EXHIBIT P10

PHILADELPHIA'S ACT 537 PLAN

City and County of Philadelphia

Act 537 Plan
Volume 1

BCM Engineers Inc.
Engineers, Planners, Scientists, and Laboratory Services

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
FIELD OPERATIONS - WATER MANAGEMENT PROGRAM
Lee Park, Suite 6010
555 North Lane
Conshohocken, PA 19428
215 832-6130

November 10, 1993

Raymond E. Shipman, Managing Director
City of Philadelphia
1600 Arch Street, 12th Floor
Philadelphia, PA 19107

Re: Act 537 Plan
City of Philadelphia
Philadelphia County

Dear Mr. Shipman:

We have completed our review of your municipality's Official Sewage Facilities Plan entitled "City and County of Philadelphia, Act 537 Plan, Volumes 1 and 2" as prepared by BCM Engineers, Inc., dated March 1993 as revised May 1993 and additional information provided by letter dated June 30, 1993. The review was conducted in accordance with the provisions of the Pennsylvania Sewage Facilities Act.

Approval of the Official Sewage Facilities Plan is hereby granted.

The plan provides for the implementation of:

1. The intention to further evaluate existing unsewered areas and to prioritize addressing these areas in the future, including but not limited to investigating, on-a-case-by-case basis, the feasibility of individual hook-ups to central sewers.

2. The initiation of a Combined Sewer Overflow (CSO) Plan for the entire collection system, which included monitoring, modeling and high flow management, as described in your NPDES permits for your Water Pollution Control Plants.

3. The rehabilitation of the Primary Clarifiers at the Northeast Water Pollution Control Plant.

4. The establishment of a Rate Stabilization Fund.

5. The initiation of future joint planning in the event future intermunicipal agreements propose changes to the capacities outlined in Table 3.2.2 on page 3-44 of the Plan. For example, the PWD notified DELCORA by letter dated of,

termination of its agreement by 2006. Any such removal of sewage flows from the City's System will require the above referenced joint planning.

6. The processing of plan revision requests pursuant to 25 PA Code, Chapter 71, Section 71.51. The Department expects the City to fully comply with this requirement. A meeting with the Department and officials from the City's Water Department, Health Department and Planning Commission must be held within 60 days of the date of this letter.

Additionally:

1. The dry weather flow projection methodology in the plan is inconsistent with current Department Policy and Procedure. Annual average flow is the "nominal" design flow used in sewage facilities planning. Flow projections must be based on established annual average flows. NPDES permit revisions to incorporate maximum monthly average flow treatment plant capacity ratings will provide greater flexibility for treatment of peak hydraulic flows. Peak hydraulic flows being defined as a treatment plants three highest consecutive monthly average flows.

If you have any questions regarding this matter, please feel free to contact me at the above number.

Very truly yours,

Joseph A. Feola

JOSEPH A. FEOLA
Water Management Program Manager

cc: Philadelphia Water Department
Philadelphia County Health Department
Philadelphia County Planning Commission
BCM Engineers
Planning Section
Division of Municipal Facilities and Grants
Re 30 (SH)301.6

REPORT TO

CITY OF PHILADELPHIA
PHILADELPHIA WATER DEPARTMENT
PHILADELPHIA, PENNSYLVANIA

FOR

PHILADELPHIA
ACT 537

MARCH 1993
REVISED MAY 1993

BCM PROJECT NO. 00-0740-0201

PREPARED BY

MICHAEL J. DASCHBACH, P.E.
ENGINEER III

DANIEL A. GRABER, P.E.
SECTION MANAGER

THOMAS R. SMITH, P.E.
ASSISTANT VICE PRESIDENT

BCM
Engineers, Planners, Scientists and Laboratory Services
07400240.doc One Plymouth Meeting • Plymouth Meeting, PA 19462 • Phone: (215) 825-3800

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ACKNOWLEDGEMENTS

BCM wishes to acknowledge the effort and cooperation of all who assisted in or provided information for the preparation of this report.

The following is a list of major contributors:

Name	Agency
Livrone, Dennis	BCPC
Holmes, Karen	DCPC
Pollison, David	DRBC
Zippin, Richard	Health Dept.
Heisler, Robert	Phila. Planning Commission
Post, Denning	PWD
Stone, Ms.	PWD
Goldiner, Lonnie	PWD
Healy, Thomas	PWD
Bernstein, Leonard	PWD
Bose, Guru	PWD
Collier, George	PWD
Golembeski, James	PWD
Kolesza, Thomas	PWD
McCusker, Daniel	PWD
Mudry, J. Eugene	PWD
Stanick, Raymond	PWD
Toffey, William	PWD
Edmunds, Faulkner	PWD
Palladino, James	PWD
Roy, Richard	PWD
Cameron, Stu	PWD
Blair, Dennis	PWD

Table of Abbreviations Used in Report

ASAP	As soon as possible
Ave.	Average
BAT.	Best available technology
BCT	Best conventional pollutant control technology
BCWSA	Bucks County Water & Sewer Authority
BOD_5, BOD	Biological Oxygen Demand
BPJ	Best professional judgement
BPT	Best practicable technology
CAAA	Clean Air Act Amendment
CCMUA	Camden County Municipal Utilities Commission
CDCA	Central Delaware County Authority
cf	Cubic feet
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CIP	Capital Improvement Plan
CM	Corrective maintenance
CMMS	Corrective management maintenance system
COWAMP	Comprehensive Water Quality Management Planning Program
CSO	Combined Sewer Overflow
CWA	Clean Water Act
D&M	Distribution and marketing
DAF	Dissolved air flotation
DCA	Darby Creek Authority
DCPC	Delaware County Planning Commission
DDX	Dichloro-diphenyl compound
DELCORA	Delaware County Regional Authority
DMR	Discharge monitoring report
DNREC	Delaware Department of Natural Resources and Environmental Control
DO	Dissolved Oxygen
DRBC	Delaware River Basin Commission
DSP	Digester sludge pumps
DVRPC	Delaware Valley Regional Planning Commission
EIS	Environmental impact statement
EPA	Environmental Protection Agency
ERP	Enforcement Response Plan
FM	Food to microorganism (ratio)

ABBREVIATIONS
(Continued)

FPS	Feet per second
FST	Final sedimentation tanks
ft_2	Feet squared
FY	Fiscal year
GC	Gas chromatograph
gpcpd	Gallons per capita per day
gpd	Gallons per day
gpm	Gallons per minute
HAPs	Hazardous air pollutants
HQ/EV	High quality/exceptional value
ICI	Industrial, commercial, institutional
I/I	Infiltration/inflow
IPP	Industrial Pretreatment Plan
IWU	Industrial Waste Unit
kg/ha	Kilograms per hectare
L	Length
lbs/day	Pounds per day
LOX	Liquid oxygen
max	Maximum
MG, mg	Million gallons
mg/l	Milligrams per liter
MGD, mgd	Million gallons per day
MLSS	Mixed liqour suspended solids
MLVSS	Mixed liqour volatile suspended solids
MOA	Memorandum of agreement
MPN	Most probable number
NE	Northeast
NEPA	National Environmental Policy Act
NEWPCP	Northeast Water Pollution Control Plant
NJDEPE	New Jersey Dept. of Environmental Protection and Energy
NL	Not limited
NOAEL	"No reasonable adverse effects level"
NPDES	National Pollutant Discharge Elimination System Permit
NSSS	National Sewage Sludge Survey
O&G	Oil and grease
O&M	Operations & maintenance
OLDS	On-lot disposal system
P&R	Planning and research
PADER	Pennsylvania Department of Environmental Resources

