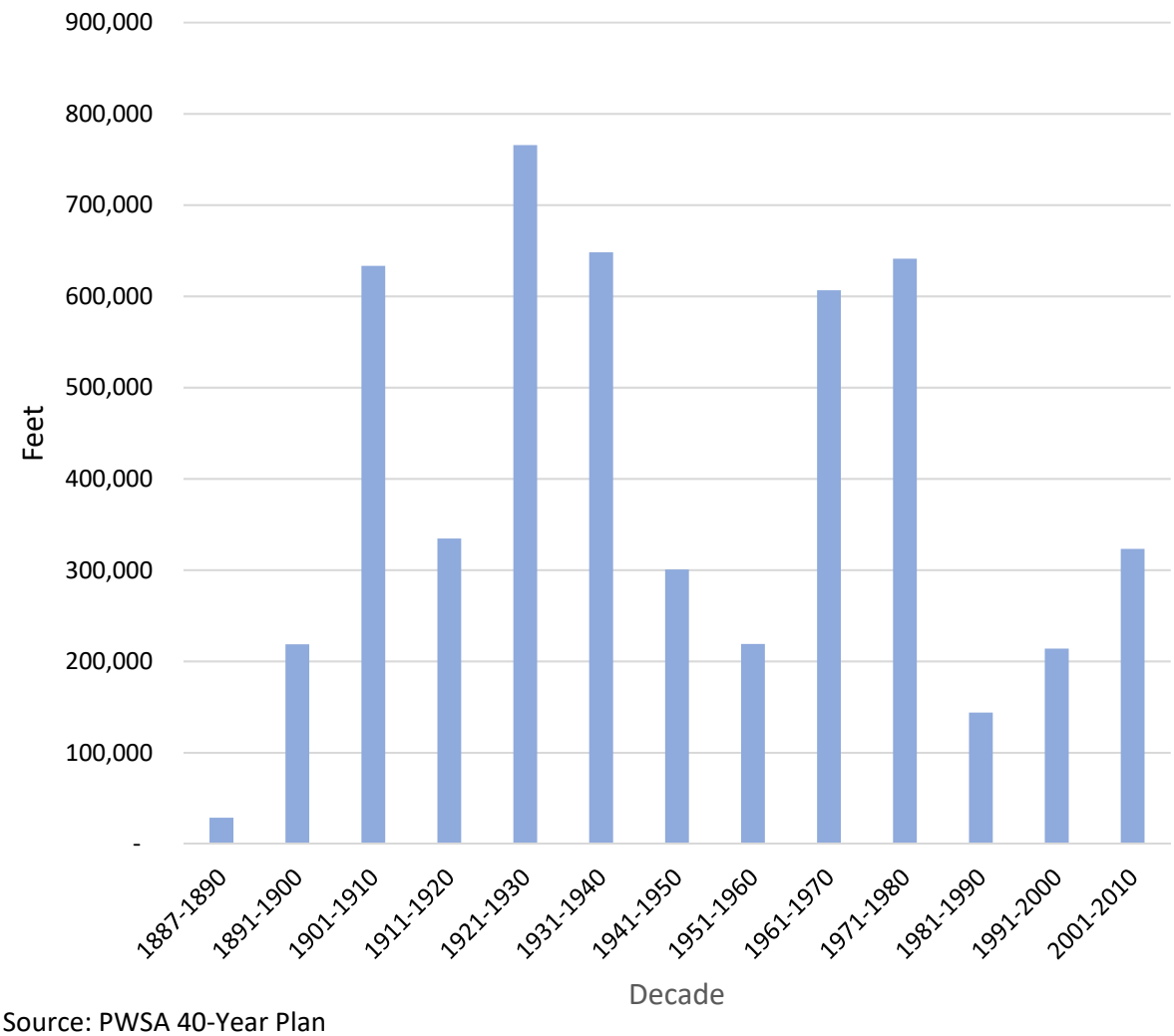
Figure 2-1
Water System Pipe Type and Length (miles)



Source: PWSA GIS Database June 2018

In 2012, an attempt was made to estimate the age of the water system. Figure 2-2 shows the results of that study. The method used to estimate the installation dates was an estimate of the system as a whole, and cannot be used to identify the age of a specific pipe segment. Secondly, the method used tends to skew the age to be newer than actual. Therefore, the information contained in Figure 2-2 is an estimate. A project is anticipated to start in 2018 to update water main material and age in the GIS system and the information contained in Figure 2-2 should be viewed as a high-level assessment of the overall age of the system.

Figure 2-2
Water Pipe Length Installed by Decade



Source: PWSA 40-Year Plan

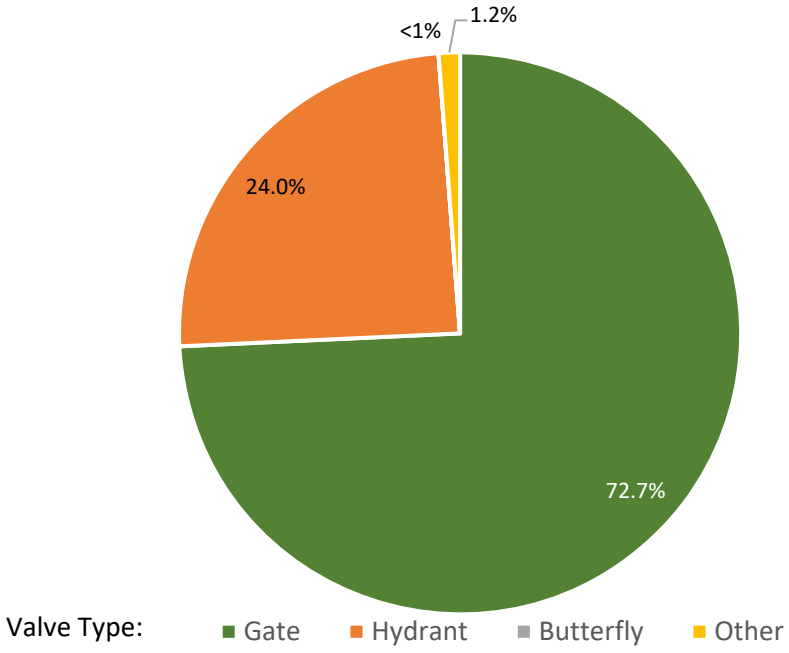
Water valve sizes range from 4 inches to 96 inches and include those shown in Table 2-1.

Table 2-1
Number of Water System Valves by Size

SIZE	ESTIMATED QUANTITY		SIZE	ESTIMATED QUANTITY
4”	637		42”	18
6”	14,595		42-1/2”	6
8”	6,136		48”	61
10”	351		50”	4
12”	2,528		50-1/4”	2
14”	8		60”	12
15”	27		72”	2
16”	573		96”	1
			TOTAL	24,961
Source: PWSA GIS Database June 2018				

Currently, the “valve type” field in the Authority’s GIS system is undergoing verification and re-evaluation. Figure 2-3 identifies the types of valves in the system and their relative proportions.

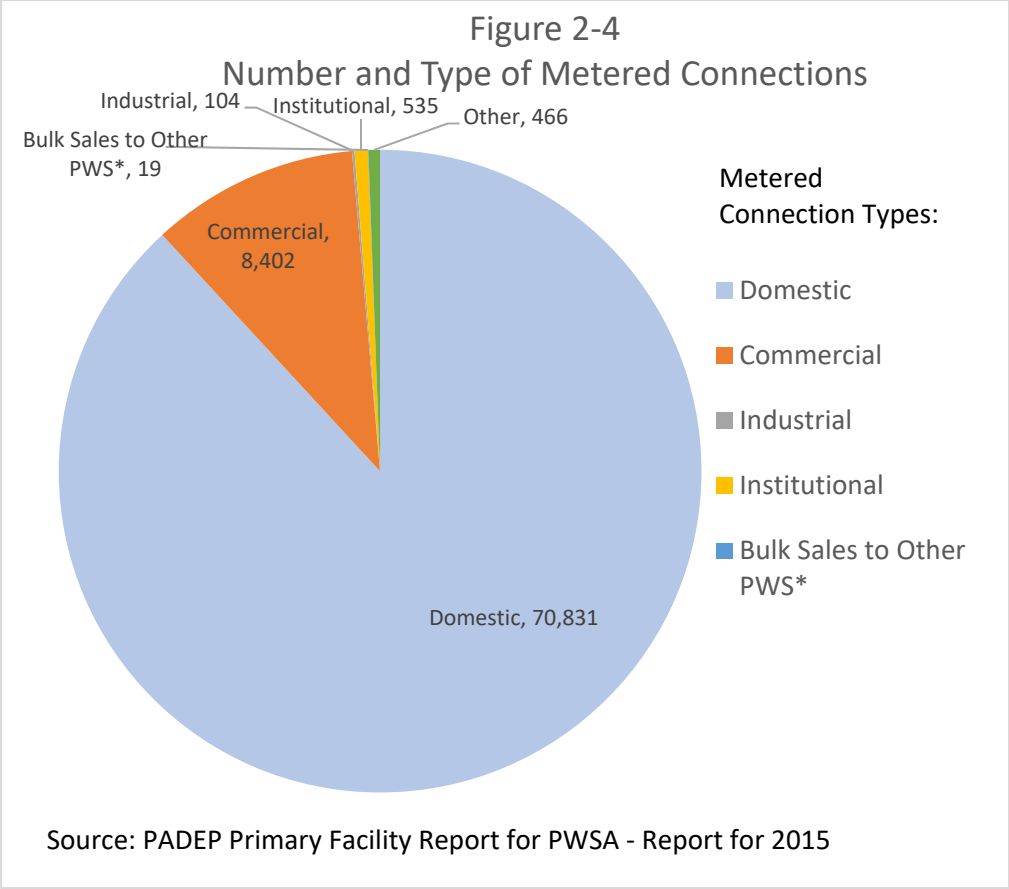
Figure 2-3 Water Valves by Type



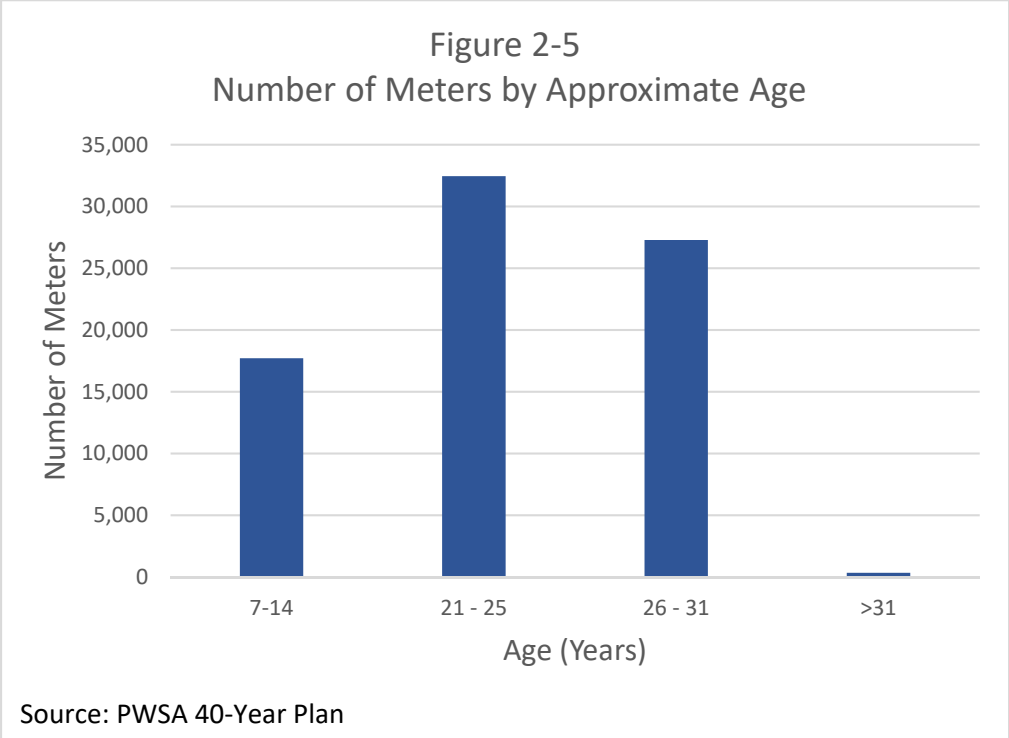
Source: PWSA GIS Database June 2018

Dividing pressure valves (currently closed) account for 486 of the valves shown in Figure 2-3. The "Other" valve category shown in the figure includes ball, cone, air control, check, pressure regulating, and vacuum release valves. Hydrant valves are typically gate valves.

The Authority's GIS database is currently being reviewed to: a) confirm locations where meters are installed; b) identify locations where meters should be added; and, c) confirm locations where a meter is legitimately absent (e.g., flat rate customer or no water service). The total meter tally is currently over 80,000 based upon the information in Figure 2-4. Figure 2-5 shows the number of meters by approximate age.



Source: PADEP Primary Facility Report for PWSA - Report for 2015



Source: PWSA 40-Year Plan

There are approximately 7,474 public fire hydrants in the system.

2.2 Lead Service Line Replacement Program

During the June 30 and December 31, 2016, and December 31, 2017 rounds of compliance sampling of water in the Authority's distribution system, the lead action level of 15 ppb as enumerated in 25 Pa. Code § 109.1101 was exceeded. The Authority's Lead Service Line Replacement (LSLR) Program was developed to address the requirements of the aforementioned code, an April 25, 2016 Pennsylvania Department of Environment (PADEP) Administrative Order, and a November 17, 2017 PADEP COA. The LSLR program outlines a plan to replace 7% of the lead service lines in the system per year until compliance with the Lead & Copper Rule Action Level for two consecutive 6-month monitoring periods can be maintained. The Authority was also directed to evaluate optimizing corrosion control measures in the system to mitigate the release of lead in drinking water.

2.2.1 Lead Service Line Replacement Policy

The Board of Directors of the Authority approved a residential LSLR Program Policy which includes the replacement of both the public and private portion of lead service lines located in the Authority's water service area. The objectives of the Program are to:

- Reduce the amount of lead (and ultimately eliminate lead service lines entirely) in the Authority's water distribution system;
- Mitigate lead exposure through water consumption for the customer as quickly as possible; and,
- Comply with state and federal regulations.

The Policy serves as the principle for which the Authority implements, through procurement contracts, its LSLR strategy to comply with the November 17, 2017 COA and meet the Board of Director's stated policy to refrain from performing partial lead service line replacements at residential properties.

The Policy includes the replacement of lead service lines at single family residential properties with service lines 1-inch diameter or less. The Authority has maintenance responsibility for the water service line from the water main to, and including, the curb-stop as described in the Authority's Rules and Regulations. This approach commits the Authority to full lead service line replacement in 2018 in accordance with the procedures outlined in the Policy. The Policy states that any single family residential property receiving partial replacement as a result of an Authority action after July 1, 2016 and before December 31, 2018 will be eligible to have their private lead service line replaced at no charge to the customer. If a homeowner replaced their private-side lead service lines between July 1,2016 and December 31, 2018, as a result of Authority action, the Authority will offer a reimbursement at the average cost of replacement for private line segments replaced during the 2018 construction period. The Policy further states that galvanized service lines will be treated as lead service lines and replaced under this policy (the former have been found to release lead into the finished water).

The Authority's lead policy is contained in Appendix C of this LTIIP.

2.2.2 Current Program Status

The November 17, 2017 COA required that the Authority replace 1,341 lead service lines on or before June 30, 2018. As of June 26, 2018, the Authority replaced 1,341 public lead services lines, meeting the COA requirements. In addition, during that same time period, over 391 private lead service lines were replaced.

In accordance with the COA, the Authority must also replace an additional 855 lead service lines by December 31, 2018. Thereafter, if the Authority has not met the 90th percentile action level during two consecutive 6-months rounds of monitoring by June 30 of each calendar year, it will, on or before June 30th of the following calendar year, have replaced at least an additional 7% of lead service lines in the system. The 7% amount is based on the total number determined in the March 29, 2018 Updated Materials Evaluation report. The cover letter transmitting the report to the PADEP which summarizes its contents is contained in Appendix D of this LTIIP.

The June 2018 first round of lead and copper sampling has confirmed that lead testing results are less than the 15 ppb in the 90th percentile. Should the Authority meet the lead action levels in the December 2018 sampling, mandatory lead service replacements will not be required after that date. The Authority is implementing a system-wide corrosion control program (discussed below) with the goal of replacing all lead service lines by 2026. It is the Authority's intention to continue its lead service line replacement Program in 2019 to replace 2,800 lead service lines and to continue to replace lead services as part of its annual water main renewal program. The presence of lead service lines will be a critical consideration when ranking small diameter water mains to be replaced in the future. The Authority proposes to accelerate this program by doubling the annual length of the Small Diameter Water Main Replacement Program in 2021 through 2026 as described below.

2.2.3 Corrosion Control Program

In April 2016, the Authority initiated an Interim Corrosion Control Study to determine the optimum chemical strategy for reducing lead release due to corrosion of lead service lines and building plumbing. The goal of the study was to identify the best approach to achieve compliance with the lead action level and not adversely impact water quality in the distribution system. The study included testing two corrosion inhibitors: orthophosphate and silicate. Each has advantages and disadvantages.

Orthophosphate is commonly used for distribution corrosion control by many water utilities. Phosphates are a nutrient and can stimulate biofilms in the distribution piping and algal growth in downstream waters. This is a concern for the Authority, which uses an uncovered finished water reservoir (Highland Reservoir 1); therefore, to avoid algal growths, a number of orthophosphate feed systems would be required downstream of the reservoir, compared to one central feed system.

Sodium silicate does not result in algae blooms but is only used for corrosion control by a limited number of water systems, i.e., data on its historical performance is more limited than that of orthophosphate.

The corrosion control study used water treatment plant filter effluent from the sedimentation basins (partially treated) and plant effluent which is to the clearwell (fully treated finished water). The study included both pipe loop stagnation/flow schemes focusing primarily on metal release from lead service

line sections, coupled with complementary, but separate testing consisting of continuous flow monitoring metal corrosion stations.

The primary results of the interim study (the *Corrosion Control Study, Final Interim Report* dated December 29, 2107) found that orthophosphate addition would be much more successful in lowering average dissolved and particulate lead release than silicate addition. However, orthophosphate addition showed a large increase in microbial populations when the chemical was added. The study recommended continuation of the testing protocols to establish the preferred chemical treatment scheme and identify appropriate dosages to effectively treat the system, while minimizing any microbial impacts.