ABBREVIATIONS
(Continued)

PC	Personal computer
PECO	Philadelphia Electric Company
PENNVEST	Pennsylvania Infrastructure Investment Authority
PFRP	Process to further reduce pathogens
PIDC	Philadelphia Industrial Development Commission
PM	Preventive maintenance
POTW	Publicly Owned Treatment Works
ppd	Pounds per day
PSRP	Process to significantly reduce pathogens
PST	Primary sedimentation tanks
PTB	Primary treatment building
PWD	Philadelphia Water Department
QA/QC	Quality assurance/quality control
RACT	Reasonably available control technology
RAP	Remedial action plan
RBC	Rotating biological contactor
RST	Rotating sludge thickner
SCS	Soil Conservation Service
SE	Southeast
SEO	Sewage enforcement officer
SEWPCP	Southeast Water Pollution Control Plant
SIP	State implementation plan
SIU	Significant Industrial User
SNC	Significant non compliance
SOP	Standard operating procedure
SPDC	Sludge Processing & Distribution Center
SS	Suspended solids
SSES	Sewer system evaluation study
SW	Southwest
swd	Side water depth
SWWPCP	Southwest Water Pollution Control Plant
THM	Trihalomethane
TOMPs	Toxic Organic Management Plan
TRI	Toxics release inventory
UNOX	Commercial pure oxygen treatment system
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
VFD	Variable frequency drive
VOCs	Volatile organic compounds

ABBREVIATIONS
(Continued)

VSS	Volatile suspended solids
W	Width
WPCP	Water Pollution Control Plant
WPCRF	Water Pollution Control Revolving Fund
WWTP	Wastewater treatment plant

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1.0 EXECUTIVE SUMMARY

This ACT 537 Plan for the City and County of Philadelphia has been prepared pursuant to the Pennsylvania Sewage Facilities Act (Act 537) PL 1535. The Pennsylvania Department of Environmental Resources (PADER) is empowered with the statutory and regulatory authority to require such plans, which are, however, developed by municipalities and must be endorsed and/or implemented by the municipalities. On behalf of the City of Philadelphia, the Philadelphia Water Department (PWD) has therefore undertaken the preparation of this, the first, ACT 537 Plan for the City/County of Philadelphia.

The planning area of this ACT 537 Plan encompasses the entire City/County of Philadelphia, which are combined into one political entity under the Home Rule Charter. Moreover, it should be clearly understood that the PWD's wastewater conveyance and treatment system is regional in nature, encompassing an additional 10 agreements with municipalities and/or authorities in the surrounding Bucks, Delaware, and Montgomery Counties. However, as agreed upon with PADER and the PWD, this Plan does not address these outlying municipalities in planning considerations beyond an evaluation of the agreements themselves and how the terms of the agreements need to be addressed by the PWD's facilities. As will be shown in the Plan, the capacity needs for these outlying municipalities is less than the current agreement allocations.

Due to the regional nature of this Plan, the purpose and intent of this study is directed towards areas in which facility needs should be focused and a general assessment of future requirements in these areas. Generally, the three main areas of study included: (1) existing unsewered areas with the City, (2) the collection system, and (3) the water pollution control plants (WPCPs), including the Solids Processing and Distribution Center (SPDC). As indicated in Section 4.1, On Lot Disposal Systems, of the almost 675,000 residences in the City of Philadelphia, there have been approximately 2,450 households identified as having on-lot disposal systems (OLDS), which is less than 0.4 percent of the City's households. These are concentrated in seven identified areas of the City, located primarily in Roxborough/Manayunk, Germantown/Chestnut Hill, and the far Northeast. Whereas reported problems in all seven areas were less than 5 percent of the OLDS, the Philadelphia Health Department currently has adopted and enforces Chapter 73 of Title 25 of the Rules and Regulations of PADER, in part through the City Plumbing Code; there is no specific program alternative to otherwise eliminate these OLDS. The PWD, on a case-by-case basis, does investigate, in association with the Health Department, the feasibility of individual hookups to the existing sewer system. Furthermore, the PWD, as part of the selected plan, intends to further evaluate the OLDS areas to prioritize addressing these issues in the future.

The collection system encompasses approximately 2,955 miles of both separate sanitary, storm, and combined sewers. The nature of the combined sewer system, which includes 175-permitted regulator overflows, is such to prevent all dry weather overflows and, to the extent currently possible, minimize wet weather overflows. The PWD has implemented in the Northeast Drainage District a model program in which there are 45 monitored, and 8 automated regulators. The

future needs, as identified through the NPDES permitting process for the WPCP, is focused on a conceptual CSO Plan, and needs include such program elements as monitoring, modeling, and a high flow management system.

Regarding the WPCPs, there are several areas which require short-term measures and which have been identified in the Plan. In summary, these areas include the rehabilitation of the Primary Clarifiers at the Northeast Water Pollution Control Plant, corrective actions for redress of a Consent Order for the Southwest Water Pollution Control Plan, and various studies necessary for improving the performance of the SPDC. Overall, the PWD presently evaluates in-house, a 6-year Capital Improvement Program (CIP). This CIP provides the basis for ensuring proper maintenance of the facilities.

An overall (general) implementation schedule has been incorporated into the Act 537 Plan in Section 7.4.

Finally, regarding the financing of operations and improvements for the sewerage facilities, the City in 1989 enacted the General Water and Wastewater Revenue Bond Ordinance to modernize the requirements applicable to the City's Water and Sewer Revenue Bonds. This Ordinance establishes a rate covenant requiring that net revenues of the City's Water and Wastewater Systems exceed debt service requirements on all bonds by 20 percent, and establish a Rate Stabilization Fund.

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2.0 GENERAL

2.1 INTRODUCTION

2.1.1 Background Authorization

On behalf of the City/County of Philadelphia, which were combined into one political entity under the Home Rule Charter, the Philadelphia Water Department (PWD) has prepared herein an Official Act 537 Sewage Facilities Plan. This Plan is mandated by the Pennsylvania Sewage Facilities Act (Act 537) PL 1535. More specifically, the Pennsylvania Department of Environmental Resources (PADER) has petitioned the PWD to submit an Act 537 Plan.

By proposal dated January 5, 1990, BCM Engineers Inc. (BCM), on behalf of the PWD, prepared a detailed scope and work plan; this scope was reviewed in detail with PADER and PWD representatives on April 6, 1990, and a subsequently revised scope of work was submitted to PADER by BCM on May 4, 1990. By letter dated July 30, 1990, the PWD work plan was approved by PADER and on August 8, 1991, the City of Philadelphia entered into a written agreement with BCM Engineers Inc. (Contract No. 91-6854) to prepare an Act 537 Sewage Facilities Plan for Philadelphia County. Unless designated otherwise in this report the term City will be utilized to mean both the City and the County of Philadelphia.

2.1.2 Regional Goals and Objectives of Wastewater Planning

The analyses and proposals of this Act 537 Plan are built upon the foundation of the following goals and objectives. It is felt that an effective planning document requires a well-established foundation of goals and objectives at the outset of the planning process to guide and unify the evaluation and recommendations for improvements. To this end, the following section provides the goals and objectives that will continue the Philadelphia Water Department's tradition of providing a proactive and effective wastewater collection and treatment program. Furthermore, these goals and objectives provide a common ground for the evaluation of each of the subjects and conditions considered in this Act 537 Plan.