Additional pilot testing and monitoring was completed as recommended in the Interim Report and a Final Report was issued on March 29, 2018. The Final Report included recommendations for performing additional testing in order to optimize the orthophosphate feed system and included review comments from the PADEP. While the report recommended the addition of orthophosphate at an initial dosage of 3.5 mg/L for lead corrosion control, additional testing at a dose of 1 mg/L is being performed. The lower dose may result in less of an increase in microbial populations and perhaps will still achieve satisfactory lead reduction. The Authority completed the design of the appropriate corrosion control chemical feed storage and feed facilities for the water system. Applications for permits for the addition of the corrosion inhibitor have been submitted to PADEP, and a construction permit was issued on September 24, 2018. Construction and implementation of optimized corrosion control is expected to be completed before the end of 2018.

2.3 Water System Replacement and Prioritization Approach

The Authority is working to accelerate the replacement of small diameter water mains. In both 2018 and 2019, it has committed to replacing two miles of small diameter main per year. With approximately 720 miles of small diameter main in the system, this equates to 0.2% of the system per year. The Authority is targeting acceleration to annually replace 1% of the system in 5 years but planned system modeling and analysis will ultimately determine what level of spending will be required going forward to maintain an adequate, safe and reliable system. The Authority will consider increasing the spending beyond the levels stated above to match the maximum funding available.

A small contract for the urgent replacement of water mains, approximately $1,000,000/year is also part of the Small Diameter Water Main Replacement (SDWMR) Program. The purpose of this small contract is to replace small areas, typically a block or less, where a watermain replacement is needed urgently due to a systemic failure.

2.3.1 2018 Small Diameter Water Main Replacement Program

The 2018 SDWMR Program consists of the projects identified in Table 2-2. These projects were qualitatively prioritized based on break history, available fire flow, and major users served. These projects are currently in design and will be constructed in 2019.

Table 2-2
Location and Quantities of Materials for 2018 SDWMR Program

Neighborhood	Streets	Length (feet)	Diameter
Homewood	Hamilton Avenue from N. Dallas Avenue to N. Homewood Avenue	2,310	Replace existing 6-inch diameter main with 12-inch diameter main
Bloomfield	S. Millvale Avenue from Liberty Avenue to Friendship Avenue, Friendship Avenue from S. Millvale Avenue to Gross Street, Gross Street from Friendship Avenue to Friendship Avenue	1,372	Replace existing 6-inch diameter main with 12-inch diameter main
Strip District	Railroad Street from 25th Street to 32nd Street	4,347	Replace existing 10-inch diameter main with 12-inch diameter main
Millvale	New connection from the Lanpher Rising Main to Evergreen Avenue	2,500	Millvale only has one connection from the Lanpher system. This second connection will provide redundancy to the Millvale system.

2.3.2 Water Main Replacement Prioritization Program

Going forward, the Authority has developed a more formal planning process for the SDWMR Program, which includes project scoring criteria to prioritize replacement projects. In 2019, the project scoring will prioritize previously identified water main replacement projects (also known as "relays"). This list includes projects which were previously submitted for grant applications or other funding sources but never completed, projects which were identified as problem areas by Authority Operations staff, and projects which were considered critical areas of the system in need of upgrade by Engineering staff. The intent is to use this prioritization model for the identification of these existing projects to choose the ones that will be included in the 2019 SDWMR program. Future SDWMR projects will be developed using a more comprehensive evaluation of each segment in the distribution system using available GIS data, and the recently updated hydraulic model. The results of this analysis will be finalized as part of an updated Water System Master Plan and CMMS development.

The criteria to be used for this prioritization model were selected based on the current availability of data that could be used to anticipate the likelihood and consequences of failure as well as water quality impacts. Failure is defined as occurring in one of four possible modes: capacity, level of service (LOS), mortality, and efficiency. Capacity failure occurs when the volume of demand exceeds design capacity. LOS failure is defined as functional requirements exceeding the design capability. This includes failure to satisfy codes and permits regarding water quality and other criteria regarding service levels. Failure due to mortality is defined as the degradation of an asset below an acceptable level of performance due to physical deterioration (pipe failure and main breaks). An efficiency failure would arise when the operations costs exceed the cost of other alternatives, such as replacement or rehabilitation.

The following is a list of criteria used for the evaluation of potential projects for the 2019 Small Diameter Main program:

2.3.2.1 Likelihood of Failure

Pipe Diameter – Pipe diameters of less than 8 inches have been selected as a priority. The intent is to replace undersized pipes to improve flow volume performance. Prior investigations (Chester, 2012) correlated the incidence of inadequately performing fire hydrants with small diameter pipes.

Fire Flow Improvements – The purpose of this criteria is to prioritize the replacement of pipes located near underperforming fire hydrants. Flow test data from hydrants adjacent to the water mains are used to target locations with this deficiency.

Pipe Break History – Segments where multiple pipe breaks have been recorded are being prioritized.

Lead Service Lines – To coordinate with the Authority's LSL replacement program, areas with a high concentration of LSLs have been prioritized for water main replacement. LSL locations were identified using approved historic record data, LSLR contract data, known replacements by Authority operations personnel, known water main relay areas, and curb box inspection results.

Working Pressure – The 40-Year Plan (Chester, 2012) identified an empirical relationship between main break frequency and normal working pressure. Mains under higher pressure were noted as being up to three times as likely to experience breaks. Pressure monitors have been installed across the City and are now being operated.

Pipe Age – The 40-Year Plan (Chester, 2012) also noted an empirical relationship between main break frequency and pipe age. Water mains installed between 1935 – 1955 had by far the highest likelihood of failure. This can likely be attributed to the widespread use of leadite joints during this period. Leadite is a plasticized sulfur cement that was widely used during this period. Pipes installed prior to 1935 also show an elevated break frequency rate, though not as high as during the leadite era. The scoring criteria for pipe age have been calibrated to account for the above noted differences in the frequency of main breaks.

2.3.2.2 Consequence of Failure

Water Main Location – Water mains located outside of the roadway have been prioritized. These pipes are located under sidewalks or even outside of the right-of-way. Due to the difficulties that may be encountered if a water main break should occur in these locations, the replacement of these water mains has been prioritized.

Traffic Functional Classification – Pipe failures under high traffic locations cause high impacts, both to the water utility in the form of increased repair costs due to traffic control, higher risks to employees and contract workers, and traffic disruptions for the community. Water mains located underneath critical transportation routes have therefore been prioritized. Primary arterials and interstates have been given the highest rating, followed by minor arterials. Major/minor collectors and local streets are ranked lowest.

Critical Facilities – Water mains serving hospitals and medical facilities have been given a higher priority rating. The consequences of the loss of water service to such facilities should a water main break are much higher than for the typical customer.

Based on the selection criteria described above, a scoring system was developed and applied to each potential project (see Table 2-3).

Table 2-3
Selection Criteria for SDWMR Program

	Criteria	Description	Score	% of Total Score
Likelihood of Failure	Pipe Diameter	8" or Greater	0	10
		6"	50	
		4" or Smaller	100	
	Fire Flow Improvements	Meets Fire Flow Requirement	0	10
		Fire Flows under 1000 gallons per minute (gpm)	50	
		Fire Flows under 500 gpm	100	

	Criteria	Description	Score	% of Total Score
	Pipe Break History	No known pipe breaks	0	20
		1 - 2 breaks per segment	50	
		3 or more breaks per segment	100	
	Lead Service Lines	0 LSL/100 LF: Based on available information, there are zero identified lead service lines per 100 LF of main replacement	0	5
		0.01 to 2.99 LSL per 100 LF: Based on available information, there are between 0.01 to 2.99 lead service lines per 100 LF of main replacement	50	
		3 or more LSL per 100 LF: Based on available information, there are over 3 lead service lines per 100 LF of main replacement	100	
	Working Pressure	< 120 psi	0	7
		120 psi - 180 psi	50	
		> 180 psi	100	
	Pipe Age	> 1970	0	10
		1955 – 1970	25	
		1935 – 1955	100	
		1910 – 1935	50	
		< 1910	100	
	Sub Total Percentage of Likelihood of Failure Criteria			**62**

	Criteria	Description	Score	% of Total Score
Consequences of Failure	Water Main Location	Water main located inside roadway limits	0	10
		Water main outside limits of roadway	10	
		Water main located under structures	100	
	Traffic Functional Classification	Major/Minor Collectors, Local Roads	0	10
		Minor Arterials	25	
		Primary Arterials and Interstates	100	
	Critical Facilities	Noncritical customers	0	18
		Has Critical Customers Tap (Hospitals and Medical facilities)	100	
	Sub Total Likelihood of Likelihood of Failure Criteria			**38**
Total Percentage				**100**

The ranking criteria outlined above will be revisited on an annual basis to ensure that the SDWMR program is cost-effective and addressing the most critical issues in the distribution system. The need to coordinate future water main replacements in conjunction with sanitary sewer or storm sewer replacement/improvement projects to minimize disruptions to the community and save on surface restoration will be considered in the site selection process. In addition, coordination efforts will also be undertaken to coordinate water main replacement with the City's road restoration projects to minimize surface restoration costs. Finally, there will be an active coordination program with other utilities to ensure the Authority's activities are integrated with other utility improvements to achieve a net savings in road restoration impacts.

2.3.3 2019 Small Diameter Water Main Replacement Program

As noted above, the 2019 SDWMR potential projects were prioritized from a list of previously identified potential projects. The highest scoring projects which fit within the allocated $8.1 million construction budget for the 2019 SDWMR Program were selected for inclusion in this project. The selected projects and their scoring are shown in Table 2-4 in Appendix B.

2.3.4 2019 Large Diameter Mains

The Authority is working to assess the condition and prioritize the rehabilitation or replacement of large diameter water mains. In 2019, strategic replacement or rehabilitation of large diameter water mains (16-inch and larger) and appurtenances is being undertaken to improve system reliability and hydraulics, which will also result in more efficient and cost-effective internal and external inspections. By maintaining a proactive approach to asset management such as this program, efforts are directed towards remedying issues before assets fail, thus resulting in a savings in the replacement cost as compared to emergency/reactive repair costs. Typically, large diameter pipe is not readily available and has a 6- to 8-week lead time for delivery. A large percentage of the Authority's large diameter mains are riveted steel, which cannot be easily repaired without the use of field fabricated specialty fittings.

Rising Mains 3 and 4 from the Bruecken Pump Station have been selected for improvements in 2019. These mains are approximately 2.3 miles in length. They will be required to maintain a higher capacity during the replacement of the clearwell. Therefore, it is imperative that they be inspected and rehabilitated or replaced first. In addition, the design for a redundant rising main to the Lanpher Reservoir will be prepared in 2019. This main is required for the clearwell replacement project as well as to allow the existing rising main to be rehabilitated.

Prioritization of additional large diameter mains for condition assessment, rehabilitation, and replacement will be completed through future system modeling and analysis projects. Many of the large diameter mains are constructed of riveted steel. At this time, in-pipe condition assessment for these riveted steel pipes is limited. Therefore, the usability of in-pipe condition assessments for these pipes will be evaluated as part of the master planning process.

2.3.5 Annual Hydrant and Valve Replacement Program

The Authority maintains annual contracts to replace broken or inoperable hydrants and replace inoperable valves. These contracts do not include the replacement of hydrants and valves though watermain replacement projects.

Hydrants that are found to be inoperable during routine maintenance and flushing activities, or reported through the local fire departments, are assigned to be replaced via the annual contract. In both 2018 and 2019, the Authority has committed to replacing one hundred hydrants per year, which is approximately 1% of the total.

Valves 4 to 10 inches in diameter that are found to be inoperable are replaced usually by Authority maintenance personnel. Valves 12 inches in diameter and larger are replaced under an annual replacement contract. As part of the 2019 Valve Replacement Project, the Authority plans to conduct a valve survey to identify valves that are paved over, inaccessible, or inoperable requiring repair or replacement. As inoperable valves are identified through the survey, they will be prioritized and included in the annual replacement contract. Planned system modeling and analysis will ultimately determine the level of spending that will be required going forward to maintain an adequate, safe and reliable system.

In order to improve the efficiency of water operations staff managing the day-to-day maintenance of the system, as well as addressing emergent needs during water main breaks, the Authority intends to develop a computerized work order maintenance system to track valve status and closures. As this is

expected to be a long-term program, as an initial step, and as part of the valve survey, a valve database will be developed that documents the location, size, type and operating condition of the valve in the system.

The valve location will be linked to geographic coordinates and linked to the water GIS. The goal of the program is to have all valves in the system linked to the GIS and valve database so that field crews can have real-time access to this information. This will allow field crews to quickly identify inoperable valves, normally closed valves (boundary valves, for example) and valves that may be closed for routine maintenance or system operations. As the valve database is expanded it will facilitate rapid system analysis to identify which valves will need to be closed to isolate a main for repairs. In addition, the valve database will improve tracking of closed valves to ensure that all valves closed during a main repair are returned to open status.

2.3.6 Small Meter Changeout

According to the best available information, the Authority has as many as 50,000 meters that have exceeded the time allowed in the Commission's recommended testing schedule and will need to be tested and replaced. Given the magnitude of the changeout program, the Authority is proposing to complete this work over a 5-year period. Initially, the existing staff will be used to accelerate the current meter changeouts, with expansion using either additional Authority staff, or through the use of outside contract services to expedite the process. The Authority plans to re-evaluate resource needs after six months of project execution to determine the most cost-effective and expedient approach to completing this program.

2.3.7 Unmetered and Flat Rate Properties

Historically, the City of Pittsburgh did not provide water meters on municipal and government buildings. It is estimated that there are roughly 200 – 400 sites that are currently unmetered. Providing meters at these buildings is a critical program to improve overall metered consumption given the current unaccounted-for water in the system. In addition, the Authority has approximately 500 flat rate customers - customers who are charged a monthly flat rate for services. These flat rate customers are typically either party line customers, service lines that serve more than one property, or locations that are known to not have meters. The Authority is proposing a 5-year period to complete the Unmetered and Flat Rate Properties meter installation program.

Initially, the cost of the meters and installation costs including meter chambers, connective piping, backflow prevention devices, etc. will be borne by the Authority under the current CIP, and in some cases the Authority and the customer will share costs. Ultimately, any costs borne by the Authority will be billed to the customers, or in the case of the City properties, accounted for in on-going contract negotiations.

2.3.7.1 Unmetered Properties

The first step in this program will be to identify all facilities that do not contain flow meters. As many of these buildings are municipal-type structures with large service connections, it is imperative to identify the building address, locate the incoming service connection to verify the size, estimate the typical daily usage, and identify the need for separate fire suppression metering in order to determine the appropriate meter size and type for the facility.

The new meters will need to be installed in accordance with the Authority's design guidelines which may include meter vaults in sidewalk areas. It is anticipated that in many instances the installation of new meters will require that a detailed design be undertaken for each location including: field location surveys to determine underground utilities in the area; determination of the appropriate size and type of meter for the facility and the potential need for separate fire suppression lines and detector check-metering; meter orientation and accessories to assure accurate metering; means and methods to effectively install the new meter(s) while minimizing shutdown periods to the building; positioning the new meters in a location that will be easily accessible for future maintenance; etc.

Approximately 100 sites have already been identified and there is a program in place to locate and visit the remaining locations. Once the inventory of unmetered properties is completed, a prioritization process will be undertaken. It is envisioned that the priorities would be to install meters at the largest users first and concentrating on those facilities that can easily accommodate a new meter with minimal impact on the facility and surrounding areas. It is expected that the meter installations will be included in annual meter installation contracts which will include approximately 50 - 75 installations depending on overall complexity and cost of the installations.

2.3.7.2 Flat Rate Properties

The first step for flat rate properties will be to evaluate each site to determine the reason that the property is flat rate. Some meters can be installed by Authority operations. However, some properties, such as party line properties, will need assistance from engineering or an outside contracting service for design of the party line separation. The Authority anticipates that many of these party lines could be lead and will also require the assistance of the lead service line replacement program team for customer outreach and regulatory compliance.

2.3.8 Large Meter Replacement Program

In addition to the installation of new meters at unmetered buildings, the Authority will also be undertaking a large meter changeout program. Those aged meters (estimated to be approximately 800, 3-inch and larger units and approximately 2,500 1.5-inch to 2-inch units) that are not in compliance with PUC regulations will be scheduled for replacement. These meter replacements will be undertaken by current staff over the next 5 years. However, the Authority will evaluate the need for additional outside contract services to perform pre-installation inspections of each location to determine work and equipment required prior to mobilization of meter crews.

2.4 Eligible Water System Property to be Improved

Table 2-5 in Appendix B describes the 12 projects or project categories which comprise the eligible water system projects of this LTIIP as discussed above. These projects conform to the definition of "eligible property" described in section 1.1.1.

2.5 Initial Planned Repair and Replacement Schedule and Projected Annual Expenditures

Table 2-6 in Appendix B identifies the costs associated with the 52 projects for each year of the project schedule through 2023 organized into the following major project categories:

- Hydrant Replacement
- Valve Replacement
- Water Relay Replacement
- Small Diameter Water Main Replacement
- Large Diameter Water Main Improvements
- Large Water Meters
- Small Water Meters
- Lead Service Line Replacement

The total projected spending for all water projects from 2018 through 2023 is $505.9 million.

2.6 Acceleration of Water Projects

2.6.1 Lead Service Line Replacement Program

Through an accelerated LSLR program needed to meet the COA deadlines, the Authority has developed a good understanding of the issues associated with lead service replacements in a City like Pittsburgh. Replacing lead service lines on public and private property in the Authority system has presented numerous construction challenges. The City's topography means that many private lead service lines run underneath obstructions such as concrete retaining walls and stairs. In addition, soil conditions vary in each neighborhood which can make trenchless techniques like boring or pulling infeasible. Water service line length also varies greatly at each property which can increase costs and impact constructability. In response to these challenges, the Authority and its contractors are applying innovation and ingenuity to minimize private property impact while also maintaining a pace of replacement to meet COA requirements.

The Authority Board of Directors approved a $44 million budget in 2018 to fund both the public and private side replacement for lead service lines throughout the Authority service area. The public and private line replacements are performed by several contractors selected by an open public bid process. The replacements are organized by work area typically made up of several contiguous blocks. The work order areas were initially selected based upon curb box inspections and historical record analysis, and further prioritized by health and census data from the Allegheny County Health Department. To spread the replacement program across the Authority service area equitably, the 2018 replacement program includes work orders in areas in each Council District and Millvale.

The Authority submitted an application to the Pennsylvania Infrastructure Investment Authority (PENNVEST) for $50 million in funding for a LSLR program in 2019. The process would be similar to 2018 in the selection of replacement areas, contractors, and other components of the program and would

replace approximately 2,800 additional public (and corresponding private as applicable) lead service lines.