2.1.2.1 Goal I: Protect Public Health

The goal of protecting the public health is consistent with PADER's sewerage facilities planning guidelines that state, "The main purpose of the Sewerage Facilities Plan of a municipality is to protect the health, safety, and welfare of the citizens living in the municipality."(1) The development and maintenance of well conceived sewage disposal systems have been very effective in eliminating and reducing waterborne diseases such as Typhoid, Cholera, and Giardia. To this end, the protection of the public against waterborne diseases, which result from the improper disposal of sanitary wastewater, is the prime motive behind the planning of any wastewater facilities.

Objectives in Meeting this Goal:

1. Maintain compliance with state, regional, and federal water quality standards that have been established with specific intended use plans.

2. Consider malfunctioning septic systems, employing the most practical and economical methods of remedy possible.

3. Provide proper operation and maintenance of municipal, non-municipal, and industrial wastewater treatment facilities.

4. Continue an aggressive and diligent contractual program for wastewater collection and treatment with those outlying municipalities and authorities that contribute flow to the Philadelphia Wastewater System.

2.1.2.2 Goal II: Protect Natural Resources

This goal is in compliance with Section 101 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500): "The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Philadelphia relies on its surface waters to generate future residential, commercial, and industrial growth, as well as to provide for a higher quality of life for its citizens.

Objectives In Meeting This Goal:

1. Utilize environmentally sound and cost-effective techniques to prevent the degradation of the Philadelphia surface and ground waters by maintaining water quality with established stream standards.

2. Promote an aggressive Industrial Pretreatment Program.

3. Identify and foster institutional arrangements for implementation of regional or basin-wide water quality plans.

4. Institute water conservation legislation to promote a reduction in water usage to ensure the future availability of water resources.

5. Encourage land and water resource management that is compatible with the protection of the region's water resources.

6. Encourage the protection of wetlands, wild areas, natural areas, parks, and other resources that may be fragile or endangered.

7. Manage, operate, and maintain the combined sewer system to comply with all applicable Federal, State, and City regulations.

8. Identify and protect those surface waters and water courses that have been set aside for recreational purposes, and allow for special consideration and care in those areas to protect the water quality.

2.1.2.3 Goal III: Provide Consistent and Appropriate Wastewater Planning

This goal for consistency in wastewater planning is essential in developing a comprehensive sewage facilities plan. The purpose and effort of this Act 537 Plan are directed to result in an effective coordination of future development and redevelopment of the planning area with available and proposed wastewater facilities. Therefore, every effort is to be made to consider and incorporate the myriad of factors impacting the Philadelphia Wastewater System. The PADER Sewerage Facilities Guide states, "A less obvious, but equally important, purpose of the Sewerage Facilities Plan is to prevent future sewerage disposal problems from occurring."(1)

The Objectives in Meeting this Goal:

1. Comply with the State Water Plan and Regional Southeastern Pennsylvania COWAMP/208 Water Quality Management Plans.

2. Comply with the Delaware River Basin Commission standards to preserve the Delaware River Estuary.

3. Compile, track, and adjust as necessary population, housing, commercial, industrial, and institutional growth projections to ensure that the collection and treatment systems are adequate to handle the expected wastewater loads.

4. Solicit problems and comments from the Philadelphia Health Department and regional and local planning agencies.

5. Confirm consistency with the documents and plans as detailed in Chapter 71, Section 71.21,a.5 PADER "Title 25: Rules and Regulations"

6. Be cognizant of and proactive with pending water quality standards and regulations.

2.1.3 Specific Project Focus

The overall goal of the proposed work effort is to prepare a sewage facilities plan that will meet the requirements established by PADER and all guidelines for Act 537 planning and to identify regional goals and objectives of Waste Water Planning. The sewage facilities plan will identify

existing and future needs, as well as improvements that must be initiated over the next 5 years to ensure adequate water pollution control within the City of Philadelphia.

To accomplish the purpose, PWD has determined to focus on the following objectives:

- To develop a plan based, to the maximum extent possible, on already existing data and reports. The PWD, which is the lead and host agency for this study, has extensive data already in place.

- To focus on those key problems and issues identified by PADER to ensure the conservation of study resources and compliance with a reasonable timetable for completion. It is not advisable to spend study resources on issues that are of little or no significance to Philadelphia; efforts should be placed upon the critical issues most meaningful in terms of pollution control and compliance with state and federal regulations.

- To conduct the work within the schedule and budgetary constraints mutually established by the City and the selected consultant.

- To comply with the City's Minority Business Enterprises/Women-owned Business Enterprises (MBE/WBE) goals set for this project.

As such, the City of Philadelphia is being required to prepare a county-wide sewage facilities plan. This plan must provide Philadelphia with a document that is usable and meets the City's needs of assuring PADER that any near future (5-year) capital improvement projects are consistent with both the State's planning requirements and the needs of the Philadelphia area. As there is no existing Act 537 Plan for Philadelphia County, the proposed sewage facilities plan will be a new document, essentially updating the existing regional water quality management and 201 Facility Plans for the Philadelphia wastewater collection, treatment, and disposal system.

The City of Philadelphia has indicated, for work plan purposes, that the only improvements currently being planned are for modifications (rehabilitation) to the primary clarifiers at the Northeast Water Pollution Control Plant (Northeast WPCP).

Although Philadelphia is essentially fully developed, PADER has requested that one primary focus of the sewage facilities plan include on-lot disposal systems in the City. Thus, among other Act 537 Plan requirements, the study will focus on the remaining unsewered areas, such as portions of Roxborough, Manayunk, and Chestnut Hill, and on any problems associated with on-lot disposal system malfunctions.

Other than the above, the County of Philadelphia Act 537 Plan is intended to serve as a general regional planning document, establishing policy, goals, and the need for further, more detailed investigations of specific long-term problem areas.

2.2 PLANNING AREA DELINEATION

The planning area of this Official Act 537 Plan encompasses the entire City/County of Philadelphia, which were combined into one political entity under the Home Rule Charter. The City of Philadelphia is committed to provide wastewater service to the population, commercial properties, institutions, and industries within its boundaries and to protect the waters into which treated wastewater is discharged. As can be seen on Figure 2.2-1, Planning Area Delineation, the City of Philadelphia is located in southeast Pennsylvania at the confluence of the Delaware and Schuylkill Rivers, bounded by Bucks County, Montgomery County, Delaware County, and the State of New Jersey.

The City itself is contained by the Delaware River on its eastern and southern boundary. At Fort Mifflin, near the Southwest WPCP, the City's boundary deviates from the Delaware River, continues west through the Philadelphia International Airport to Darby Creek, completing the southern boundary. Darby Creek forms the lowest portion of the western boundary and separates the City from Delaware County to its confluence with Cobbs Creek, where the latter creek continues as the western boundary northward to U.S. Route 1, City Line Avenue. City Line Avenue reverses north eastward to the Schuylkill River and marks the boundary with Montgomery County. The City boundary bisects the Schuylkill River up to the vicinity of Northwestern Avenue in a northeast direction to Stenton Avenue. Stenton Avenue is the northern boundary of the City as it turns southwest to slightly south of Willow Grove Avenue, then back to a northeast direction for a short distance to Cheltenham Avenue. The boundary follows Cheltenham Avenue southwest of Tookany Creek Parkway where it turns northeast a short distance to Cottman Avenue to Burholme Avenue. The boundary follows Burholme Avenue for a short distance, then continues northwest to Poquessing Creek. Here the boundary follows Poquessing Creek back to the Delaware River, completing the northern boundary and forming the divide with Bucks County.

As described later in this report, the City of Philadelphia has entered into intermunicipal agreements with ten outlying municipalities/authorities to accept, convey, treat and dispose of their wastewater; however, this official plan does not address these municipalities in planning considerations beyond an evaluation of the agreements themselves and how the terms of these agreements will need to be addressed by the PWD's facilities. Figure 2.2-2 Philadelphia Regional Service Areas also delineates those areas that are serviced by the Philadelphia collection and treatment facilities. Together, the City and outlying municipalities form the large watershed of the Lower Delaware and Lower Schuylkill Rivers and the largest regional wastewater system in Pennsylvania.

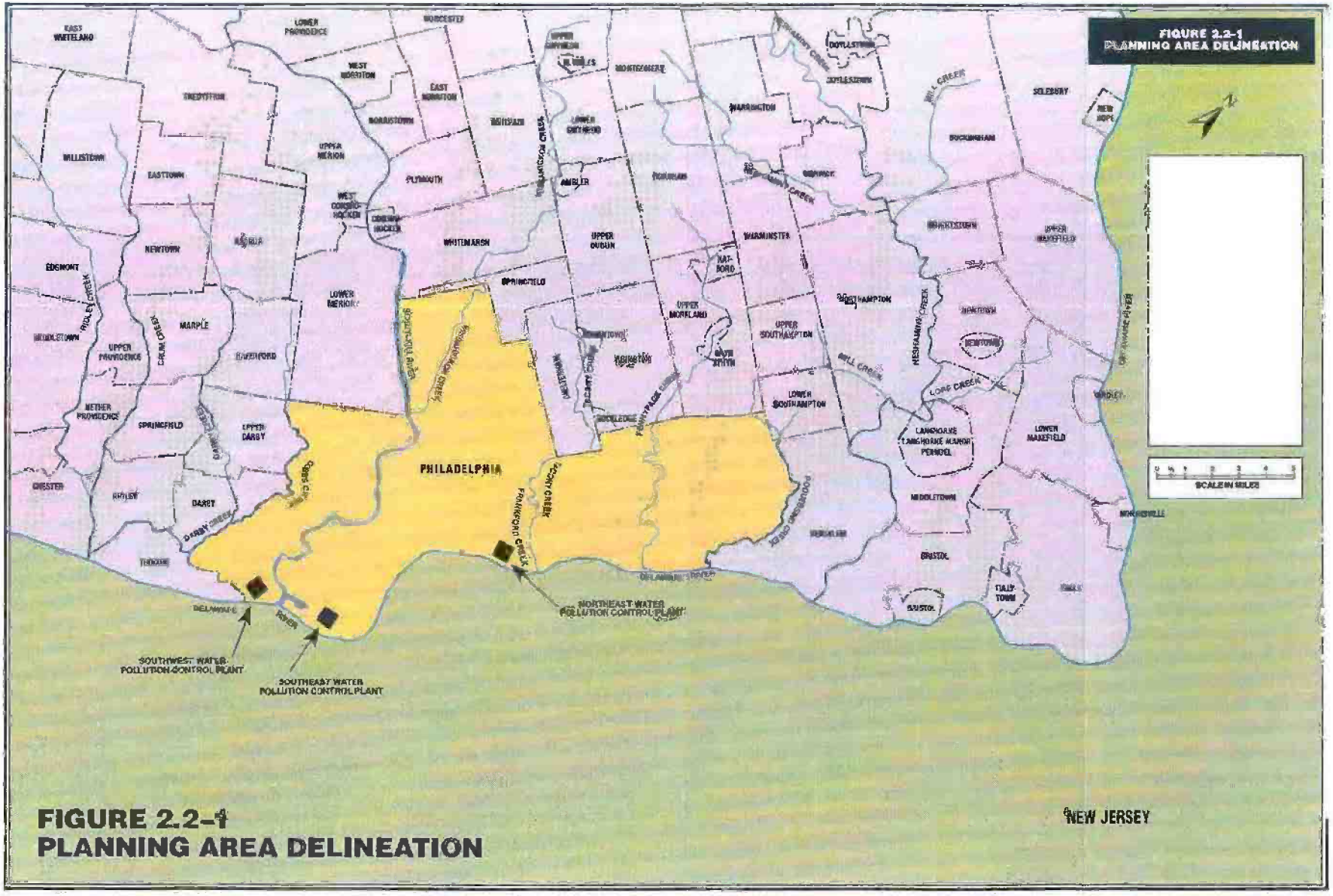

FIGURE 2.2-1
PLANNING AREA DELINEATION

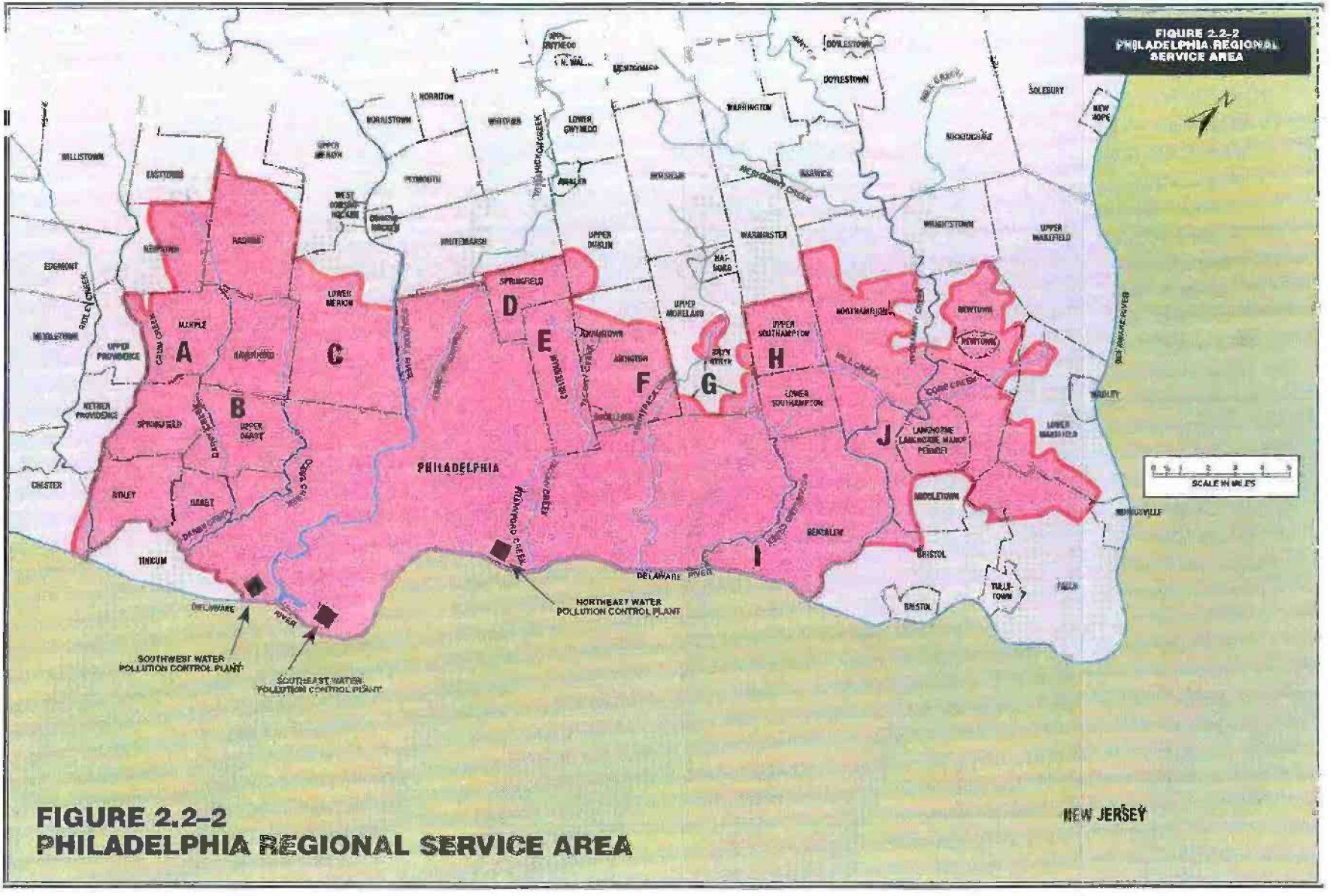

FIGURE 2.2–2
PHILADELPHIA REGIONAL SERVICE AREA

The total area and population served by the Philadelphia wastewater collection and treatment system, is summarized below:

	Area (acres)	Population
Philadelphia	86,500	1,586,000
Outlying municipalities	147,700	700,000
TOTAL	**230,600**	**2,286,000**

2.3 WORK PLAN

The following describes the effort required for the various tasks in this project. These tasks generally conform to PADER Act 537 Planning Guidelines and have been approved by PADER and the PWD.

2.3.1 Task 1 - Planning Objectives and Needs

The Plan includes a review of all wastewater planning previously conducted under the Federal Construction Grants Program and the State's Chapter 94 Wasteload Management Program. In addition, the plan reviews Philadelphia land use plans and zoning and identifies inconsistencies between wastewater plans and land use plans, zoning plans, or other local or regional plans. This task also incorporates the efforts required to obtain information on the outlying municipalities and refine the focus and objectives of the Plan with PADER and the regional planning agencies.

2.3.2 Task 2 - Physical Description of the Planning Area

The plan as proposed will present information on the planning area, such as the delineation of the service area, municipal and county boundaries, major drainage basins, and areas served by the City's three Wastewater Treatment Facilities.

For the portions of Roxborough, Manayunk, and Chestnut Hill, where the majority of on-lot sewage disposal facilities are in use, the Plan describes soils and general geological features based on information from United States Geologic Survey (USGS) and Soil Conservation Service (SCS) maps.

The Plan is based upon Planning Commission population information for the City as a whole and, as available, for growth areas within the City. Flows for outlying municipalities that contribute wastewater to Philadelphia have been reviewed based upon information available to the City as supplied by areas outside Philadelphia but within the Water Department service area.

Areas served by centralized water systems within the City of Philadelphia sewer service area have been identified.

The Plan includes a desktop study as a means of identifying wetlands throughout the service area using the National Wetlands Inventory (NWI) mapping system. However, it should be noted that before any construction is undertaken for a proposed facility, a site must be inspected, all wetlands delineated, and all appropriate permits obtained.

2.3.3 Task 3 - Evaluation of Existing Wastewater Treatment and Collection Systems

City of Philadelphia Health Department records have been reviewed to identify areas with on-lot sewage disposal systems and documented system malfunctions.

The Plan identifies and describes major interceptors, force mains, and pumping stations within the City of Philadelphia. PWD maintenance records have been consulted to identify any existing or potential future overload conditions.

The annual Wasteload Management Reports from the City of Philadelphia have been used to identify and describe the existing wastewater treatment facilities and problems related to National Pollutant Discharge Elimination System (NPDES) Permit violations. Violations are discussed along with the status of any actions taken to achieve compliance with treatment requirements. Previous studies and reports pertaining to operation and maintenance at the City's Water Pollution Control Plants (WPCPs) are reviewed and summarized in the Plan.