Based on the March 29, 2018 Updated Materials Evaluation report, there are an estimated 12,218 lead service lines within the Authority's water system. It is the Authority's intention to replace the remainder of the lead service lines through a combination of its annual water main renewal program, continued minor (as required) LSLR programs, and replacements by the Authority's Operations Department as a response to leaks. After the LSLR Programs of 2017, 2018 and 2019, there will be an estimated 6,600 lead service lines remaining that would be replaced under the annual water main renewal program.

After 2019, future LSLR programs will focus on areas of the City where water mains were installed due to unacceptable fire-flow in neighborhoods with existing mains in sidewalk areas. In these areas the new water mains only serve fire hydrants and the existing water mains located in sidewalk areas continue to serve the residences. In these areas new service lines will be connected to the new main (in all locations, not just where there is lead), and the old water mains in sidewalk areas will be taken out of service and abandoned. There will also be the potential of a future individual LSLR contract to address other locations (as compared to the neighborhood contracts previously described).

As previously described, one critical criteria for selecting future water main renewal locations is the presence of lead lines, which the Authority anticipates will be the focus of the water main renewal program for the next several years.

Finally, the Authority's Operations Department routinely replaces about 200-250 lead service lines per year in response to leaks in water mains or service lines. This number is anticipated to decrease in progressive years as the number of lead service lines are reduced in the system.

Based on the LSLR program outlined above, Table 2-7 shows the anticipated timetable for removal of lead service lines by 2026. Note that the number of lines replaced via LSLR Contracts and the SDWMR program will be refined as the concentration of lead service lines in individual areas is further characterized:

Table 2-7
Anticipated Timetable For Removal of Lead Service Line Lines by 2026

Year	Method			Total Removed	Cumulative Remaining
	LSLR Program	Small Diameter Water Main Replacement	Operations		
2016 - 2019	4925	277	984	6186	6614
2020		450	175	625	5989
2021		1100	150	1250	4739
2022		900	125	1025	3714
2023		1050	100	1150	2564
2024		825	75	900	1664
2025		800	50	850	814
2026		750	50	825	0

In order to replace the remaining lead service lines under the annual SDWMR program, it will be necessary to increase the number of miles of main replacement per year. Table 2-8 presents the current and "accelerated" SDWMR program currently under consideration by the Authority. The accelerated program is expected to be needed to effectively eliminate the remaining lead service lines from the system.

Table 2-8
Current and Proposed Accelerated SDWMR Program

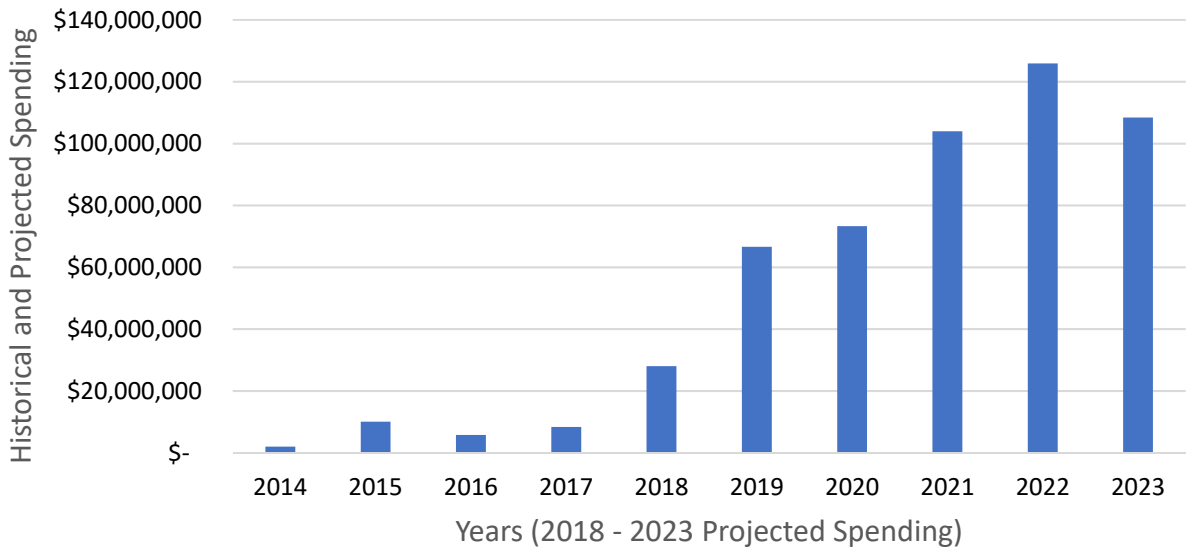
Year	Existing Budgeted SDWMR Program*	Accelerated SDWMR Program
2019	$10,880,000	-
2020	$54,340,000	-
2021	$54,630,000	$114,770,000
2022	$57,170,000	$120,060,000
2023	$58,880,000	$123,610,000
2024	$60,700,000	$127,390,000
2025	$61,570,000	$129,160,000
2026	$63,370,000	$133,020,000

*Costs shown in Table 2-6 (previously presented) for years 2022 through 2024 represent incurred expenses and not the total budget of the project.

2.6.2 Acceleration of Other Water System Improvements

In addition to the accelerated LSR program described in section 2.6.1, the Authority is working to accelerate the replacement of small diameter water mains as described in section 2.3. Additional infrastructure replacements and rehabilitations will be identified and implemented on a case by case basis. Figure 2-6 shows the historical spending on water system improvements presented previously plus the proposed spending based on the information presented herein. The proposed 5-year (2019 – 2023) spending on eligible water system projects is $478 million.

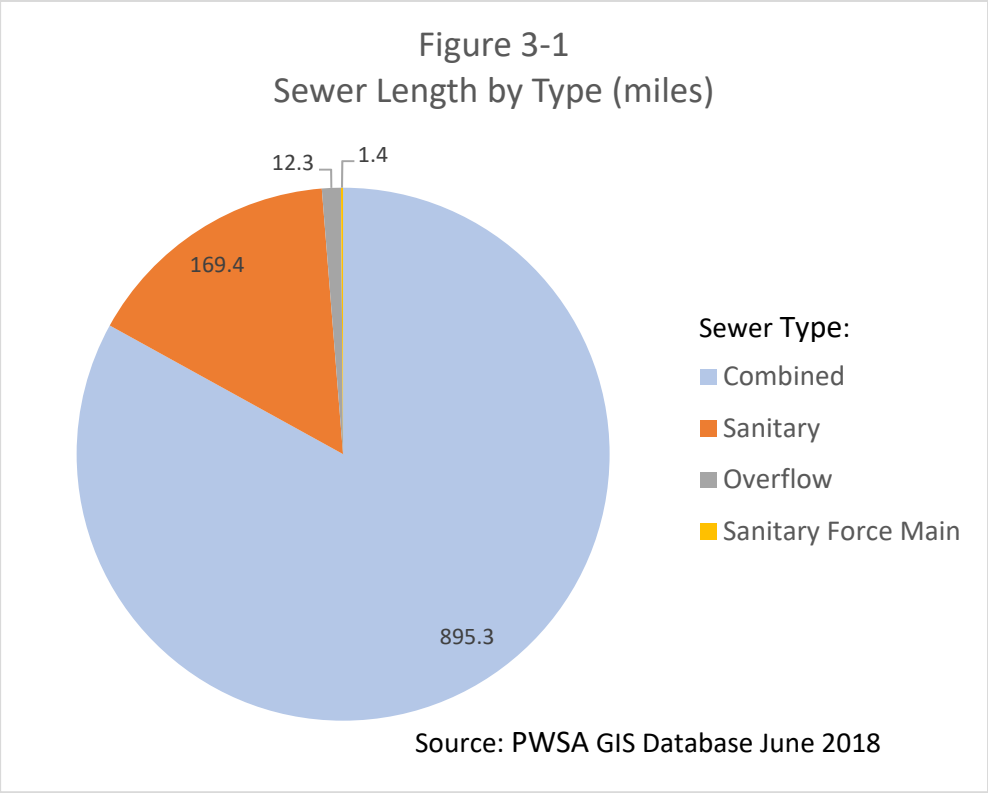
Figure 2-6
Historical (2014-2017) and
Projected (2018-2023) Spending
Eligible Water System Projects



3 SEWER SYSTEM

3.1 General Description of Eligible Sewer Property

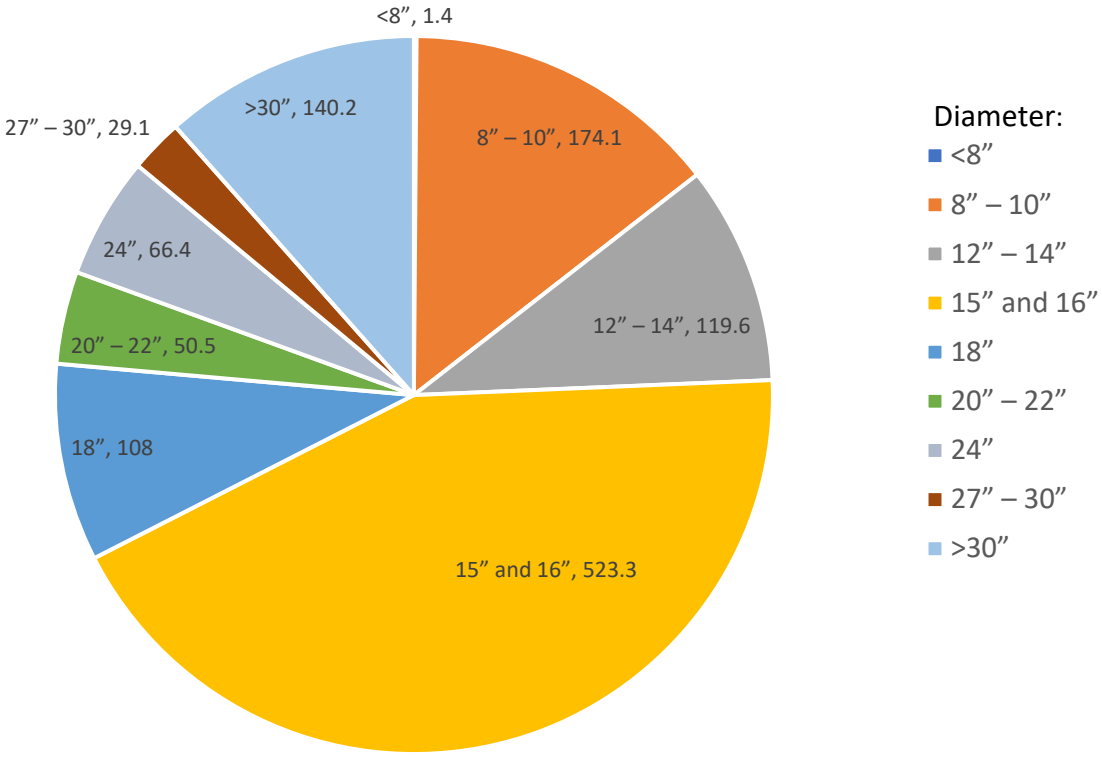
The eligible property associated with the Authority's sewer system consists of approximately 1,080 miles of sewer comprising separate sanitary and combined sanitary and storm, overflows, and sanitary force mains as shown in Figure 3-1. Approximately three-quarters of the Authority's sewers are combined (pipes that carry both sanitary and storm flows).



The eligible property within the system includes lift stations (also referred to as pump stations). The Authority operates and maintains four sanitary sewer lift stations: Browns Hill Road Pump Station, Evergreen Road Pump Station, Mifflin Road Pump Station, and Rodgers Street Pump Station. The Browns Hill Road Pump Station has two constant speed pumps/motors each rated at 250 gallons per minute (gpm) at 55 feet total dynamic head (TDH). The Evergreen Road Pump Station has two constant speed pumps/motors each rated at 150 gpm at 55 feet TDH. Mifflin Road Pump Station has two constant speed pumps/motors each rated at 500 gpm at 88 feet TDH. The Rodgers Street Pump Station has two constant speed pumps/motors each rated at 1,000 gpm at 95 feet TDH.

Sewer pipe sizes range from less than 8-inch diameter to greater than 30-inch diameter, as shown in Figure 3-2, which includes the lengths of storm sewers because separate sizes for sanitary, combined, and storm are not presently available.

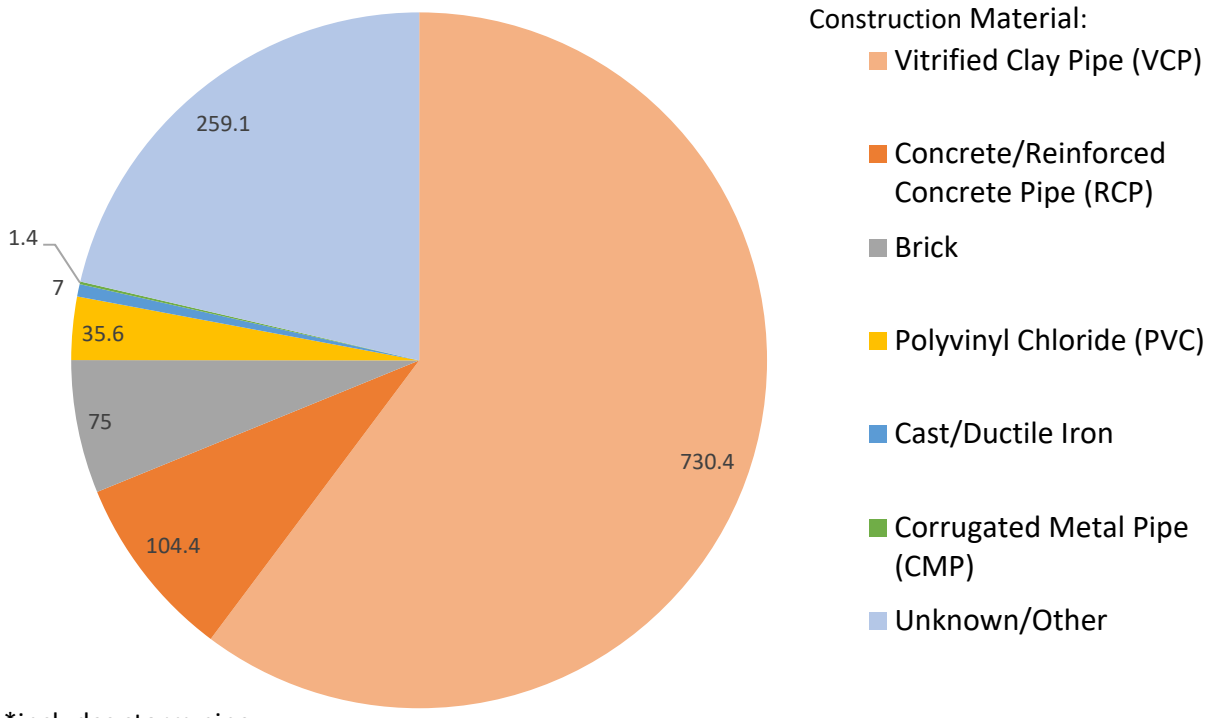
Figure 3-2
Sewer Length (in miles) by Diameter*



*includes storm pipe
Source: PWSA GIS Database June 2018

As would be expected of an older sewer system, a majority of the sewers are composed of Vitrified Clay Pipe (VCP), as shown in Figure 3-3.

Figure 3-3
Sewer Length (in miles) by Material of Construction*



*includes storm pipe
Source: PWSA GIS Database June 2018

The sewer system contains approximately 29,000 manholes including 98 CSO diversion chambers. Manhole types include standard, lamp hole, equalization chamber, and flow dividers. The total does not include 49 manholes with sewer use defined in the GIS system as "undefined"; these "undefined manholes" could be private manholes since no record drawings have been located to date to confirm ownership. The system also contains 38 CSO.

As noted above, the Authority's GIS database is being updated constantly, and not all eligible property is currently "logged" into the system. The data upload to the GIS system is an on-going effort, and the statistics reported above may change as a result of ongoing system data review and "clean-ups".

3.2 Eligible Sewer System Property to be Improved

Recognizing the need for continual renewal of the Authority's sewer collection and conveyance system to maintain quality and reliable service to its customers, the Authority has established three annual rehabilitation and pipe reconstruction project types to accelerate the renewal of its system: Sewers Under Structures, Small Diameter Sewer Rehabilitation, and Large Diameter Sewer Rehabilitation. Sewers Under Structures will target existing sewer infrastructure located under or adjacent (within 20 feet) to buildings, bridges, or railroads or located on steep slopes. Small and Large Diameter Sewer Rehabilitation projects utilize cost effective trenchless technologies to restore the structural integrity,

reduce root intrusion, and reduce infiltration and inflow on mains less than 36-inch in diameter and 36-inch diameter or greater, respectively.

In an effort to accelerate the sewer system CIP, the Authority has initiated the aforementioned sewer renewal contracts in 2018. Sites were selected based on the asset's physical condition, location, and/or regulatory compliance obligations. The projects are summarized in Table 3-1.

Table 3-1
Selected Sewer System Eligible Property Locations for Rehabilitation or Replacement

Year and Project Types	Sewer System Eligible Property Description
2018 Sewers Under Structures	Four project locations have been identified: 1. Ellsworth Avenue – 20-inch vitrified clay, combined sewer main, 30 feet deep and located under 5135 Ellsworth Avenue. 2. Oakwood Bridge - 215 linear feet of 24-inch vitrified clay, combined sewer main located adjacent to the Oakwood Road Bridge. 3. South 16th Street - 700 linear feet of 20-inch and 24-inch vitrified clay, combined sewer main located under the Union Supply Company building, CSX railroad tracks, and the Three Rivers Heritage Trail. 4. Centre Avenue - 575 linear feet of 15-inch vitrified clay, combined sewer main located under a 20-inch water main that serves UPMC Shadyside and a telecommunications duct bank.
2019 Small Diameter Sewer Rehabilitation	Approximately 6 miles of cured-in-place sewer lining (CIPP) located in sewersheds M-34 and S-18. The following locations are anticipated to be CIPP in M-34: Appian Way (including the paper street), Poplargrove Street Way (including the paper street), Plummet Way (including the paper street), Concordia Street between Appian Way and E Agnew Avenue, E Agnew Avenue between Brownsville Road and Concordia Street, and Brownsville Road from E Agnew Avenue to 2117 Brownsville Road. The following locations are anticipated to be CIPP in S-18: Brownsville Road between Clifton Street and Stewart Avenue, Windfall Way, Biscayne Drive, Biscayne Place, Edgar Street, Valera Street between Azur Way and Biscayne Drive, Bellpain Street, Wysox Way, Nice Way, Maytide Street between Brownsville Road and Nice Way, Dickman Way, Bethesda Street, Merritt Avenue between Brownsville Road and Bethesda Street, Clause Avenue, Stewart Avenue between Brownsville Road and Clause Avenue, Newburn Avenue and Parkdale Avenue.