A listing of all direct industrial discharges within the City of Philadelphia have been obtained from the Water Department and incorporated into the Plan. Unpermitted collection/disposal systems within the City, if possible, are identified through review of the Water Department Industrial Waste Unit's records.

2.3.4 Task 4 - Evaluation of Wastewater Treatment Needs

The Plan delineates areas where sewerage systems may be needed within 5 years. These areas will be determined based on financial feasibility, Sewage Enforcement Office (SEO) information, the extent of illegal sewage connections, and a review of planning work completed under the Federal Construction Grants Program to establish sewage needs.

The Plan also evaluates wastewater treatment needs in terms of treatment plant capacity and degree of treatment required as described in the annual Wasteload Management Reports. In addition, the flow records and equivalent population figures shown in the Annual Reports and Infiltration/Inflow (I/I) reports are referenced to assess the infiltration and inflow in the collection system.

2.3.5 Task 5 - Alternative Evaluation as Required

The City has been directed by PADER to examine alternatives to meet its 5-year wastewater facility needs. As a means of representing the level of effort typical to this aspect of the Act 537 Plan, we will describe two "hypothetical" alternatives and our approach towards evaluation.

A typical plan will, for example, identify and analyze the need for additional primary tanks at the Northeast WPCP, and for extension of the collection system in the Northwest part of the City, i.e., portions of Roxborough, Manayunk, and Chestnut Hill. The plan will evaluate facility alternatives for consistency with county, state, and regional programs. It will evaluate the feasibility of each alternative and present an economic analysis, as appropriate. The plan will also analyze the potential recreation and open-space opportunities in the planning of the proposed facilities.

2.3.6 Task 6 - Institutional Evaluation

The institutional evaluation involves identification of existing public organizations and governmental authorities providing wastewater treatment services. Each entity is analyzed in terms of such factors as:

- Present indebtedness and potential borrowing capability
- Staffing and administrative resources
- Legal authority to implement planning recommendations
- Legal authority to operate, maintain, inspect, and test treatment facilities
- Legal authority to collect revenues, implement provisions of adopted ordinances, and negotiate with sewer users

The Plan recommends administrative and legal activities to ensure Plan implementation, as necessary, and identify methods of financing construction and operation of the sewerage system.

2.3.7 Task 7 - Select Wastewater Treatment and Institutional Alternatives

The Plan identifies and describes the technical and institutional alternatives of choice that are necessary to meet the 5-year needs. This selection is based on all information reviewed and described previously herein.

2.3.8 Task 8 - Implementation

A schedule is developed for carrying out the recommended Official Plan. The schedule includes milestone dates for design, construction, and startup of any capital facilities designated in the 5-year plan. In addition, a schedule for initiation of any feasibility studies is proposed.
In terms of the funding application process, the Plan identifies milestone dates for both the primary and secondary sources of funding.

2.4 WASTEWATER FACILITIES LEGISLATION, REGULATION, AND RESPONSIBILITY

The following is a synopsis of the federal, regional, state, and local standards and regulations that control the planning, permitting, construction, and operation of wastewater facilities in Philadelphia County. Although many of the pieces of legislation examined pertain to the overall protection of water quality, only those aspects relating to wastewater facilities are discussed herein.

It should be noted that recent regulatory proposals dealing with specific wastewater related topics have been incorporated into Section 6.4 of this Plan.

2.4.1 Federal Standards and Regulations

2.4.1.1 Clean Water Act

The most significant federal legislation pertaining to water quality is the Clean Water Act. This Act is essentially a compilation of amendments that have been made over the years to the 1948 Federal Water Pollution Control Act. The most important amendments occurred in 1972, 1977, 1981, and 1987. The 1977 amendments included the renaming of the Act to the Clean Water Act. The administrator of the Act is the U.S. Environmental Protection Agency (EPA).

As it presently stands, the Act consists of six titles. Title I specifies the prime objective of the Act: "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." To achieve this objective, several national goals are declared, including:

- Waters should be fishable and swimmable by 1983.
- The discharge of pollutants to waters should be eliminated by 1985.
- The discharge of toxic pollutants in toxic amounts should be prohibited.
- Federal financial assistance should be provided for the construction of public wastewater facilities.
- Area-wide waste treatment management planning should be developed and implemented.
- A major research and demonstration effort should be made to develop the technology necessary to eliminate the discharge of pollutants.

Title II of the Clean Water Act establishes procedures for federal assistance for public wastewater facilities and authorizes funding appropriations for projects under this Title. Section 208 of Title II directs states to develop areawide wastewater management plans for areas identified as having

water quality control problems. Such a plan was conducted by the Delaware Valley Regional Planning Commission for southeastern Pennsylvania (including Philadelphia County). That plan is titled COWAMP/208: Water Quality Management Plan, Southeastern Pennsylvania (1980).

The main purpose of Title III is to establish effluent limitations for public dischargers, industrial waste and non-public dischargers, industrial users of public wastewater facilities, and toxic pollutants applicable to all dischargers. Title III also requires states to set water quality standards for state streams (based on protected uses of streams) in accordance with, or more stringent than, federal criteria. In addition, enforcement, inspection, and monitoring activities are prescribed to ensure compliance with the Act.

Title IV establishes the National Pollutant Discharge Elimination System (NPDES), which provides for the issuance of permits for discharges, to ensure compliance with effluent limitations. Title IV also provides for the establishment of ocean discharge criteria, permitting of dredged or fill materials (administered by the U.S. Army Corps of Engineers), and control of sewage sludge disposal.

Title V contains general provisions for administration of the Act. It establishes a water pollution control advisory board that assists the EPA in administering the provisions of the Clean Water Act. In addition, this title requires the submittal of reports to Congress on the measures that have been taken to implement the objectives of the Act.

Through the 1987 amendments to the Act, Title VI establishes provisions for the EPA to make capitalization grants to each state for the purpose of developing water pollution control revolving funds. The revolving funds are to provide assistance for construction of public wastewater facilities, implementation of non-point source management programs, and development and implementation of conservation and management plans for estuaries for national significance.

In addition, Section 320 of the Federal Water Quality Act establishes a National Estuary Protection Program to promote long-term planning and management in nationally significant estuaries that are threatened by pollution, development, or overuse. The overall goal of the program is to protect and improve the water and sediment quality of these estuaries, thus enhancing the living resources of the Nation. The Act specifically names estuaries that are to receive priority consideration by the EPA for inclusion in the program. The Delaware Bay was included in the list. A significant portion of the contributing flow to the Delaware Bay has its origin in Pennsylvania watersheds, including the City of Philadelphia and its associated planning area.

Pennsylvania is cooperating with New Jersey, Delaware, and the EPA to develop a Comprehensive Management Plan for the Delaware Estuary. This plan will include Pennsylvania's strategy to integrate the Federal Water Quality Act's initiatives for the Delaware Bay into its ongoing water quality management program activities. The intended result is the development of a comprehensive conservation and management plan that recommends priority corrective actions and compliance schedules addressing point and non-point sources of pollution to restore and maintain the chemical, physical, and biological integrity of the estuary. Plan goals will include

restoration and maintenance of water quality; establishment of a balanced indigenous population of shellfish, fish, and wildlife; and enhancement of recreational activities in the estuary. In addition, the plan will ensure that the designated uses of the estuary are protected. These plans will be reviewed by the EPA and will be implemented in accordance with schedules established in the plan.

2.4.1.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 provides for the consideration of environmental consequences of federal actions by requiring that all federal agencies submit an Environmental Impact Statement (EIS) for any project that directly or indirectly affects the human environment and uses federal funding, federal land leasing, or required federal permits for operation. EISs include a discussion of the positive and negative effects on the environment resulting from proposed projects and alternatives to the projects. As administrator of the construction grants program under Title II of the Clean Water Act, the EPA is the reviewer of EISs on wastewater projects having significant environmental impact and requesting federal subsidy.

2.4.2 Regional Standards and Regulations

2.4.2.1 Delaware River Basin Commission

The Delaware River Basin Commission (DRBC) has the responsibility under an interstate compact to manage the water and water-related resources of the Delaware River Basin. Its members include the governors of Pennsylvania, New York, New Jersey, and Delaware and an appointee of the President of the United States. It is the intent of DRBC to adopt uniform and coordinated policies for water conservation, control, and use and management in the basin (including those for water supply, water pollution control, flood protection, watershed management, recreation, hydroelectric power generation, water withdrawals, and diversions), in addition to establishing standards for the planning, development, and financing of water resource projects according to such plans and policies.

2.4.2.2 COWAMP/208 Regional Water Quality Management Plan

The COWAMP/208 program has its origin in the Clean Water Act. The "208" portion of the program's name refers to Section 208 of the Act, which provides for areawide waste treatment management programs. The "COWAMP" portion of the name refers to the Comprehensive Water Quality Management Plan, a statewide program initiated by the Pennsylvania Department of Environmental Resources (PADER) in 1974. Aimed at evaluating water quality in a comprehensive manner, both programs deal with pollution sources such as urban storm water runoff, agricultural pollution, and wastewater treatment discharges.

In southeastern Pennsylvania (including the City of Philadelphia), these two programs were combined into a single plan - the COWAMP/208 Water Quality Management Plan. This plan was prepared by the Delaware Valley Regional Planning Commission and approved by the Governor

and EPA in 1980. It has provided a framework for water quality management in the region since that time. Although wastewater projections produced in the plan may be out of date, the Clean Water Act requires that wastewater facilities be consistent with this plan and any differences be addressed and justified.

2.4.3 State Standards and Regulations

2.4.3.1 Clean Streams Law

The most significant State legislation pertaining to the protection of water quality is the Pennsylvania Clean Streams Law. The law was enacted on June 22, 1937, and has been amended several times through the 1980s. The purpose of the law is to preserve and improve the purity of waters in the Commonwealth. It declares that the discharge of sewage, industrial wastes, or any substance that causes or contributes to water pollution is not a reasonable or natural use of water, is against public policy, and is a public nuisance. To ensure compliance with the law, the State granted PADER the authority to formulate, adopt, and enforce rules and regulations; establish policies and priorities; and issue orders or permits for pollutant discharges. PADER also has the authority to establish policies for effective water quality control and management in the Commonwealth and to develop and implement comprehensive plans for public water supply and waste management (e.g., Comprehensive Water Quality Management Programs [COWAMPs]). Fines, civil penalties, bond forfeitures, and permit fees are paid into a Clean Water Fund that, in turn, is used to eliminate pollution.