Year and Project Types	Sewer System Eligible Property Description
2019 Sewers Under Structures	1. Flemington Street– 740 linear feet of 15-inch and 20-inch vitrified clay, combined sewer main located under 1075 Flemington Street and on an inaccesible steep slope (>35%) to Beechwood Boulevard. 2. Washington Landing River Crossing – 282 linear feet of 8-inch ductile iron, sanitary sewer main located under the Allegheny River. 3. Seaton Avenue - 402 linear feet of 8-inch vitrified clay, sanitary sewer main located under a building addition and swimming pool.
2020 Large Diameter Sewer Rehabilitation	1. Heth's Run/Zoo –Trenchless rehabiliation of a 60-inch combined trunk sewer that is approximately 85 feet deep starting at DC121L001 and transversing downstream 670 linear feet. 2. East Busway– Trenchless rehabiliation of 72-inch and 96-inch combined trunk sewers starting at JCT051R012 and transversing downstream 325 linear feet to MH051R023.

These and the additional projects projected to be implemented throughout the 5-year duration of this LTIIP are identified and described in Table 3-2 located in Appendix B.

3.3 Future Sewer Rehabilitation Prioritization Approach

In order to cost-effectively prioritize future sanitary sewer rehabilitation, the Authority will employ a risk-based approach to prioritize the neighborhoods and/or pipe segments that are included in the annual projects, where risk is defined as:

$$Risk = Likelihood\ of\ Failure\ \times Consequence\ of\ Failture \times Redundancy$$

To accomplish this cost-effective prioritization, the Authority plans to perform a GIS desktop analysis, which is anticipated to be completed by late Spring of 2019. This analysis will assign a risk score to each pipe segment within its system when complete. Additionally, to reduce the impact to customers and save on mobilization and demobilization costs, projects will be formed by grouping prioritized assets by geographic proximity and similar risk rankings.

3.3.1 Likelihood of Failure

The likelihood of failure component represents the probability that the asset will fail based on the asset's physical condition. This score will be determined by reviewing internal, closed-circuit television (CCTV) inspections coded using the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP), which is an industry standard for performing condition assessments. Table 3-3 lists and describes the condition scoring for sewers in the wastewater collection system.

Table 3-3
Likelihood of Failure Scoring

PACP Grade	Description	General Guidelines for Timing of Pipe Failure
1	Minor Defects	Failure unlikely in the foreseeable future
2	Defects that have not begun to deteriorate	Failure unlikely for 20 years
3	Moderate defects that will continue to deteriorate	May fail in 10 to 20 years
4	Defects that will become a grade 5 in the foreseeable future	Likely to fail in 5 to 10 years
5	Defects requiring immediate action	Has failed, or will fail in less than 5 years

For assets without existing inspection data, desktop assessments using operations and maintenance history (if available), material, and date of construction will be used until condition assessment data is available. Collapses or other significant defects that cannot be rehabilitated using trenchless technology on critical pipe segments (e.g. deformation) will be repaired or replaced using open-cut methods as soon as possible using the Authority's annual urgent or reconstruction contracts. These segments will be assigned a condition score of 6.

3.3.2 Consequence of Failure

The consequence of failure (CoF) score represents the direct and indirect impact to the customers and environment if the asset fails; it will utilize the following "Triple Bottom Line" criteria:

- Financial impact resulting from the need to conduct an urgent repair: this accounts for the relative cost to repair failures (i.e. depth, pipe size, and accessibility) and any fines or other regulatory costs incurred due to a failure.
- Societal impact resulting from the loss of service of the asset: this takes in account the number of customers affected by the failure, the type of customers affected (i.e. hospitals, schools, etc.), and the location of the asset.
- Environmental impact resulting from any discharges: this accounts for the relative impact to the surrounding environment if a failure leads to a discharge.

An overall consequence of failure score will be calculated (see Table 3-4) as a weighted average of all the individual consequence of failure factors and the maximum score will be 6. The weighting factors will be 0.25 for each financial and social criterium and 0.50 for environmental criteria. Proposed weightings and ranges presented may be adjusted as the systemwide analysis is performed.

Table 3-4
Consequence of Failure Scoring

CoF Factor	Description	CoF Score	Triple Bottom Line Criteria
Diameter	Less than 10”	1	Financial, Social
	≥ 10" < 15"	2	
	≥ 15" < 24"	3	
	≥ 24" < 36"	4	
	≥ 36" < 60"	5	
	≥ 60"	6	
Depth	Less than 6'	1	Financial, Social
	≥ 6' < 10'	2	
	≥ 10' < 14'	3	
	≥ 14' < 18'	4	
	≥ 18' < 24'	5	
	>24'	6	
Location	Unpaved Road	1	Financial, Social
	Minor Local Road	2	
	Major Local Road	3	
	Collector Road	4	
	Arterial/Building/Pool	5	
	Highway/Waterway/Railroad	6	

CoF Factor	Description	CoF Score	Triple Bottom Line Criteria
Distance from Environmentally Sensitive Features	150 LF or more	1	Environmental
	100 - 150 LF	2	
	75 - 100 LF	3	
	50 - 75 LF	4	
	25 - 50 LF	5	
	Less than 25 LF	6	
Distance Between Downstream Pipe to a Service Lateral for Customer with High Importance	20,000 LF or more	1	Social
	15,000 – 20,000 LF	2	
	10,000 – 15,000 LF	3	
	5,000- 10,000 LF	4	
	1,000 – 5,000 LF	5	
	Less than 1,000 LF	6	
Accessibility of Pipe	On Right-of-Way - No Traffic Control	1	Financial
	On Right-of-Way - Traffic Control	2	
	On Public Land with Vehicle Access	3	
	On Public Land without Vehicle Access	4	
	On Private Lands with Vehicle Access	5	
	On Private Land without Vehicle Access	6	

3.3.3 Redundancy

The availability of redundant assets mitigates the consequences of asset failure and overall risk. Redundancy scores will range from 0.1 for complete redundancy to 1 for no redundancy. In general, the redundancy factor for most of the wastewater collection system will be 1 because gravity sewer systems do not typically have redundancy in their design. However, for specific assets known to have alternate flow paths where diversion can occur with no system impacts, redundancy will be factored into the risk calculation.

In summary, the proposed risk scoring methodology is summarized in Table 3-5.

Table 3-5
Risk Scoring Methodology

Criteria	Scale (Best Case → Most Risk)
Likelihood of Failure	1 (almost new) to 6 (failed)
Consequence of Failure	1 (least critical) to 6 (most critical)
Redundancy	0.1 (complete redundancy) to 1 (no redundancy)
Risk	1 (least risk) to 36 (highest level of risk)

3.4 Initial Planned Repair and Replacement Schedule and Projected Annual Expenditures

Table 3-6 in Appendix B identifies the costs associated with the projects for each year of the project schedule (2018, 2019-2023), organized into the following major project categories:

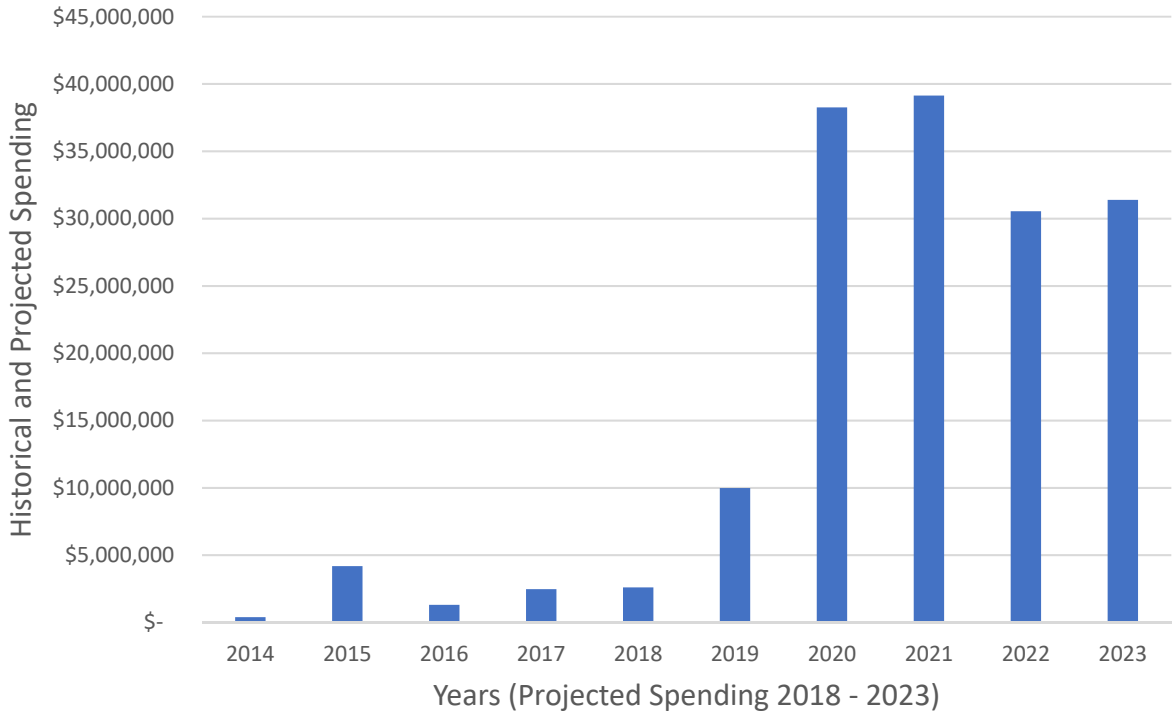
- Small-Diameter Sewer Rehab
- Large-Diameter Sewer Rehab
- Sewer Reconstruction (Annual Indefinite Delivery Indefinite Quantity (IDIQ) Contract)
- Sewers Under Structures

The total projected spending for sewer system eligible properties projects from 2018 through 2023 is $152 million.

3.5 Acceleration of Sewer Projects

Figure 3-4 shows past and projected spending on eligible sewer system projects for the period 2014 through 2023. The value for 2015 reflects projects which were funded through a combined capital and operations budget, which accounts for its disproportion to years prior and after.

Figure 3-4
Historical (2014-2017) and
Projected (2018-2023) Spending
Eligible Sewer System Projects



4 WATER/SEWER (HYBRID) PROJECTS

4.1 General Description of Eligible Hybrid Projects

Water/Sewer (Hybrid) projects are defined as those which contain both water and sewer elements or sanitary and storm sewer elements and are not practicable to segregate those project costs associated with water and those project costs associated with sewer. Table 4-1 in Appendix B describes the three eligible properties projects which we have categorized as "Hybrid" as follows:

- Utility Cost Shares: Infrastructure replacement which is carried out as a result of projects in the vicinity by other agencies or utilities.
- Smallman Street Reconstruction: Sewer separation and water main replacement in association with local redevelopment.
- Maytide Storm and Sanitary Sewer System Improvements: reconstruction and realignment of local storm and sanitary sewers.

4.2 Initial Planned Repair and Replacement Schedule and Projected Annual Expenditures

Table 4-2 in Appendix B identifies the costs associated with the Hybrid Eligible Properties Projects for each year of the project schedule. As such, the projected total spending on the three projects from 2018 through 2023 is approximately $25.9 million.

5 SUMMARY OF PAST AND PROJECTED CAPITAL SPENDING

Table 5-1 shows the past and projected spending for water, sewer, and hybrid projects, all previously described in this LTIIP. These data are graphically displayed in Figure 5-1 in Appendix A. The projected 5-year spending (2019 – 2023) for all eligible property types for the purpose of this "5-Year LTIIP" is $648 million.

Table 5-1
Historical and Projected Capital Spending (2014-2023)
(in Thousands of Dollars)

Fiscal Year	Total Capital Spending	Water Projects	Sewer Projects	Hybrid Projects	Total Eligible
2014	$9,991	$3,177	$400	$1,983	$5,560
2015	$41,502	$998	$4,186	$10,040	$15,225
2016	$29,903	$894	$1,305	$5,777	$7,976
2017	$30,283	$4,331	$2,476	$8,330	$15,137
2018	$66,000	$28,002	$2,599	$5,547	$36,148
2019	$150,000	$66,616	$9,985	$8,641	$85,243
2020	$225,000	$73,266	$38,254	$4,917	$116,437
2021	$330,000	$103,975	$39,142	$3,000	$146,117
2022	$305,000	$125,908	$30,551	$3,000	$159,459
2023	$265,000	$108,401	$31,392	$750	$140,543

6 COST EFFECTIVENESS AND EVALUATION METRICS

The increase in the volume of capital project delivery planned for the next 5 years demands an ever-increasing level of management excellence to achieve the efficiencies necessary to meet the challenge of adhering to project budgets and schedules. The Authority has for the past 30 years run an engineering and construction department comprised of Authority employees and contracted professionals. The Authority staff and its outside consultants and contractors will continue to work seamlessly as a unit in terms of controlling and monitoring all aspects of the capital program. Impediments to the attainment of the aggressive construction program proposed must be identified in advance and when barriers to the efficient attainment of pre-established budget and schedule goals are identified, they must be resolved quickly and consistently. This approach will ensure the success of the program, measured in large part by cost savings.

The rehabilitation and replacement of water mains, for example, will undoubtedly result in a reduction in non-revenue water losses and future main breaks. However, there is a need for a comprehensive and systematic approach to the delivery of the accelerated capital improvements program. The Authority has implemented (and is continuously improving) a number of tools which will ensure the cost-effective and efficient planning, design, procurement, construction, and close-out of projects. These tools include the e-Builder project management information system, the Program Management Plan (PMP), and contractor procurement process. All three tools are described in more detail below. In addition, cost-effectiveness will be ensured by the selection of the appropriate construction techniques (such as trenchless construction) during the planning stages of a project.

6.1 e-Builder Project Management Information System

e-Builder is a robust, web-based project management information system. It allows, through specifically defined permissions, both internal and external project managers to manage their project budgets, schedules, change orders, contractor/vendor invoice payments, and other critical project related activities in one centralized location. In addition, this system allows the Authority to better manage the interactions and integral project finances for multiple, related projects at a program level.

e-Builder was initiated by the Authority in July 2015. e-Builder has allowed the establishment of customized processes that best fit day-to-day project management activities. The e-Builder system allows Authority personnel at all levels to access data and tangible project status reports for the project. Dashboards have been developed for internal and external project participants, allowing the e-Builder users the ability to manage, monitor and quickly identify:

- Bottlenecks within the processes
- Staffing needs
    - Capital and operations expenditures
    - Change orders
    - Schedule adherence and deviations throughout the project cycle

Over the past 3 years, the e-Builder system has helped move the Authority from a manual paper-based management system to an electronic, collaborative, web-based system that captures critical project related data and information in one centralized repository. The Authority has designed their system to allow access by contractors and consultants who use e-Builder for a number of critical project processes, such as to process payments electronically, upload 30%-60%-90% and final design documents, and house daily site reports and construction photos/videos. e-Builder provides a vehicle for continuous communication between primary project participants.

Since the implementation of e-Builder, the Authority has experienced measurable results and improvements. For example:

- Reduction in the magnitude of change orders from 35% of original project budget to below the industry average of 5%
- Reduction in the time for vendor invoice approval from (on historic average) 45-60 days to 35 days
- Reduction in the time for contractor payment application approvals from on historic average) 45-60 days to 38 days
- New contractors bidding work for the first time
- Increased Women-owned Business Enterprise (WBE) participation nearing the Authority goal of 7% compared to past participation which was historically documented around 2%

The Authority will continue the development and refinement of its e-Builder system to accommodate the expansion of the capital improvement program.

6.2 Program Management Plan

A Program Management Plan (PMP) is being finalized to facilitate the incorporation of best industry practices to optimize project planning and delivery at the Authority. Standard processes and procedures supported e-Builder represent many of the documented primary tools outlined in this document. The PMP is a "living" document and is being updated on a continual basis to encourage uniformity in staff practices, record retention, and contracting practices.

The PMP describes the processes, activities, and procedures that the Authority's project management and administrative staff will use to organize to manage the increased workload outlined in the CIP and to efficiently and effectively maintain its water and sewer utility systems. The draft table of contents of the PMP is contained in Appendix E of this LTIIP.

Development and use of standard processes and procedures by Authority staff assures the consistency, quality, and timeliness of actions taken by project personnel in the delivery of critical capital projects. Improved interfaces between Authority personnel and external resources improves the ability to deliver projects on time and within budget, while working to meet or exceed pre-established project performance goals.

The PMP provides a living template to successfully and sustainably manage and deliver the Authority's CIP projects. It is designed to provide a blueprint to track project activities and program progress against compliance obligations and other benchmarks, thus giving the Authority an accurate "finger on the pulse" for each project, and in aggregate, for each program. Its implementation outlines the processes to encourage timely and appropriate corrective action. It will also help the Engineering and Construction Department improve consistency and quality in many areas, such as data management, contract language, policies and procedures, standardized forms and formats, interpretation, design standards, analysis, problem resolution, change management, construction management, documentation, and more, all of which lead to better performance and productivity.

The PMP establishes the framework for a high-level overview of the processes inherent in the successful development, planning, design, and construction of a project. In addition, it includes core functional procedures to be performed on a routine basis. Procedures were developed by interviewing Authority staff and consultants with specific hands on per topic covered, and the development of workflows to optimize the steps associated with specific processes.

The PMP includes a number of tools, forms, and references to further support project activities. These tools provide the Authority with guidance, information, and supplemental materials for better comprehension and for use in conjunction with the procedures. These PMP materials are intended to keep the processes and procedures as concise as practical and limit the need to revise procedures when the tools and forms are revised.

6.3 Cost-effective Design, Project Management and Construction

6.3.1 Design and Constructability Reviews

In general, a majority of the Authority's construction projects are designed by contracted professional engineering consulting firms. Therefore, the Authority employs a robust review process that includes input from the Authority's engineering department and operations staff as well as independent third-party reviewers.

The design Scope of Work (SOW) generally requires the consultant to undertake an initial study or evaluation phase to document the detailed design in a Technical Design Memorandum (TM), or Basis of Design Report (BODR), depending on the complexity of the project. These documents are reviewed by the Authority and an independent third-party reviewer (typically a third-party engineering consulting firm). Following acceptance of the TM or BODR, the consultant will be notified to advance (or modify) the detailed design.