The rules and regulations promulgated by PADER in accordance with the Clean Streams Law are contained within Chapters 91 through 103 of PADER's "Title 25: Rules and Regulations." The following listed chapters are specifically related to discharges of pollutants:

- Chapter 91: General Provisions - Administration of the Clean Streams Law
- Chapter 92: National Pollutant Discharge Elimination System (NPDES) - Permits are required for point source discharge of pollutants. Monitoring may be required.
- Chapter 93: Water Quality Standards - Establishes protected uses for waters of the Commonwealth and sets safe concentration limits for pollutants. Wasteload allocation and ambient stream concentrations are used to establish effluent limitations.
- Chapter 94: Municipal Wasteload Management - Requires wastewater facility owners/operators to manage wasteloads, submit an annual report to PADER, submit a plan to reduce overloads, and develop and implement an industrial waste pretreatment program. Allows PADER to impose a ban on connections to wastewater treatment facilities under certain conditions.

- Chapter 95: Wastewater Treatment Requirements - Specifies treatment requirements for dischargers; prescribes phosphorus limitations for discharge to lakes, impoundments, and streams.

- Chapter 97: Industrial Wastes - Establishes treatment requirements for industrial discharges and specifies pretreatment standards for industrial wastes discharged to public wastewater facilities.

- Chapter 101: Special Water Pollution Regulations - Establishes regulations for pollution incidents, activities utilizing polluting substances, impoundments for polluting substances, and agricultural pollution control.

2.4.3.2 Pennsylvania Sewage Facilities Act

The Pennsylvania Sewage Facilities Act of 1966 (as amended), more commonly referred to as "Act 537," is the primary legislation regulating individual and community sewage disposal systems and sewage facility planning in general. The Act requires municipalities to submit (individually or jointly) official sewage facilities plans to PADER for approval and to provide plan revisions when necessary. Residents or property owners may also request PADER to require a municipality to revise its official plan. Official sewage facilities plans are required to determine the existing and future sewerage needs of the municipality(s) and develop wastewater facility alternatives to address these needs, taking into consideration municipal land use planning, existing state plans, population estimates, engineering, and economics. These plans are to be reviewed by appropriate planning agencies, including an areawide planning agency. PADER is also authorized to administer grants to counties, municipalities, and authorities to assist in the preparation of official plans and revisions to these plans. The reimbursement for costs incurred through plan preparation will equal one-half of the total cost.

The Act requires that permits be issued for the construction, installation, or alteration of individual and community wastewater systems. The Act also establishes a state advisory committee that reviews proposed and existing rules, regulations, standards, and procedures. Rules and regulations regarding community and individual systems are developed by PADER and adopted by the Commonwealth's Environmental Quality Board. In addition, a State Board of Certification of Sewage Enforcement Officers is created to administer sewage enforcement officer certification programs. There are also provisions for issuing penalties and civil suits for violations of the Act in addition to provisions for hearing complaints and appeals for persons aggrieved by the action of Sewage Enforcement Officers.

The rules and regulations promulgated by PADER in accordance with the Pennsylvania Sewage Facilities Act are contained within Chapters 71, 72, and 73 of PADER's "Title 25: Rules and Regulations." The following list briefly summarizes the provisions of these chapters:

- Chapter 71: Administration of Sewage Facilities Program - Provides for a comprehensive planning mechanism for solving and preventing sewage disposal problems. Specifies various requirements for revision of official sewage

facilities plans and for acquiring planning grants. Specifies regulations pertaining to the use of holding tanks.

- Chapter 72: Administration of Sewage Facilities Permitting Program - Provides for the issuance of permits for subsurface sewage disposal systems and retaining tanks. Specific permitting responsibilities and procedures of local agencies and Sewage Enforcement Officers are detailed. Regulations for rural residence systems are also included.

- Chapter 73: Standards for Sewage Disposal Facilities - Establishes requirements for the design, location, and construction of sewage facilities to be administered by Sewage Enforcement Officers.

2.4.3.3 Pennsylvania Infrastructure Investment Authority Act

The Pennsylvania Infrastructure Investment Authority (PENNVEST) Act (Act 16) was signed into law on March 1, 1988. The Act creates a 13-member board that coordinates state appropriations, federal funds, and bond authorizations that can be used to assist municipalities in the financing of wastewater and water system construction, improvements, and expansion.

Moreover, the Act is now being implemented as regulated through the Pennsylvania code, "Title 25, Chapter 963, Pennsylvania Infrastructure Investment Authority."

The Delaware Estuary Program, previously discussed in Section 2.4.1.1, has a potential impact on the Water Pollution Control Revolving Fund (WPCRF), a component part of PENNVEST funding. Section 320(f)(2) of the Clean Water Act, which sets the requirement for implementation of the management plans, also states that funds authorized to be appropriate under Titles II and VI and Section 319 of the Act may be used to assist states with the implementation of the plans. The applicable requirements referred to are contained in Sections 602(b)(5) and 216 of the Act. These Sections limit the use of funds in a WPCRF to projects that ensure progress toward compliance with enforceable deadlines, goals, and requirements of the Act. Priority is established for projects for secondary treatment, more stringent treatment, infiltration/inflow correction, major sewer system rehabilitation, new collector sewers and appurtenances, and combined sewer overflows. Projects that meet the above description and are within the Delaware Estuary can receive funds under PENNVEST if the project is included in Pennsylvania's Intended Use Plan. After the enforceable needs have been met, funds can be used for implementation of the Delaware Estuary Comprehensive Management Plan.

While attaining compliance with all the enforceable requirements of the Act will be a long-term project, the Delaware Estuary Comprehensive Management Plan will also identify projects that currently may be eligible for PENNVEST assistance now (priority list projects) in addition to future projects that may be funded from the WPCRF after all the statewide needs have been met.

2.4.3.4 Sewage Treatment Plant and Operators' Certification Act

The Sewage Treatment Plant and Operators' Certification Act of 1968 (as amended) creates a state board for the examination and certification of treatment facilities and sewage treatment plant operators. The Act requires that certified operators be responsible for the operation of treatment plants and distribution systems. A classification system is used in the certification of operators for specific types of treatment facilities.

2.4.3.5 Municipal Authorities Act

The Municipal Authorities Act of 1945 (as amended) allows for the incorporation of an authority by a particular municipality or group of municipalities. The Act prescribes the rights, powers, and duties of authorities and empowers them to acquire, construct, improve, maintain, and operate projects (such as wastewater facilities) and fix charges to the users in the area served by projects. In addition, authorities may borrow money and issue bonds for projects. The Act also prescribes the rights of bondholders, confers the right of eminent domain on authorities, and allows authorities to enter into contracts with and accept grants from the federal government.

2.4.3.6 Borough Code, First Class Township Code and Second Class Township Code

The Borough Code (P.L. 581, February 1, 1966, as amended), the First Class Township Code (P.L. 1206, June 24, 1931, as amended), and the Second Class Township Code (P.L. 103, May 1, 1933, as amended) allow municipalities such as those tributary to the City of Philadelphia to construct or acquire wastewater systems, contract with other municipalities to form a joint system, or connect into sewers of adjacent municipalities. The cost of municipal wastewater systems can be financed through municipal funds or the issuance of bonds. Municipalities may also appropriate or transfer monies to a municipal authority to be used for planning, constructing, improving, or replacing facilities. Property owners who benefit from wastewater facilities may be assessed for the cost of construction of the facility on a front-footage basis or proportional basis through charged connection fees and charged use fees for operation and maintenance of the facility.

These codes also allow municipalities to establish boards of health and/or health officer(s) who may enact and enforce rules and regulations deemed necessary for the preservation of public health. In Philadelphia, the City of Philadelphia Health Department, authorized through the County Code and the Local Health Administration Law, provides for the protection of public health. In the outlying areas, municipal codes allow for the creation of municipal boards of health or health officers who administer on-lot sewage disposal management programs, ensuring proper operation and maintenance of on-lot systems.