Independent reviews of the detailed design are typically performed following the completion of the 30%, 60% and 90% design phases. These technical reviews are completed prior to the issuance of final Contract Documents by the Authority. Constructability reviews, including a detailed evaluation of the cost estimate, are performed at a minimum at the 60% and 90% phases, and at 30% for more complex projects. Submittals include contract drawings developed at the appropriate level of detail, draft specifications incorporating the Authority's standard specifications, updated construction cost (to a level of refinement in accordance with the Association for the Advancement of Cost Engineering (AACE)), an update on the required permits for the project, and an update on the comments and actions from the previous reviews.

The overall design review process is designed to ensure that the project meets the Authority's goals and objectives, the implementation schedule is being maintained and the budget is being monitored to ensure it is within available project funding. The review process also includes stakeholder input and interaction, again depending on the type of project and potential impact on the community, other utilities, or concerned citizen groups.

As part of the Authority's design review, appropriately selected subject material experts (SME's) are included in the process to incorporate lessons learned from similar projects. Reviews are performed with the focus on potential areas of contract claims, design recommendations to improve the overall construction process, and avoidance of potential conflicts within the documents.

In addition to these design reviews, the Authority also has an internal post-construction review process that obtains feedback on recently completed construction projects to solicit lessons learned or construction techniques that can be utilized on future contracts to save money or avoid costly construction claims.

6.3.2 Project Audits

As the Authority continues to accelerate the CIP, staff are encouraged to identify potential obstacles and challenges in advance and mitigation actions before issues are encountered and cause project delays. By conducting internal project audits with project managers with specific "look ahead" and "cost to complete" reviews, the Authority will be alerted quickly and will be able to take action. The project audits are intended to review significant project milestones, final deliverables, and current project status. A workflow process has been developed in e-Builder called "PWSA Project Audit Process (PPA)", which will house all the talking points and discussions that take place during the project audit meeting. This information will then be summarized in a report used to brief the Director of Engineering and Construction.

To date, a number of valuable "Lessons Learned" have been identified and shared with staff to provide the basis for improved the performance of future projects. The Authority will build upon the aforementioned "lessons learned" which will result in the development of:

- Strategies which will increase the successful outcomes of future projects
- Project success criteria which will include schedule, budget, and customer and stakeholder satisfaction metrics
- Change management success criteria which will include metrics associated with staff involvement, public interaction, and change transition

6.4 Contract Bidding Procedures

As a Municipal Authority, the Authority is required to publicly bid construction contracts and the purchase of goods in accordance with Chapter 56, PL 287. The Authority has a long history of successfully bidding such services. Generally, large improvement projects such as pump stations or storage facility upgrades would be bid as one construction project with multiple contracts. The Authority is required to follow the Separations Act 53 P.S. 1003 and 71 C.S.A. 1618 which requires the use of a separate contract for plumbing, heating & ventilating, and electrical work. In addition, the Authority has established an Equal Opportunity Contracting (EOC) Program effective December 15,

2017. The EOC Program specifics are available on the Authority's website. Potential vendors and contractors are encouraged to review the EOC Program information that defines the participation goals for the engagement of currently certified minority, women and service disabled veteran business contractors. The bidders are required to submit the package of certifications included with the contract documents relating to Equal Employment Opportunity.

For linear projects such as water main replacements, sewer rehabilitation, and hydrant and valve replacement contracts, the projects are organized into large enough contracts that provide economic incentive for contractors to bid.

The Authority has pre-qualified several engineering firms to provide expedited design phase services. These firms are selected based on the anticipated scopes of work and the firm's qualifications to complete the work, including availability and experience of the staff, proximity of the staff to the City, and other parameters. Firms are selected to perform expedited designs of water main and sewer line rehabilitation and/or replacement, green stormwater infrastructure projects, and other infrastructure improvements. As a project scope of work is developed, a request for proposal (RFP) is prepared by the Authority and issued to several (pre-qualified) on-call consultants. The RFP includes the detailed scope of work, contracting requirements, project delivery schedules and deliverables. For larger projects, separate RFPs are developed, and the engineering services are publicly advertised and a selection is made based on proposals submitted.

Given the need to ramp-up the overall CIP, the Authority is employing a Program Manager to assist the Authority's engineering department with executing the water, sewer and stormwater capital improvement program. The Program Management staff include embedded staff within the Authority's office working together with the Authority's staff as an extension of the engineering department. Depending on the nature of the project, or as specific engineering needs arise, additional technical resources will be engaged to cost-effectively and time-critically support the CIP.

7 WORKFORCE MANAGEMENT AND TRAINING PROGRAM

The Commission requires a utility to have a workforce management and training program adequate to ensure that the utility has access to a qualified workforce to perform work in a cost-effective, safe, and reliable manner. The Authority's proposed workforce management and training program is described below.

7.1 Current and Proposed Workforce

The challenges presented by an expanded infrastructure improvement program described in Section 5 of this LTIIP are not insurmountable. The existing workforce at the Authority provides a solid foundation upon which to build the staff and skills its needs to become a high-performing organization.

The current and projected full-time workforce of the Authority is presented in Table 7-1. It is shown in the table that 122 new employees are planned to be hired to accomplish the work associated with the CIP which includes the eligible property infrastructure improvements. Onboard staff will be supplemented by contracted personnel.

Table 7-1
Current and Projected Workforce

DEPARTMENT	CURRENT	2019 BUDGET	PROPOSED ADDITIONS	2023 PROJECTED TOTAL
Executive/Administration	4	4	1	5
Customer Service	49	55	4	59
Management Information Systems	8	10	9	19
Finance	5	8	6	14
Procurement	3	3	3	6
Human Resources	4	6	3	9
Legal	2	3	1	4
Warehouse	4	6	3	9
Public Affairs	6	8	3	11
Water Quality (Lab)	5	5	7	12
Water Treatment Plant	45	56	12	68
Water Distribution	97	132	20	152
Sewer Operations	37	34	20	54
Engineering & Construction	29	64	30	94
Environmental Compliance	3	8	0	8
Total	301	402	122	524

Success in hiring new permanent employees will depend upon the attainment of two major objectives:

1. Increasing our hiring effectiveness
2. Enhancing workforce engagement and performance

Developing a strong workforce to meet the demands of planning, designing, and overseeing the construction of new and rehabilitated infrastructure and other capital improvement programs will rely upon identifying and hiring qualified applicants. To that end, the Authority is committed to:

- Implementing a new Human Resources Information System (HRIS)
- Reviewing and improving job postings and position descriptions
- Optimizing and streamlining the hiring process and timeline
- Reviewing employee total compensation packages to ensure competitiveness with the engineering and utility industries

The Authority will aim to extend its outreach to industry publications, community partnerships, and other venues to reach prospective talent.

The Authority will use two measures of success to determine the effectiveness of its hiring program:

1. Hiring response time: our goal will be that the average time to fill existing positions is less than three months from the date of the vacancy
2. Position vacancy rate: our goal will be an average vacancy rate of less than 3%.

In terms of the second goal to enhance workforce engagement and performance, the Authority understands that increasing the efficiency and effectiveness of the organization requires engaged, developed, and high-performing employees. Growing and retaining the existing workforce will require the Authority to:

- Work cooperatively with unions to find and act on opportunities to increase workforce performance and effectiveness
- Complete a training program roadmap and inventory of the training requirements for all positions at the Authority
- Dedicate additional resources to training and development, as well as health, safety, and risk management
- Establish and track productivity goals for work groups, where applicable
- Develop a program to recognize high-performing employees

Four measures of success will be used to determine effectiveness of its workforce engagement program:

- Training hours per year: with a goal of 20 hours per year per employee
- Safety compliance: our goal will be to maintain a worker's compensation experience modification rate of less than 1.0
- OSHA compliance: meet OSHA requirements
- Staff engagement survey: one every 3 years

The Authority will use a combination of internal and external resources to address the critical staffing needs associated with the infrastructure improvement program. The Authority will utilize Program Management support to execute the program with design and construction management services primarily provided by consultants. The Authority intends to cost-effectively increase staffing levels to ultimately assume the role of program management of the CIP.

7.2 Training Programs

7.2.1 e-Builder Training

The Authority's Program Management Team with support of Authority Project Controls personnel have conducted e-Builder training for Authority personnel and others on the myriad elements of the system. The personnel trained and to be trained, and the topics of training, are shown in Table 7-2 (located in Appendix B). The Team provides one-on-one and group training and distributes reference materials to each participant. In addition to this formal training, "e-Builder Hot Topic Meetings" are held monthly. Typical topics include:

- Common issues of frequent occurrence that need to be addressed with project managers and others
- Feedback from project managers regarding any e-Builder issues
- Notification or updates related to existing internal processes or procedures
- Refresher training on any e-Builder module requested by Project or Program Manager
- Reinforcing rules to Project Managers and others;
- Introducing newly purchased e-Builder modules
- Notification on any e-Builder system updates or changes made by e-Builder
- Updates on Authority policies or procedures

7.2.2 Other Training

Other training programs are conducted by in-house and contracted personnel on such topics as hydraulic modeling, low impact development (LID), sustainability, and safety. Authority engineering staff are certified Sustainability Professionals (SPs) through the Institute for Sustainable Infrastructure training on the Envision rating system. Training programs associated with Health & Safety are described in Section 7.4 of this LTIIP.

7.3 Construction Management and Inspection

The Authority utilizes subcontracted construction inspectors to provide numerous services during the installation of water mains, service lines, sewer lines, laterals and manholes in the collection system. The Authority maintains one inspector on staff and also utilizes qualified consultants to provide construction inspection services. These inspectors perform a wide range of services including the following tasks, as well as any other work that may be necessary to complete the construction activities.

- Monitor the installation of the water and sewer lines and appurtenances to confirm that they are properly bedded and installed in accordance with the Authority's specifications and/or Contract Documents
- Observe, perform testing to ensure that the new utilities meet specified performance requirements
- Monitor the pipe backfill for proper compaction in accordance with Authority's specifications and/or local municipal, county or PennDOT requirements
- Confirm that all materials such as pipe, fittings, hydrants, valves, service connections, backfill materials, etc. being used in the project meet the Authority's specifications
- Record the quantities of pipe and other materials installed
- Document the quantities of pipe and other materials, labor, equipment, etc., for accurate billing and payments
- Document all locations of pipe, valves, service connections, laterals, etc., for accurate mapping and record keeping
- Interact with City residents to lessen the impact of the project and answer or address issues that may arise during the project
- Communicate with local businesses that may be impacted by the construction activities to ensure that normal operations can be maintained and service outages are minimized and do not disrupt business
- Coordinate contractors with school districts, various City agencies, and emergency services so that bus routes, trash pick-up, mail delivery, and emergency response are minimally impacted
- Monitor temporary restoration activities during construction to ensure that roads are safely traveled and sidewalk areas are clear for pedestrians
- Monitor the final restoration required in projects to ensure that they are done in compliance with PennDOT or City specifications
- Observe contractor's implementation of contractor safety plans and advise contractor of any observed conditions of imminent danger. Inspectors are authorized to advise supervisors of unsafe conditions and can shut down a project until an imminent danger situation is addressed.

7.4 Safety

In 2014, the Authority contracted with Compliance Management International (CMI) to assist in the overall Health & Safety Program. CMI completed a 3-month assessment of the Authority to identify gaps and opportunities. As a result of the assessment, CMI developed a Safety Improvement Plan (SIP). The SIP incorporated 12 key initiatives:

1. Urgent Safety Programs (Excavations, Confined Space, Personal Protective Equipment (PPE), Work Zone & Traffic Control)

2. Goals & Objectives - Track safety metrics, identify trends, develop reports/goals
3. Leadership/Management – Train Authority management in safety program management
4. Safety Training
5. Safety Inspections (Facility/Job Sites)
6. Safety Committees
7. Job Safety Analysis (JSA)
8. Accident Prevention/Incident Investigation
9. Corrective Action Tracking
10. New Employee Orientation
11. Emergency Procedures
12. Occupational Illness/Health

In the past 4 years, the Authority has developed and implemented a variety of related programs, including:

- New Employee orientation training program
- Safety Management Training for Authority managers
- Written policies and procedures including confined space, work zone and traffic control, Authorized LOTO, NFPA 70E, Chemical Right to Know, Blood Borne Pathogens (BBP), and excavation safety

Most of these trainings are provided on an annual basis as part of a full day safety refresher training. In May 2018, the Authority recertified over 80 employees as Certified Flaggers and another round of training for Competent Persons for Excavations certifications is being provided.

In 2016 and 2018, the Authority conducted Industrial Hygiene Monitoring including both air sampling and noise sampling. As a result of the monitoring program, the Authority implemented an Occupational Safety & Health Administration (OSHA)-compliant respiratory program. Safety metrics and injury trends are continuously tracked and improvements in the provision and use of PPE and other operational equipment to reduce employee risks and injuries have also been noted.

8 OUTREACH AND COORDINATION ACTIVITIES

8.1 Construction Coordination

As previously indicated in this report, the Authority is currently updating its GIS to add water and sewer system data, evaluate and edit existing data, and refine its data retrieval processes in order to make the system more comprehensive, dependable, and easy to use. Annually, water and sewer system capital projects including replacements, rehabilitations, and repairs are selected and vetted to the Authority's engineering department before being prioritized for the coming budget year. As part of this process, the Authority solicits information from PennDOT, Allegheny County, homeowner's associations and other utilities as to their intentions to undertake paving and other public works projects during the budget year. The Authority attends monthly utility coordination meetings with the City's Department of Mobility and Infrastructure (DOMI) and other local utilities and coordinates construction and repair efforts when possible to avoid conflicts where overlapping work is identified.

Whenever and wherever the Authority decides to undertake a pipe or manhole refurbishment project on a road pre-scheduled for paving, the project is coordinated with the State, County, City or appropriate municipality. The Authority works closely with the government agency to ensure that the design, permitting and construction of the Authority's infrastructure project will be completed in time to allow for the road to be paved.

In some cases, the government agencies will agree to postpone paving of its roads to match the Authority's completion of construction date, even if it extends into the subsequent year. Typically, where the Authority undertakes a project where paving has been pre-planned by the involved government agency, the Authority and its rate payers will benefit financially through the avoidance of road surface restoration.

The Authority will continue the proactive means to identify opportunities to coordinate pipe replacement and road paving.

8.2 Lead Service Line Replacement Program Outreach

In full support of the COA, the Authority has built a program to support its customers through the lead service replacement process. These outreach and communication efforts encourage property owners to participate in the current no-cost private lead service replacements offered in contract work areas. The Authority is committed to these outreach efforts as a way of encouraging private line replacements and to reduce the number of partial (public-only) lead service line replacements.

The Authority's outreach and communications programs involve written communications with property owners and residents about the LSLR program and includes a letter describing the process, several information sheets and an agreement necessary for the Authority's contractors to perform the work. In addition to this initial information package, the Authority follows up with door hangers, service line work notices, 48-hour notices, post-replacement service line flushing instructions, and test kit instructions. In addition to the written communications, the Authority also has a fully staffed Lead Help Desk team at the Authority's office. The Lead Help Desk team is responsible for the communication with the property owner and resident for the lead service line replacement program. Their primary goals are to inform property owners and residents about the program and reduce the number of partial lead service line replacements by encouraging eligible property owners to agree to private lead line

replacements. Not only does the Lead Help Desk team respond to questions via their dedicated email and hotline, they also proactively call property owners in the work order areas to follow-up on unsigned property owner agreement forms and to schedule pre-construction coordination meetings.

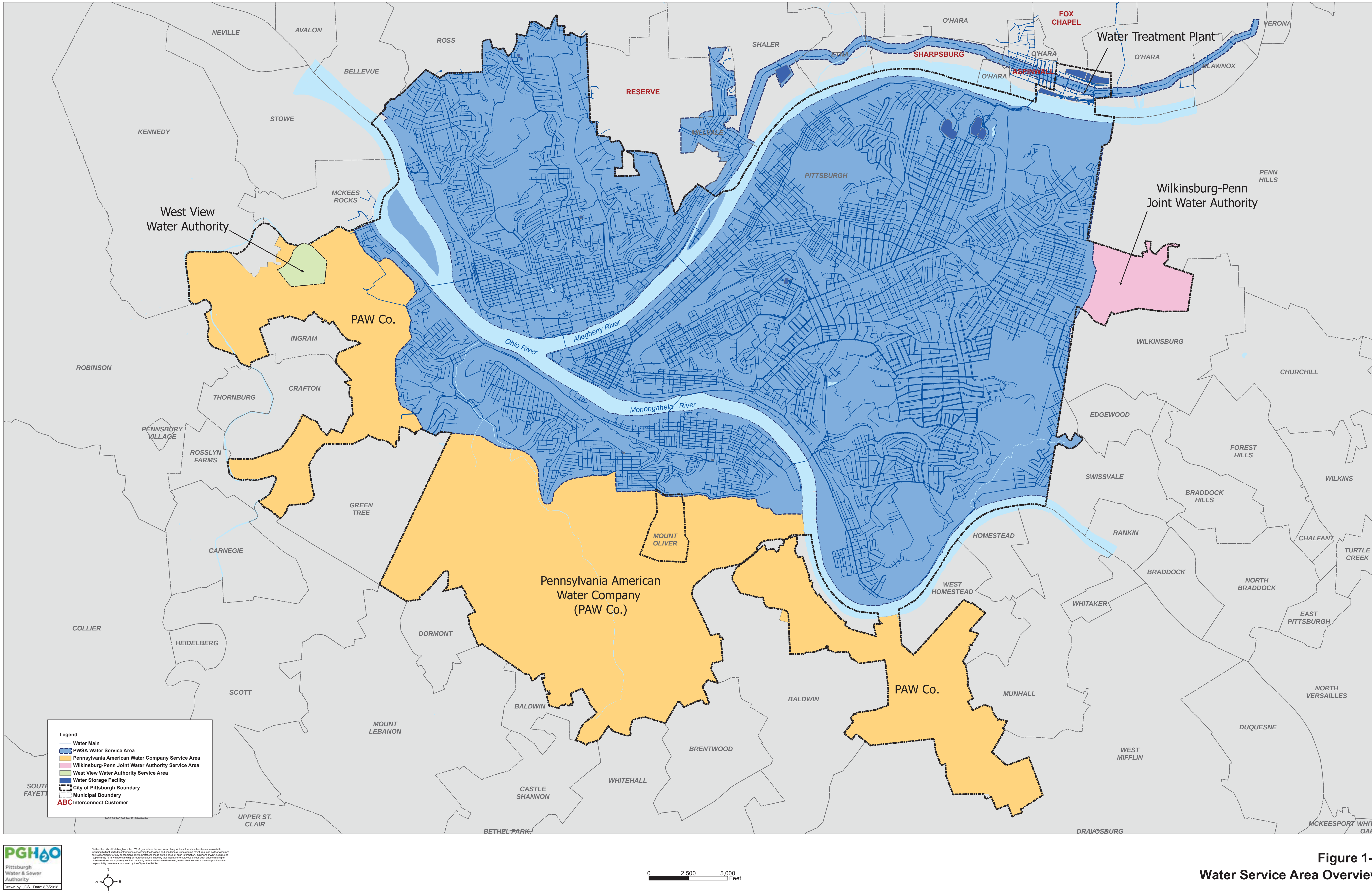
The Authority also employs Field Liaisons who are responsible for coordinating lead service line replacement work between the Authority's contractors, property owners and often tenants. Field Liaisons contact each property owner to help them understand the replacement process and potential impacts of the work, and to encourage private property owners who have not responded to communications from the Authority's Lead Help Desk. Their presence on-site also helps assure that the Authority's contractor's meet all quality assurance and regulatory requirements such as providing NSF-approved filters and lead water test kits.

8.3 Other Capital Improvement Construction Outreach

As the Authority grows its capital improvement program, there is a greater need to work closely with stakeholders throughout the community to prepare them for water, sewer, and green stormwater infrastructure projects impacting their communities. The Authority has created a comprehensive capital improvement outreach protocol to connect project managers and the Authority's public affairs team in the early stages of a project to ensure that the Authority clearly communicates the benefits, impacts, and expectations of construction work. Since 2015, this protocol has been implemented on 17 projects and is currently being used to guide communications on 16 on-going projects.

The protocol sets timelines and expectations for communications on projects, from the 30% design phase until completion. Project managers and members of the Authority's public affairs team are expected to use an approved set of communications templates, such as letters and informational handouts, to properly relay project details to residents, business owners, and other community leaders who represent those affected by the work. The information is also disseminated to stakeholders in the form of releases to media and government officials and emails to residents who may have concerns about construction impacts.

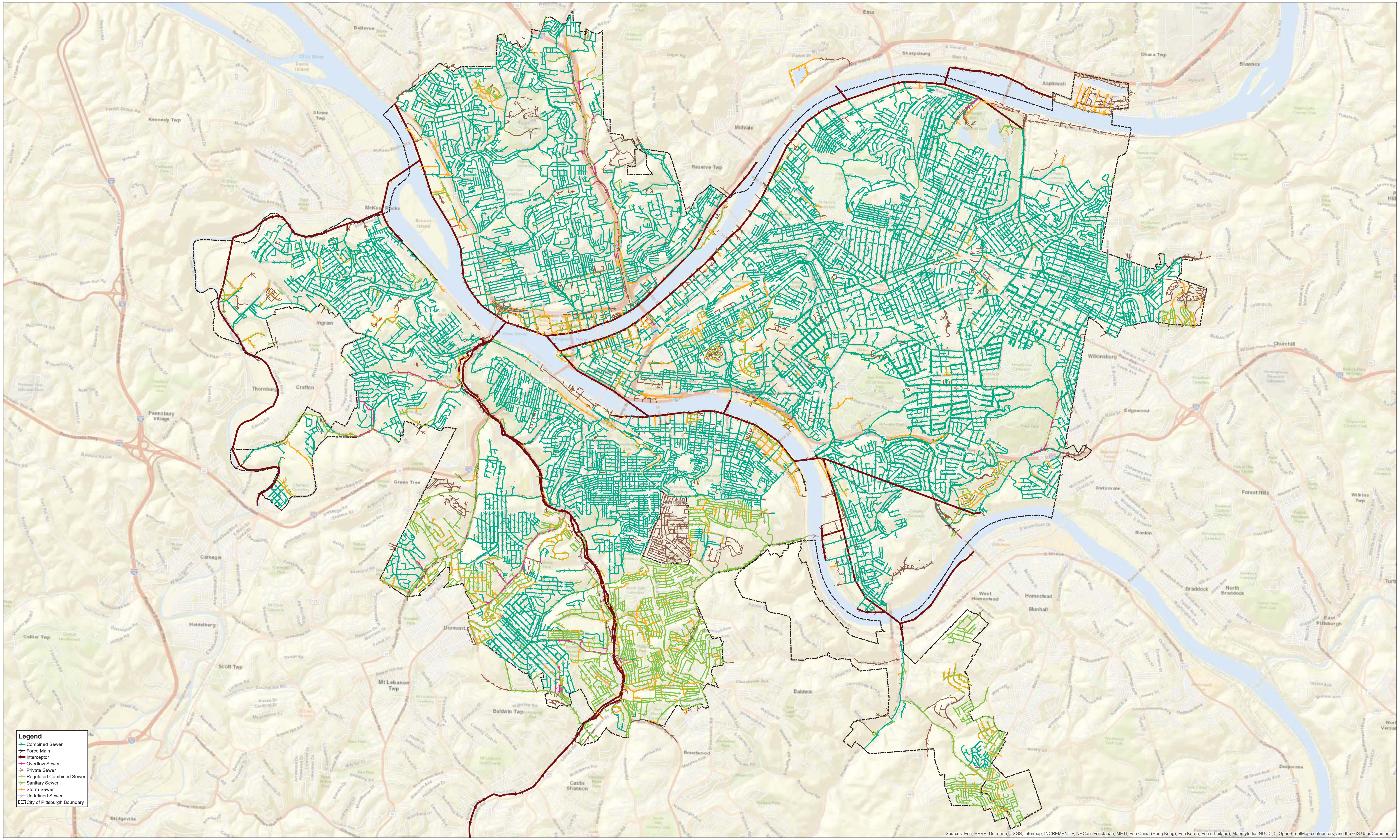
Appendix A
Figures



Pittsburgh Water & Sewer Authority

Drawn by: JDS Date: 8/6/2018

Figure 1-1
Water Service Area Overview



PGH2O
Pittsburgh Water & Sewer Authority
Drawn by: JDS Date: 8/6/2018

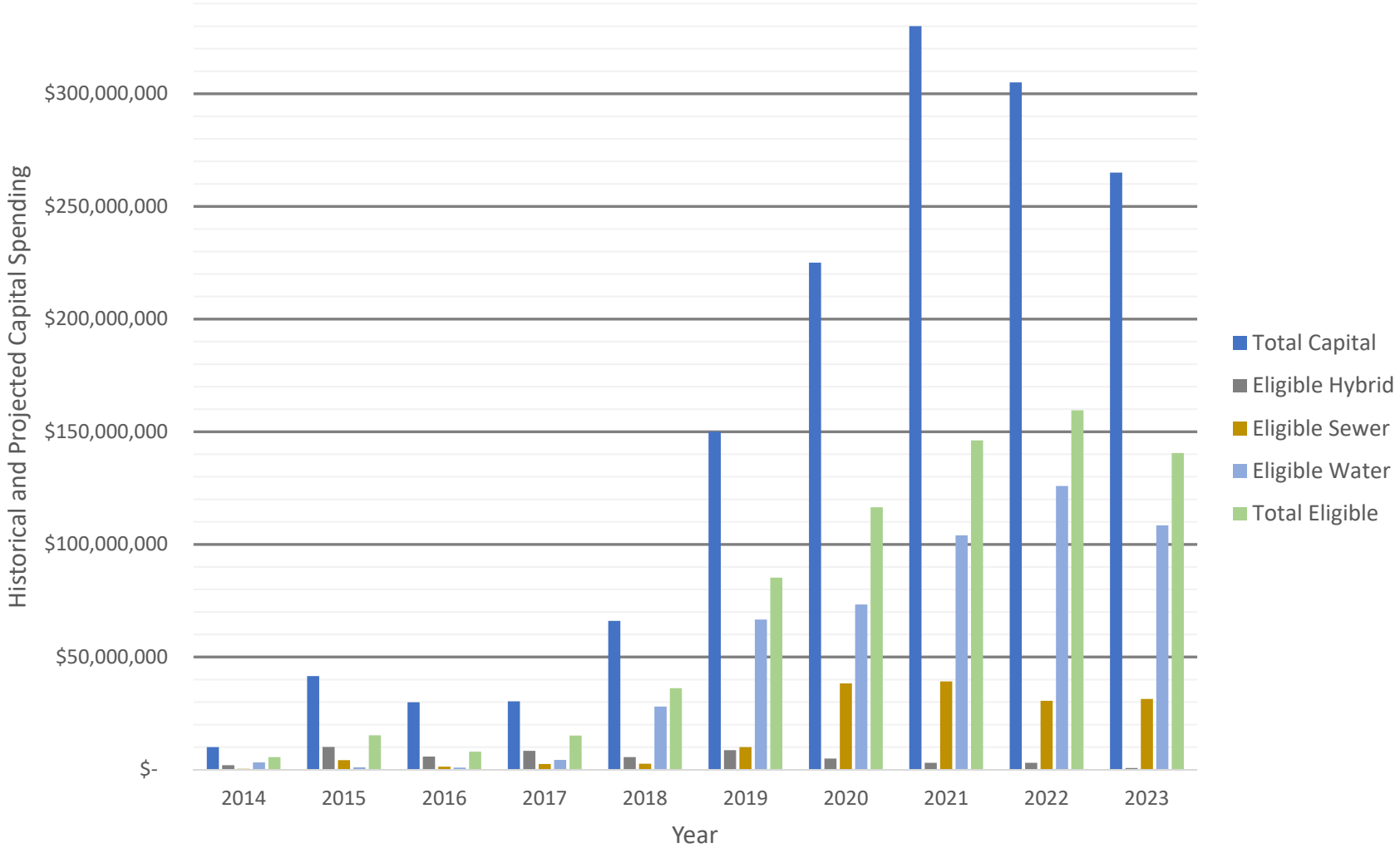
Neither the City of Pittsburgh nor the PWSA guarantees the accuracy of any of the information hereby made available, including but not limited to information concerning the location and condition of underground structures, and neither assumes any responsibility for any conclusions or interpretations made on the basis of such information. COP and PWSA assume no responsibility for any understanding or representations made by their agents or employees unless such understanding or representations are expressly set forth in a duly authorized written document, and such document expressly provides that responsibility therefore is assumed by the City or the PWSA.

N W E S

0 2,500 5,000 Feet

Figure 1-2
Sewer Service Area Overview

Figure 5-1
Historical and Projected Capital Spending
2014 - 2023



Appendix B
Tables

Table 2-4
2019 Small Diameter Water Main Replacement Program Selected Projects

Project Name	Project Scope Description	Min. Pipe Diameter	Fire Flow Improve-ments	Pipe Break History	Working Pressure	Lead Service Lines	Pipe Age	Water Main Location	Traffic Functional Classification	Critical Facilities	Total Weighted Score	Preliminary Cost Estimate	Cumulative Costs
Hazelwood System Improvements	Tecumseh/W. Elizabeth area	100	100	50	0	50	100	0	100	100	67.5	$2,915,000	$2,915,000
South Side Slopes System Improvements - Phase 1	Replace 6" main on Elanor Street from Arlington Ave. to Cobden Street with 12", 6" main on Coben Street from Eleanor to Northview Street with 12", and along Sumner St between Cobden and 10" main, along Stromberg between Northview and 10" main and along Northview between Cobden and Mission Street. Abandon existing 10-inch diameter main from Cobden Street to Stromberg Street. 4,250 lf total	100	100	100	50	50	100	100	0	0	67.5	$2,337,500	$5,252,500
Baum Boulevard (12")	Replace 3,100 lf of 12-inch diameter main on Baum Blvd from S. Graham St to S. Highland Ave.	0	100	100	0	50	50	0	100	100	62.5	$1,705,000	$6,957,500
Massachusetts Avenue Area	2,600 LF of 8" mains to replace existing 6" mains along Massachusetts Ave. from Termon to Falck, Falck from Mass. To Fleming Ave., Fleming Ave. from Falck to Hubbard, Hubbard to McClure Ave.	50	100	50	50	50	100	0	0	100	57.5	$1,430,000	$8,387,500

Table 2-5
Water System Eligible Properties to be Improved

Project Name	Project Description
Hydrant Replacement (Annual IDIQ Contracts)	Replacement of approximately 100 broken or older model type hydrants throughout the water distribution system annually, excluding hydrants replaced during relays.
Valve Replacement (Annual IDIQ Contracts)	Replacement of defective or non-operational valves on transmission and distribution mains throughout the water distribution system, excluding valves replaced during relays. Includes locating, assessing and documenting the operability, raising to grade, and/or cleaning existing buried or obstructed valves. Increasing the number of operable valves in the system will reduce the number of customers that may be impacted and the number of valves that would need to be closed during emergency conditions.
Water Relay (Annual IDIQ Contracts)	Replacement of existing water mains, valves, fittings, service connections, and hydrants due to emergency situations.
Small Diameter Water Main Replacement	Strategic replacement of water mains (including lead service lines) to improve system reliability as well as improve water pressure, maintain water quality, and minimize disturbance to the community. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality and available hydrant flows will also improve by removing tuberculated mains.
Large Diameter Water Main Improvements	Strategic condition assessment, replacement or rehabilitation of large diameter water mains (16-inch and larger) and appurtenances to improve system reliability and hydraulics, including internal and external inspections. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus resulting in a savings in the replacement cost as compared to emergency/reactive repair costs. Typically, large diameter pipe is not readily available and has a 6 to 8 week lead time for delivery. A large percentage of the Authority's large diameter mains are riveted steel, which cannot be easily repaired without the use of field fabricated specialty fittings.
Unmetered and Flat Rate Properties	Installation of meters serving customers who were previously unmetered. Meter installation includes a new meter pipe and ancillary piping improvements. Some replacements may require the service line replacement to separate party lines.
Large Water Meters	Replacement of large meters for compliance with Section 65.8.
Small Water Meters	Replacement of small meters for compliance with Section 65.8.
Lead Service Line Replacement	Replacement of lead service lines, both public and private. Due to the exceedance of the action levels from compliance tests for lead and copper, the Pennsylvania Department of Environmental Protection required the Authority to perform additional distribution system water quality monitoring, optimization of corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement.
District Water and Pressure Meters	Installation of water meters and pressure monitors in the distribution system to determine water usage and loss, and pressure loss.
Aspinwall Pump Station to Lanpher Reservoir Rising Main	Construction of a new, redundant rising main from Aspinwall Pump Station to Lanpher Reservoir. The existing 60-inch rising main that supplies the Lanpher Reservoir is a 150 year old riveted steel pipe, has several tap connections to critical and bulk customers, and has experienced recent pipe failures. The proposed rising main would serve as a primary supply source for Lanpher Reservoir during the Clearwell Replacement Project and a redundant supply line in case of a failure or planned cleaning and rehabilitation of the existing 60-inch supply main.
Bruecken Pump Station Valve Vault	Upgrade to the mechanical and structural reliability of the six discharge manifold valve vaults at the Bruecken Pump Station, including associated electrical and control improvements. Includes the replacement of fourteen electric motor operated gate valves; addition of a surge relief valve in each of four rising mains; addition of aluminum access platforms, ladders, and hatchways in the roof of each vault; providing new lighting in each vault; replacement of the control panel for the gate valves; and, replacement of the standby generator that enables operation of the gate valves during power outages. To meet improvements mandated by an Administrative Order issued by the PADEP on 10/25/17, three diesel engine driven pumps and standby generators capable of operating one of the pump station's main pumps will also be purchased and installed.
Low Pressure Area Remediation	Fix chronically low pressure areas by either extending neighboring higher pressure districts into the area, booster pump stations, or household booster pumps. This project is in response to the low pressure monitors required by the October 2017 Administrative Order.
Washout Disconnection	Investigation and, if necessary, disconnection of large water main washouts from the sewer system. A number of older washouts on larger mains were directly connected to sewers with a closed valve during construction. These washouts (cross connections) in accordance PA DEP requirements, must be completely disconnected from the sewer.

Table 2-6
Water System Eligible Properties Project Schedule and Costs

	Projected Annual Expenditure (2018 Dollars)						
Project Name	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL COST**
2017 Hydrant Replacement (Annual IDIQ Contract)	$ 793,713	$ 376,725	$ -	$ -	$ -	$ -	$ 1,170,438
2019 Hydrant Replacement (Annual IDIQ Contract)	$ -	$ 803,220	$ 531,780	$ -		$ -	$ 1,335,000
2020 Hydrant Replacement (Annual IDIQ Contract)	$ -	$ -	$ 862,534	$ 567,466	$ -	$ -	$ 1,430,000
2021 Hydrant Replacement (Annual IDIQ Contract)	$ -	$ -	$ -	$ 872,534	$ 577,466	$ -	$ 1,450,000
2022 Hydrant Replacement (Annual IDIQ Contract)	$ -	$ -	$ -	$ -	$ 872,534	$ 577,466	$ 1,450,000
2023 Hydrant Replacement (Annual IDIQ Contract)[1]	$ -	$ -	$ -	$ -	$ -	$ 946,848	$ 946,848
SUB-TOTAL FOR HYDRANT REPLACEMENT	**$ 793,713**	**$ 1,179,945**	**$ 1,394,314**	**$ 1,440,000**	**$ 1,450,000**	**$ 1,524,314**	**$ 7,782,286**
2017 Valve Replacement (Annual IDIQ Contract)	$ 1,710,764	$ 647,616	$ -	$ -	$ -	$ -	$ 2,358,380
2019 Valve Replacement (Annual IDIQ Contract)	$ -	$ 3,931,742	$ 2,633,258	$ -	$ -	$ -	$ 6,565,000
2020 Valve Replacement (Annual IDIQ Contract)	$ -	$ -	$ 4,075,626	$ 2,729,374	$ -	$ -	$ 6,805,000
2021 Valve Replacement (Annual IDIQ Contract)	$ -	$ -	$ -	$ 4,144,940	$ 2,775,060	$ -	$ 6,920,000
2022 Valve Replacement (Annual IDIQ Contract)	$ -	$ -	$ -	$ -	$ 4,281,900	$ 2,868,100	$ 7,150,000
2023 Valve Replacement (Annual IDIQ Contract)[1]	$ -	$ -	$ -	$ -	$ -	$ 4,432,451	$ 4,432,451
SUB-TOTAL FOR VALVE REPLACEMENT	**$ 1,710,764**	**$ 4,579,358**	**$ 6,708,884**	**$ 6,874,314**	**$ 7,056,961**	**$ 7,300,551**	**$ 34,230,831**
2017 Water Relay (Annual IDIQ Contract)	$ 718,035	$ -	$ -	$ -	$ -	$ -	$ 718,035
2018 Water Relay (Annual IDIQ Contract)	$ 77,308	$ 1,347,692	$ 135,000	$ -	$ -	$ -	$ 1,560,000

Table 2-6
Water System Eligible Properties Project Schedule and Costs

	Projected Annual Expenditure (2018 Dollars)						
Project Name	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL COST**
2019 Water Relay (Annual IDIQ Contract)	$ -	$ 93,308	$ 1,496,192	$ 160,500	$ -	$ -	$ 1,750,000
2020 Water Relay (Annual IDIQ Contract)	$ -	$ -	$ 93,308	$ 1,473,692	$ 153,000	$ -	$ 1,720,000
2021 Water Relay (Annual IDIQ Contract)	$ -	$ -	$ -	$ 93,308	$ 1,496,192	$ 160,500	$ 1,750,000
2022 Water Relay (Annual IDIQ Contract)[1]	$ -	$ -	$ -	$ -	$ 100,308	$ 1,608,192	$ 1,708,500
2023 Water Relay (Annual IDIQ Contract)[1]	$ -	$ -	$ -	$ -	$ -	$ 100,308	$ 100,308
SUB-TOTAL FOR WATER RELAY REPLACEMENT	**$ 795,343**	**$ 1,441,000**	**$ 1,724,500**	**$ 1,727,500**	**$ 1,749,500**	**$ 1,869,000**	**$ 9,306,843**
2018 Small Diameter Water Main Replacement	$ 715,660	$ 3,315,909	$ 5,511,769	$ 839,743	$ -	$ -	$ 10,383,081
2019 Small Diameter Water Main Replacement	$ 24,848	$ 1,369,091	$ 4,924,742	$ 4,561,319	$ -	$ -	$ 10,880,000
2020 Small Diameter Water Main Replacement	$ -	$ 2,301,111	$ 10,900,937	$ 36,456,607	$ 4,681,345	$ -	$ 54,340,000
2021 Small Diameter Water Main Replacement	$ -	$ -	$ 2,272,222	$ 10,938,296	$ 36,828,897	$ 4,590,585	$ 54,630,000
2022 Small Diameter Water Main Replacement[1]	$ -	$ -	$ -	$ 2,336,667	$ 11,411,075	$ 38,507,872	$ 52,255,614
2023 Small Diameter Water Main Replacement[1]	$ -	$ -	$ -	$ -	$ 2,411,111	$ 11,751,223	$ 14,162,334
2024 Small Diameter Water Main Replacement[1]	$ -	$ -	$ -	$ -	$ -	$ 2,485,556	$ 2,485,556
SUB-TOTAL FOR SMALL DIAMETER WATER MAIN REPLACEMENT	**$ 740,508**	**$ 6,986,111**	**$ 23,609,671**	**$ 55,132,631**	**$ 55,332,429**	**$ 57,335,236**	**$ 199,136,585**
2019 Large Diameter Water Main Improvements	$ -	$ 878,333	$ 2,324,167	$ 7,418,591	$ 10,971,409	$ 1,957,500	$ 23,550,000

Table 2-6
Water System Eligible Properties Project Schedule and Costs

	Projected Annual Expenditure (2018 Dollars)						
Project Name	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL COST**
2020 Large Diameter Water Main Improvements	$ -	$ 684,242	$ 1,261,591	$ 5,434,258	$ 4,559,909	$ -	$ 11,940,000
2021 Large Diameter Water Main Improvements	$ -	$ -	$ 689,697	$ 1,297,727	$ 5,544,394	$ 4,638,182	$ 12,170,000
2022 Large Diameter Water Main Improvements[1]	$ -	$ -	$ -	$ 693,333	$ 1,321,515	$ 5,670,515	$ 7,685,363
2023 Large Diameter Water Main Improvements[1]	$ -	$ -	$ -	$ -	$ 698,788	$ 2,897,651	$ 3,596,439
2024 Large Diameter Water Main Improvements[1]	$ -	$ -	$ -	$ -	$ -	$ 1,540,000	$ 1,540,000
SUB-TOTAL FOR LARGE DIAMETER WATER MAIN IMPROVEMENTS	**$ -**	**$ 1,562,575**	**$ 4,275,455**	**$ 14,843,909**	**$ 23,096,015**	**$ 16,703,848**	**$ 60,481,802**
2019 Unmetered and Flat Rate Properties	**$ -**	$ 345,000	$ 2,792,476	$ 1,702,524	$ -	$ -	$ 4,840,000
2020 Unmetered and Flat Rate Properties	**$ -**	$ -	$ 355,833	$ 2,868,143	$ 1,751,024	$ -	$ 4,975,000
2021 Unmetered and Flat Rate Properties	**$ -**	$ -	$ -	$ 364,167	$ 2,941,476	$ 1,794,357	$ 5,100,000
2022 Unmetered and Flat Rate Properties[1]	**$ -**	$ -	$ -	$ -	$ 375,000	$ 3,023,810	$ 3,398,810
2023 Unmetered and Flat Rate Properties[1]	**$ -**	$ -	$ -	$ -	$ -	$ 383,333	$ 383,333
SUB-TOTAL FOR UNMETERED AND FLAT RATE PROPERTIES[1]	**$ -**	**$ 345,000**	**$ 3,148,310**	**$ 4,934,833**	**$ 5,067,500**	**$ 5,201,500**	**$ 18,697,143**
2019 Large Water Meters	**$ -**	$ 1,925,000	$ 175,000	**$ -**	**$ -**	**$ -**	$ 2,100,000
2019 Large Water Meters	**$ -**	**$ -**	**$ 2,016,667**	**$ 183,333**	**$ -**	**$ -**	$ 2,200,000
2020 Large Water Meters	**$ -**	**$ -**	**$ -**	**$ 2,016,667**	**$ 183,333**	**$ -**	$ 2,200,000

Table 2-6
Water System Eligible Properties Project Schedule and Costs

	Projected Annual Expenditure (2018 Dollars)						
Project Name	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL COST**
2021 Large Water Meters	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,108,333**	**$ 191,667**	$ 2,300,000
2022 Large Water Meters [1]	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,200,000**	$ 2,200,000
SUB-TOTAL FOR LARGE WATER METERS	**$ -**	**$ 1,925,000**	**$ 2,191,667**	**$ 2,200,000**	**$ 2,291,667**	**$ 2,391,667**	**$ 11,000,000**
2018 Small Water Meters	$ 1,094,966	$ 1,154,094	$ -	$ -	$ -	$ -	$ 2,249,060
2019 Small Water Meters	$ -	$ 1,400,000	$ 700,000	$ -	$ -	$ -	$ 2,100,000
2020 Small Water Meters	$ -	$ -	$ 1,466,667	$ 733,333	$ -	$ -	$ 2,200,000
2021 Small Water Meters	$ -	$ -	$ -	$ 1,466,667	$ 733,333	$ -	$ 2,200,000
2022 Small Water Meters	$ -	$ -	$ -	$ -	$ 1,533,333	$ 766,667	$ 2,300,000
2023 Small Water Meters[1]	$ -	$ -	$ -	$ -	$ -	$ 1,600,000	$ 1,600,000
SUB-TOTAL FOR SMALL WATER METERS	**$ 1,094,966**	**$ 2,554,094**	**$ 2,166,667**	**$ 2,200,000**	**$ 2,266,667**	**$ 2,366,667**	**$ 12,649,060**
2017 Lead Service Line Replacement	$ 6,347,403	$ 159,557	$ -	$ -	$ -	$ -	$ 6,506,959
2018 Lead Service Line Replacement	$ 15,723,862	$ 14,960,534	$ 702,674	$ -	$ -	$ -	$ 31,387,070
2019 Lead Service Line Replacement	$ -	$ 28,745,981	$ 20,382,422	$ -	$ -	$ -	$ 49,128,403
SUB-TOTAL FOR LEAD SERVICE LINE REPLACEMENT	**$ 22,071,264**	**$ 43,866,072**	**$ 21,085,096**	**$ -**	**$ -**	**$ -**	**$ 87,022,433**
District Water and Pressure Meters	$ -	$ 116,667	$ 1,616,143	$ 972,190	$ -	$ -	$ 2,705,000

Table 2-6
Water System Eligible Properties Project Schedule and Costs

	Projected Annual Expenditure (2018 Dollars)						
Project Name	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL COST**
Aspinwall Pump Station to Lanpher Reservoir Rising Main	$ 14,080	$ 1,378,729	$ 3,192,229	$ 10,689,729	$ 23,943,229	$ 10,224,884	$ 49,442,880
Bruecken Pump Station Valve Vault	$ 781,347	$ 28,183	$ -	$ -	$ -	$ -	$ 809,530
Low Pressure Area Remediation	$ -	$ 406,642	$ 1,029,259	$ 1,193,445	$ 170,654	$ -	$ 2,800,000
Washout Disconnection[1]	$ -	$ 247,149	$ 1,123,991	$ 1,767,083	$ 3,483,316	$ 3,483,316	$ 10,104,855
TOTAL	**$ 28,001,985**	**$ 66,616,525**	**$ 73,266,184**	**$ 103,975,635**	**$ 125,907,936**	**$ 108,400,981**	**$ 506,169,246**

[1]Project expenditures will continue to occur after 2023

Table 3-2
Sewer System Eligible Properties to be Improved

Project Name	Project Descriptions
Small Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of less than 36-inch diameter sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning, pre and post construction CCTV inspections, and if necessary, excavated point repairs and manhole rehabilitation. Provides the Authority a means to address inflow and infiltration and several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.
Large Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of 36-inch diameter or greater sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning and pre and post construction CCTV inspections. Provides the Authority a means to address several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.
Sewer Reconstruction (Annual IDIQ Contracts)	Reconstruction of existing sewers, manholes, catch basins, and inlets due to emergency situations or pipe failures.
Sewers Under Structures	Rehabilitation, relocation, and abandonment, if applicable, of existing sewer infrastructure located under or adjacent to buildings, bridges, or railroads or located on steep slopes.
Utility Cost Shares	Infrastructure replacement due to coordination with other agencies or utilities. Coordination with other utilities can reduce expenditures up to 75% of the total project cost and reduces the length of time that the public is inconvenienced due to construction efforts.
Tide Gate Installations	Installation of tide gates at 44 combined sewer overflow diversion chamber locations to assist in preventing river water intrusion.
2019 Wastewater System Improvements	Reconstruction of existing structurally deficient sewer mains on Wiese Street, Wilbur Street, Creedmoor Avenue, Ornament Way, Cooperfield Avenue, N. Sheridan Avenue, Port Way, and Swimburne Street.
31st Ward Sewer System	Evaluation to identify and locate the source(s) of the infiltration and inflow (I/I), removal of public I/I sources, and rehabilitation/replacement of the Rogers Street and Mifflin Road Pump Station and force main. Project will be designed and constructed in a minimum of two phases to ensure the pump stations are properly sized and the flow conveyed will not negatively impact the downstream sewer subshed.
Ivyglen and Odette Sewer Reconstruction and Separation Project	Installation of a new sanitary sewer and storm sewer on Odette and Ivyglen, which will eliminate the combined sewer outfall and a sewer on an unstable slope.

Table 3-6
Sewer System Eligible Properties Project Schedule and Costs

	Projected Annual Expenditure						
Project Name	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL COST**
2016 Sewer Lining (Annual IDIQ Contract)	$ 621,286	$ 68,130	$ -	$ -	$ -	$ -	$ 689,415
2018 Small Diameter Sewer Rehabilitation (Annual IDIQ Contract)	$ 8,194	$ 1,572,917	$ 178,889	$ -	$ -	$ -	$ 1,760,000
2019 Small Diameter Sewer Rehabilitation (Defined Sites)	$ 7,308	$ 817,692	$ 7,666,859	$ 768,141	$ -	$ -	$ 9,260,000
2020 Small Diameter Sewer Rehabilitation (Annual IDIQ Contract)	$ -	$ 620,962	$ 6,041,859	$ 2,837,179	$ -	$ -	$ 9,500,000
2021 Small Diameter Sewer Rehabilitation (Annual IDIQ Contract)	$ -	$ -	$ 959,231	$ 9,345,513	$ 4,385,256	$ -	$ 14,690,000
2022 Small Diameter Sewer Rehabilitation (Annual IDIQ Contract)	$ -	$ -	$ -	$ 1,428,462	$ 9,417,179	$ 6,244,359	$ 17,090,000
2023 Small Diameter Sewer Rehabilitation (Annual IDIQ Contract)[1]	$ -	$ -	$ -	$ -	$ 1,470,769	$ 9,698,718	$ 11,169,487
2024 Small Diameter Sewer Rehabilitation (Annual IDIQ Contract)[1]	$ -	$ -	$ -	$ -	$ -	$ 1,513,077	$ 1,513,077
SUB-TOTAL SMALL DIAMETER SEWER REHAB	**$ 636,787**	**$ 3,079,701**	**$ 14,846,838**	**$ 14,379,295**	**$ 15,273,204**	**$ 17,456,154**	**$ 65,671,979**

Table 3-6
Sewer System Eligible Properties Project Schedule and Costs

	Projected Annual Expenditure						
Project Name	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL COST**
2020 Large Diameter Sewer Rehabilitation	$ -	$ 332,000	$ 3,468,000	$ -	$ -	$ -	$ 3,800,000
2021 Large Diameter Sewer Rehabilitation	$ -	$ -	$ 366,000	$ 3,834,000	$ -	$ -	$ 4,200,000
2022 Large Diameter Sewer Rehabilitation	$ -	$ -	$ -	$ 376,000	$ 3,934,000	$ -	$ 4,310,000
2023 Large Diameter Sewer Rehabilitation	$ -	$ -	$ -	$ -	$ 386,000	$ 4,054,000	$ 4,440,000
2024 Large Diameter Sewer Rehabilitation[1]	$ -	$ -	$ -	$ -	$ -	$ 396,000	$ 396,000
SUB-TOTAL LARGE DIAMETER SEWER RAHABILITATION	**$ -**	**$ 332,000**	**$ 3,834,000**	**$ 4,210,000**	**$ 4,320,000**	**$ 4,450,000**	**$ 17,146,000**
2016 Sewer Relay	$ 654,602	$ -	$ -	$ -	$ -	$ -	$ 654,602
2018 Sewer Reconstruction (Annual IDIQ Contract)	$ 532,179	$ 814,653	$ -	$ -	$ -	$ -	$ 1,346,832
2019 Sewer Reconstruction (Annual IDIQ Contract)	$ 17,857	$ 1,030,055	$ 572,088	$ -	$ -	$ -	$ 1,620,000
2020 Sewer Reconstruction (Annual IDIQ Contract)	$ -	$ 19,345	$ 1,111,662	$ 618,993	$ -	$ -	$ 1,750,000
2021 Sewer Reconstruction (Annual IDIQ Contract)	$ -	$ -	$ 19,345	$ 1,096,662	$ 603,993	$ -	$ 1,720,000
2022 Sewer Reconstruction (Annual IDIQ Contract)	$ -	$ -	$ -	$ 19,345	$ 1,111,662	$ 618,993	$ 1,750,000
2023 Sewer Reconstruction (Annual IDIQ Contract)[1]	$ -	$ -	$ -	$ -	$ 20,833	$ 1,194,936	$ 1,215,769
2024 Sewer Reconstruction (Annual IDIQ Contract)[1]	$ -	$ -	$ -	$ -	$ -	$ 20,833	$ 20,833
SUB-TOTAL SEWER RECONSTRUCTION (ANNUAL IDIQ CONTRACT)	**$ 1,204,638**	**$ 1,864,053**	**$ 1,703,095**	**$ 1,735,000**	**$ 1,736,488**	**$ 1,834,762**	**$ 10,078,036**

Table 3-6
Sewer System Eligible Properties Project Schedule and Costs

	Projected Annual Expenditure						
Project Name	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL COST**
2018 Sewers Under Structures	$ 260,797	$ 469,149	$ 4,194,164	$ 1,690,836	$ -	$ -	$ 6,614,946
2019 Sewers Under Structures	$ 42,857	$ 822,857	$ 3,231,714	$ 3,022,572	$ -	$ -	$ 7,120,000
2020 Sewers Under Structures	$ -	$ 44,571	$ 854,857	$ 3,359,873	$ 3,140,699	$ -	$ 7,400,000
2021 Sewers Under Structures	$ -	$ -	$ 45,286	$ 869,143	$ 3,366,857	$ 3,133,714	$ 7,415,000
2022 Sewers Under Structures[1]	$ -	$ -	$ -	$ 47,000	$ 901,143	$ 3,537,905	$ 4,486,048
2023 Sewers Under Structures[1]	$ -	$ -	$ -	$ -	$ 48,429	$ 929,714	$ 978,143
2024 Sewers Under Structures[1]	$ -	$ -	$ -	$ -		$ 50,143	$ 50,143
SUB-TOTAL SEWERS UNDER STRUCTURES	**$ 303,654**	**$ 1,336,577**	**$ 8,326,021**	**$ 8,989,424**	**$ 7,457,128**	**$ 7,651,476**	**$ 34,064,280**
Tide Gate Installations	$ -	$ 295,263	$ 308,684	$ 3,210,675	$ 685,378	$ -	$ 4,500,000
2019 Wastewater System Improvements	$ -	$ 853,333	$ 2,915,683	$ 1,580,984	$ -	$ -	$ 5,350,000
31st Ward Sewer System	$ 303,975	$ 474,538	$ 6,319,589	$ 5,036,301	$ 1,078,420	$ -	$ 13,212,824
Ivyglen and Odette Sewer Reconstruction and Separation Project	$ 150,000	$ 1,750,000	$ -	$ -	$ -	$ -	$ 1,900,000
TOTAL	**$ 2,599,054**	**$ 9,985,466**	**$ 38,253,909**	**$ 39,141,679**	**$ 30,550,618**	**$ 31,392,392**	**$ 151,923,119**

NOTES 1 Project expenditures will continue to occur after 2023

Table 4-1
Water/Sewer (Hybrid) Eligible Properties to be Improved

Project Name	Project Description
Utility Cost Shares	Infrastructure replacement due to coordination with other agencies or utilities. Coordination with other utilities can reduce expenditures up to 75% of the total project cost and reduces the length of time that the public is inconvenienced due to construction efforts of (often) multiple entities.
Maytide Storm and Sanitary Sewer System Improvements	Reconstruction of storm infrastructure from Merritt Avenue to the storm interceptor on Ravilla Avenue, the realignment of the sanitary sewer on Maytide (Sanderson to Valline), and the rehabilitation and/or reconstruction of the sanitary sewer mains on the undeveloped rights-of-way in the vicinity. Localized property and street flooding has been well-documented for several years at this location and the undeveloped right-of-way of Sanderson has significantly deteriorated. Additionally, inspections of the sanitary sewers in the vicinity revealed structural and construction defects.
Smallman Street Reconstruction	Relocation of the existing combined sewer infrastructure, which is located under the existing building, sewer separation and water main replacement due to the redevelopment of the Produce Terminal Building, and realignment of the streetscape.

Table 4-2
Water/Sewer (Hybrid) Eligible Properties Project Schedule and Costs

	Projected Annual Expenditure						
Project Name	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**TOTAL COST**
Utility Cost Shares	$ -	$ 2,250,000	$ 3,000,000	$ 3,000,000	$ 3,000,000	$ 750,000	$ 12,000,000
Maytide Storm and Sanitary Sewer System Improvements	$ 157,779	$ 428,378	$ 1,916,790	$ -	$ -	$ -	$ 2,502,947
Smallman Street Reconstruction	$ 5,389,572	$ 5,962,309	$ -	$ -	$ -	$ -	$ 11,351,881
TOTAL	**$ 5,547,351**	**$ 8,640,687**	**$ 4,916,790**	**$ 3,000,000**	**$ 3,000,000**	**$ 750,000**	**$ 25,854,828**

Table 7-2
e-Builder Training Matrix

Training Category	Project Managers	Executive Director and Chief of Staff[2]	Program Management Team	Engineering	Procurement	Communications	Environmental and Compliance	Finance	Operations	Engineering and Design Consultants	Subconsultants	Developers	Contractors	Construction Managers
POSITION[1]-->	**1,2**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1,2**
e-Builder Module Navigation	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Project Access	X	X	X	X	X	X	X	X	X	X	X		X	X
Locating and Understanding Project Finances	X	X	X		X			X						X
Completion, Submittal, and Approval of e-Forms	X	X	X	X	X		X			X	X	X	X	X
Creating and Using Reports	X	X	X	X	X	X	X							X
Managing Project Schedules	X		X								X			X
Time Tracking	X		X	X			X		X		X			X
Project File Management	X		X	X	X	X	X			X	X			X
Understanding and Using Dashboards	X	X	X		X		X	X						X
Redlining Documents	X		X	X			X			X				X
Invoice Submittal and Review	X		X				X	X		X		X	X	X
Change Order Submittal and Review	X	X	X				X			X			X	X
Preparing and Logging Meeting Minutes	X		X				X			X			X	X
Posting RFPs	X												X	X
Conducting Monthly Project Audits (new module)	X		X	X	X		X	X	X	X				X

NOTES:

(1) POSITION CODES:

1 - Authority Personnel

2 - Outside Consultants/Contractors/Embedded Staff

(2) Executives use e-Builder for approving certain contracts and change orders

Appendix C
PWSA Lead Policy

Policy: 2018 Lead Line Replacement Program

Effective Date: 1/26/2018
Approved By: RAW
Robert A. Weimar
Revision No.: 1.0
Revision Date: 1/22/2018

1. Overview

In efforts to reduce the amount of lead in the Pittsburgh Water and Sewer Authority's (PWSA's) water distribution system, mitigate lead exposure through water consumption for the customer, and comply with state and federal regulations, the PWSA Board of Directors is asked to authorize a residential Lead Service Line Replacement (LSLR) program which includes the replacement of both the public and private portion of lead service lines (LSLs) located in PWSA's drinking water service area.

2. Purpose

This Policy would serve as the principle for which the PWSA can implement, through procurement contracts, a full-line LSLR strategy to comply with the Pennsylvania Department of Environmental Protection (DEP) requirements included in the November 17, 2017 Consent Order and Agreement (COA) between PWSA and DEP and meet the Board of Directors' previously stated policy to refrain from performing partial lead service line replacements at residential properties.

3. Policy

The PWSA Board of Directors adopts this policy to allow for the implementation of multiple contracts which will accomplish the goal of full-line LSLR at single family residential properties with service lines 1-inch in diameter or less, for which the PWSA has maintenance responsibility for the water service line from the water main to and including the curb stop, as more fully described in PWSA Rules and Regulations. This policy commits PWSA to full-line lead line replacement in various circumstances detailed in the procedures section of this policy.

Any single family residential property receiving a partial replacement after 7/1/2016 and before 12/31/2018 will be eligible to have their private lead service line replaced by PWSA, at no charge to the customer. Partial LSL replacements that were completed as part of previous LSLR Contracts will be replaced as part of ongoing work being completed under current LSLR Contracts. Partial LSLR completed as part of PWSA Operations' replacements or water relays will be replaced as part of a future LSLR Contract.

Because galvanized iron has been proven to release lead into water, galvanized iron service lines will be treated as lead service lines and replaced under this policy.

If a homeowner replaced their private side LSL between 7/1/2016 and 12/31/2018, PWSA will offer a reimbursement. The reimbursement amount will be based on the average cost of replacement for private line segments replaced during the 2018 construction period. This reimbursement amount will be subject to formal review and approval by the PWSA Board of Directors no later than January 31, 2019.

4. **Procedure**

1. Contracts, Agreements and Purchases shall be awarded only to responsible firms or individuals that possess the ability to perform successfully under the terms and conditions of a proposed contract.

2. PWSA contracts for LSLR shall accomplish the full LSLR through various contractual approaches.

a. **Full LSLR utilizing prior service line confirmation data:** This contract will utilize data collected through PWSA's Curb Box Inspection Program, which has been in effect since the Fall of 2016. PWSA will coordinate with customers identified as having private LSL to replace the full line during construction at no cost to the property owner. For 2018, the overall work orders will be prioritized based on the prevalence of children and incidences of high blood lead levels in the City areas being addressed. PWSA will also offer to retroactively replace private lead service lines from LSLR's performed by PWSA or its contractors from July 2016 to the April 1, 2018 current program start date, at no cost to the property owner. The retroactive replacement program will start as soon as practicable, but no later than the 2019 construction season.

b. **Full LSLR, targeting at-risk households using funding from the DEP Community Environmental Project (CEP):** PWSA's program will target its private LSLRs to households with at-risk populations present. At-risk households include those with pregnant mothers and children under the age of six years old, as recommended by public health officials. Households receiving replacements under this program will also be required to meet to-be-determined income requirements. Specific details of this program shall be consistent with the program as approved by DEP as required by the COA.

c. **Emergency LSLRs:** PWSA will address replacement of the private LSL when PWSA's operations crew replaces a public LSL as a result of line breaks and leaks. This construction contract shall address partial LSLR caused by unplanned emergency replacements. These private replacements will be

offered at no cost to the property owner in 2018. This contract will also cover replacement of the private side as a result of partial replacements that occurred as part of water relays or operations replacements between 7/1/2016 and 12/31/2018.

d. **Water Main Relays:** When replacing water mains (referred to as a water main relay), PWSA will offer to replace the private side lead service line when it replaced the public service line. In 2018, these private side replacements will be at PWSA's cost.

3. Property owners eligible for private LSLRs under the program described in 2(a) will be contacted ahead of time and asked to enter into an agreement to allow PWSA employees and contractors to gain access to their private property in order to replace their private LSL. The agreement that will allow PWSA employees and contractors to gain access to the private property in order to replace LSLs will include provisions that require that the property owner(s) release and hold harmless the PWSA from any and all claims, causes of action, damages or losses, of any nature, whatsoever with respect to the work performed by PWSA or its contractors. Homeowners will then be asked to cooperate with PWSA's timeline for replacement and allow workers access to the service line.

4. Replacements performed under the CEP described in 2(b) will be identified by customer-requests and vetted through a third-party administrator. Details of the program must be approved by DEP.

5. Property owners who are in a position to receive a full LSLR per program described in 2(c) will be asked to coordinate with PWSA in an expedited fashion. PWSA will work to make the replacement process as convenient for the homeowner as possible.

6. Property owners who do not agree to PWSA's terms for full LSLR will be subject to a partial lead service line replacement. The potential health risks of a partial LSR will be outlined in the communications provided to the homeowner.

7. PWSA will not perform any site restoration for the private side replacement except for backfilling the trench and sealing any wall or floor penetrations. PWSA will not replace any landscaping, interior finishes, paving, seeding, or walkways. All restoration costs shall be borne by the homeowner.

8. PWSA's management shall monitor all contracts to ensure that this policy is carried out, and will report to the PWSA Board of Directors routinely on the status of the LSLR program.

9. PWSA management will evaluate the efficacy of each program and may propose policy modifications to the Board from time to time. Specifically, PWSA will re-evaluate the cost structure of private LSLRs for the year 2019 and thereafter.

Appendix D

March 29, 2018 Updated Materials Evaluation Cover Letter/Summary

PGH2O Pittsburgh Water & Sewer Authority

March 29, 2018

Renee Diehl, Operations Section Chief
Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, Pennsylvania 15222-4745

Re: Updated Materials Evaluation and Lead Service Line Replacement Schedule
Pittsburgh Water and Sewer Authority

Dear Ms. Diehl:

Pursuant to Paragraph 3.c.ii of the Consent Order and Agreement (COA) dated November 17, 2017, between the Pennsylvania Department of Environmental Protection (PADEP) and the Pittsburgh Water and Sewer Authority (PWSA), PWSA is providing the following:

- An Updated Materials Evaluation
- Updated lead service line information collected and processed subsequent to the January 2, 2018 Lead Service Line Preliminary Data Summary Submittal to PADEP
- An Updated Lead Service Line Replacement (LSLR) Schedule

Updated Materials Evaluation

Per the COA, the Updated Materials Evaluation is included in its entirety in Attachment A. This updated Materials Evaluation is based upon the data provided to PADEP in the January 2, 2018 preliminary data summary submittal.

PWSA is presenting this Updated Materials Evaluation based on a substantial amount of new data including the following:

Penn Liberty Plaza I
1200 Penn Avenue
Pittsburgh PA 15222

info@pgh2o.com
T 412.255.2423
F 412.255.2475

www.pgh2o.com
@pgh2o

Customer Service /
Emergencies:
412.255.2423

- Digitization and evaluation of approximately 42,214 available public side historical records
- Field verification data from approximately 1,589 service line excavations
- 1,996 curb box inspections

According to PWSA rules and regulations, PWSA owns the portion of the water service line from the water main to the curb box for all water service lines of 1-inch in diameter or less serving a single family residential dwelling. Residential lines larger than 1-inch, multi-family residential lines, and non-residential lines are owned in their entirety by the property owner. In addition, fire lines were not included in the materials evaluation. The quantities noted above reflect only service lines owned by PWSA. The preliminary data summary provided on January 2, 2018 included both PWSA-owned service lines as non-PWSA owned lines. Therefore, the quantities noted above are less than the totals provided in the January 2, 2018 data summary. At the time of this evaluation, available records show that PWSA owns a portion of the service line for a total of 71,755 residential customers.

This evaluation is an update to the Lead Service Line Inventory Estimate submitted per 25 Pa. Code § 109.1103(g)(1) on September 30, 2016 that estimated the number of lead service lines owned by PWSA. The earlier estimate was developed using different approaches based on limited data (803 historical records, 180 service line excavations) and yielded results that ranged from 25 to 46 percent of the evaluated residential service lines estimated to be lead.

Using a conservative approach, based on this limited data, PWSA estimated in 2016 that it owned approximately 19,152 lead service lines. PADEP approved the use of this number for the first year of lead service line replacement.

The Updated Materials Evaluation assessed the following:

- Evaluation of the accuracy of the historical record data
- Updated assessment of the number of PWSA-owned lead service lines

PGH2O Pittsburgh Water & Sewer Authority

Historical record data accuracy was reevaluated based on the digitized historical records and additional service line verification data and curb box inspections. The results in the Updated Materials Evaluation report confirmed the September 30, 2016 evaluation findings that the historical records are frequently biased towards lead, meaning that the historical records indicate lead and the line is later confirmed by curb box inspection or site verification (excavation) to be nonlead. This is termed as a false positive result. Based on the high false positive rate detailed in the attached report, historical data alone cannot be used to determine the total number of PWSA-owned service lines that are lead.

The Updated Materials Evaluation report developed a new statistical model based on the historical records data set, along with curb box inspections, and site verifications (excavations) completed to date. The service line materials evaluation model was formulated as a decision tree of sequential criteria arranging in descending order of confidence and strength of association with lead services. Each criteria step was assigned a lead proportion.

This evaluation demonstrated that 17 percent of the total 71,755 service lines (or 12,218) are lead. This model result has an estimated precision of +/- 10 percent (10,996- 13,440) based on the weighted average of a 95% confidence ranges across the decision tree steps.

Using a revised value of 12,218 lead service lines, 7 percent results in a quantity of 855. This result is lower than the September 2016 estimate, which showed 7 percent of the then estimated lead service lines to be 1,341.

As previously described, very limited data were available for the 2016 analysis and confidence in this updated materials inventory evaluation has increased for several reasons:

- Lack of data for the 2016 preliminary estimate necessitated casting a wide net of alternative assumptions to err on the conservative side and to manifest low certainty in the underlying information.
- Completed digitization of historical records meant that the installation date was available for the majority of service lines in the

updated assessment (installation date is the best single predictor for lead).

- Availability of ten times more field verification data afforded a robust evaluation of historical record service line material accuracy as well as known results for the verified services.
- The updated assessment yielded an overall proportion of lead service lines close to the overall verified rate of lead material observed during LSLR water main relay projects.

Although the Updated Materials Evaluation yielded a lower number of lead service lines, the 2018 lead service line replacement schedule, presented below, is based on the current COA requirements to replace 1,341 lead service lines between July 1, 2016 and June 30, 2018. It also currently includes an additional 1,341 lead service lines by December 31, 2018, based on the September 2016 Lead Service Line Inventory Estimate. A detailed lead service line replacement schedule is provided as part of this submittal.

Updated Lead Service Line Data

Historical records for the PWSA-owned portion of the water service line were provided to PADEP on January 2, 2018. As per the COA, an updated historical record table is provided in Attachment B. This updated record includes material information on the portion of the service line owned by the customer. However, the Materials Evaluation described above only applies to the PWSA-owned portion of the lead service line, so the updated customer-owned material information was not used for this Updated Materials Evaluation.

Although the 2018 curb box inspection contract has commenced, no data is available from these inspections at the time of this submittal.

Updated Lead Service Line Replacement (LSLR) Schedule

Table 1 presented below lists the number of lead service lines replaced to date. From July 1, 2016 to March 24, 2018, a total of 760 PWSA-owned lead service lines have been replaced.

PGH2O Pittsburgh Water & Sewer Authority

Table 1 - Lead Service Lines Replaced to Date

	PWSA Operations	2017 LSLR Contracts	Water Main Replacement Projects (Water Relays)	Total
Jul-16	20	0	0	**20**
Aug-16	22	0	11	**33**
Sep-16	29	0	10	**39**
Oct-16	40	0	11	**51**
Nov-16	22	0	5	**27**
Dec-16	10	0	2	**12**
Jan-17	23	0	0	**23**
Feb-17	27	0	1	**28**
Mar-17	28	0	0	**28**
Apr-17	12	0	4	**16**
May-17	26	77	1	**104**
Jun-17	24	33	0	**57**
Jul-17	25	8	0	**33**
Aug-17	27	20	0	**47**
Sep-17	26	28	0	**54**
Oct-17	39	5	0	**44**
Nov-17	27	0	13	**40**
Dec-17	26	0	7	**33**
Jan-18	23	0	1	**24**
Feb-18	24	0	0	**24**
Mar-18	23	0	0	**23**
Total	**523**	**171**	**66**	**760**

Lead Service Lines are proposed to be replaced under the following projects:

- **2017 Lead Service Line Replacement Contracts** – Three contracts were awarded in 2017 and have been extended to July 2018. Full length LSLR (PWSA-owned and residential private lines) will take

place in the neighborhoods previously investigated under these three contracts.

- **2018 Lead Service Line Replacement Contracts** – Five contracts were awarded on March 23, 2018. Each contract has the capacity to replace approximately 350 lead service lines (PWSA-owned and residential private lines).
- **PADEP Community Environmental Project** – One contract total for replacing privately-owned lead service lines for low-income homes. This contract will also replace PWSA-owned lead lines at these locations if one is present. Since the private replacements are funded through the PADEP Community Environmental Project, PWSA will account for the private service line replacements separately from the PWSA-owned replacements. PWSA-owned replacements will be funded by PWSA's capital budget, not the Community Environmental Project. A total of 200 lines will be replaced under this contract with approximately 100 of the replacements occurring by December 31, 2018. If additional funds remain from the CEP after replacement of these lines, additional lines will be replaced.
- **PWSA Field Operations** – PWSA Field Operations will continue to replace lead service lines in instances of emergencies such as a water line break or leak or as a coordinated public replacement when customers who do not fall under one of the other contracts listed above desire to change their portion of the lead service line.
- **Water Main Relay Projects** – Water main replacement projects where lead service lines (PWSA-owned and residential private lines) will be replaced in conjunction with the water main replacement.

An additional 580 lead service lines are required by the COA to be replaced by June 30, 2018. These additional lines are anticipated to be replaced as summarized in Table 2.

Table 2 Lead Service Line Replacement Schedule

Date Range	Program/Contract	Number Replaced/to be Replaced
July 1, 2016 to March 24, 2018 (actual)	Urgent Replacement or Coordination by PWSA Operations Group	523
	Water Main Relay	66
	2017 LSLR Contract	171
March 26, 2018 to June 30, 2018 (planned)	2017 LSLR Contract	272
	2018 LSLR Contract	231
	Urgent Replacement or Coordination by PWSA Operations Group	80
Total July 1, 2016 to June 30, 2018		**1,343**
July 1, 2018 to December 30, 2018 (planned)	2017 LSLR Contract	122
	Urgent Replacement or Coordination by PWSA Operations Group	144
	Water Main Relay	0
	2018 LSLR Contract	1,242
	CEP Contract	100
Total July 1, 2018 to December 31, 2018		**1,608**

A detailed schedule for the 2018 Lead Service Line Replacement contracts can be found in Attachment C. As a conservative estimate, only four of the five contracts are considered in this schedule.

PWSA's LSLR program reflects the Authority's 2018 lead service line replacement policy, which is structured to allow residents to avoid potentially harmful partial lead service line replacements. For 2018, PWSA is offering to coordinate replacement of privately-owned lead service lines, if PWSA initiates a replacement of the publicly-owned portion. Eligible customers must consent to the private line replacement work, which will be performed by PWSA or its contractors at no direct cost to customers in 2018. Coordinating full lead line replacements is a new activity for PWSA and its contractors since private replacements were previously interpreted to be prohibited by the

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Pennsylvania Municipal Authorities Act. The Act has been amended to permit replacement by municipal authorities of privately-owned lead service lines.

While full lead service line replacements are not required under the COA with PADEP, PWSA had determined that it is an appropriate measure to undertake to protect the public health of its customers.

If any additional information is needed or if we can answer any questions, please let us know.

Regards,

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Interim Executive Director

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Appendix E

Program Management Plan (PMP) Draft

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