2.4.3.7 County Code

The County Code (P.L. 323, August 9, 1955, as amended) allows counties to appropriate monies to municipalities to aid in the construction and maintenance of wastewater facilities. In addition, counties may create a board of health to improve and protect public health.

2.4.4 County/City Regulations

In addition to federal, regional, and Commonwealth legislation governing wastewater treatment and disposal, the City of Philadelphia has established policies and enacted ordinances pertaining to wastewater flow management. The primary legislation determining City policies is the Home Rule Charter. In particular, the City revised the Water Department Regulations in 1990 to adopt Wastewater Control Regulations in response to the Clean Water Act and the General Pretreatment Regulations. The Industrial Pretreatment Plan (IPP), which includes an Enforcement Response Plan (ERP), was developed to regulate non-domestic discharges to the City wastewater conveyance and treatment systems.

2.4.4.1 Home Rule Charter

The Philadelphia Home Rule Charter was adopted in April 1951. Section 5-800 authorizes PWD to operate the City's water supply and the City's wastewater collection, treatment, and disposal systems. PWD is further charged with ensuring sound and safe operation of the City's wastewater treatment plants and collection system and is responsible for maintenance, repair, and improvement of the City's wastewater facilities. When authorized by the City Council, the PWD shall acquire, design, and construct additional sewage facilities as needed to fulfill these charges.

The Charter grants PWD the authority to fix and regulate rates for wastewater disposal services so as to yield at least an amount equal to operating expenses and interest and sinking fund charges on any debt incurred, or about to be incurred, for wastewater disposal services. When authorized by the City Council, PWD may contract to supply the services of City water and wastewater facilities to users outside the City limits.

A provision in the Charter grants City Council the power to create an authority or contract with a private operator to supply the above services to the City and to abolish the PWD. This transfer of responsibility to an authority or private owner is allowable if such course of action would be an advantage to the City and beneficial to its citizens.

2.4.4.2 Wastewater Control Regulations

The PWD has adopted Wastewater Control Regulations to meet the Home Rule Charter mandate, as well as the Clean Water Act requirement, that the City prevent the introduction of pollutants into the City's wastewater system. These regulations apply to all contributors to the wastewater collection and treatment system and ensure compliance with all applicable federal and state laws. These regulations provide for the issuance of permits to certain non-domestic and industrial users and enforcement of general requirements for other users; authorize monitoring and enforcement activities; and require user reporting and compliance schedule submissions. Further discussion of these regulations is contained in Section 4.4, and a copy is included in Appendix A.

2.4.4.3 Industrial Pretreatment Plan

As the owner and operator of three publicly owned treatment works (POTWs), the PWD has the primary responsibility for enforcing all federal pretreatment requirements as stipulated in the Clean Water Act, the City's Wastewater Control Regulations, and the City's NPDES permits. The Enforcement Response Plan (ERP) of the IPP was developed to meet this responsibility. The ERP establishes guidelines for identifying non-compliance, enforcement responses, calculation of fines, and compliance schedules. The ERP may be amended at any time and for any reason at the sole discretion of the PWD. A more detailed discussion of the ERP is included in Section 4.4.3.

2.5 PREVIOUS STUDIES AND PLANNING

2.5.1 Existing Facility Plans

2.5.1.1 Report on Design Studies, Northeast Water Pollution Control Plant, for the Philadelphia Water Department, March 1972

The "Report on Design Studies for the Northeast Water Pollution Control Plant" is one of three such reports prepared for the Philadelphia Water Department in 1972 and 1973. These reports discuss the basis for design and the evaluation of alternative systems for improvements to each of the three water pollution control plants (WPCPs) within Philadelphia. These improvements were proposed in response to more aggressive wastewater treatment requirements being implemented at the time by federal, regional, and state regulatory agencies that mandated secondary treatment of wastewater, to an expected increase in tributary size due to the planned regionalization of the southeast Pennsylvania wastewater collection and treatment systems, and to an expected increase of population within Philadelphia and the surrounding region.

This report includes a study of the Northeast WPCP's tributary area and contributing population at the time the report was written, and the projected increase in size of the area and population to the year 2020 based upon the extension of the tributary areas into surrounding counties and an increase in population. An evaluation of the wastewater flows and characteristics is described, projecting the amount and loadings of the wastewater flow to be handled in the year 2020. Furthermore, a description of the existing facilities at the Northeast WPCP is presented. These existing facilities treated wastewater through screening, grit chamber, primary sedimentation, and secondary treatment by means of the modified aeration activated sludge process. At the time the report was written, the WPCP's biosolids (sludge) were barged to sea and dumped in the ocean.

Based upon a comparison of the required level of treatment, expected wastewater flows, and loadings to the existing facilities, the needs of the Northeast WPCP were assessed, including resolving the primary problems at the plant related to the following:

- Air supply capabilities
- Final tank solids withdrawal and return capabilities
- Separation of flow from separate interceptors with different industrial-strength wastewater

Several alternative systems were considered to meet the expanded needs at the WPCP including:

1. Conventional activated sludge
2. Step aeration
3. Contact stabilization
4. The Kraus Process
5. The complete mix activated sludge
6. The Unox Process

Following the evaluation of the above processes, a detailed description of proposed facilities is presented. The selected plan includes the expansion of plant capacity from 100 mgd to 250 mgd and an arrangement for full-activated sludge treatment with pure oxygen aeration based on the Unox Process. Furthermore, it is noted that the Philadelphia Water Department to continue to research alternative biosolids management methods, since biosolids disposal at sea might not be an indefinitely viable alternative. Preliminary outline plans are presented to be phased into three stages of construction at a total cost of $71,600,000 (1972 dollars).

2.5.1.2 Report on Design Studies, Southwest Water Pollution Control Plant, for the Philadelphia Water Department, October 1972

The "Report on Design Studies for the Southwest Water Pollution Control Plant" is the second study prepared for the PWD. It presents the basis for design and the evaluation of alternative systems for improvements to each of the three Philadelphia WPCPs. Similar to the Northeast Water Pollution Control Plant improvements, the improvements proposed for the Southwest WPCP are in response to the increase in wastewater treatment requirements evolving at the time, which mandated secondary treatment of wastewater and regionalization of the wastewater collection and treatment systems.

Included in the Southwest Report are many of the tabulations and projections of population and wastewater flows that were developed in the Northeast WPCP Report. The Southwest Report also discusses plans by the Delaware Valley Regional Planning Commission (DVRPC) to regionalize the wastewater systems and possibly eliminate five wastewater treatment plants in counties surrounding Philadelphia. The tributary areas of these five plants would then be routed to the three Philadelphia Water Pollution Control Plants. The population projections on which the expansion and improvements to the Southwest WPCP are based (to the year 2020) accommodate this regionalization plan. Again, following the format established in the Report on Design Studies for the Northeast WPCP, the Southwest Report uses these tributary and population projections to develop wastewater flows and loading projections to the year 2020. Furthermore, a description of the existing facilities is presented. At the time this report was written, wastewater was treated at the Southwest WPCP through a primary treatment process including removal and grinding of

screenings, grit removal, flocculation, and sedimentation. Biosolids (sludge) from the Southwest and Southeast Plants was treated at the Southwest WPCP through a process including concentration tanks, heaters, digestion tanks, and lagoons. The digested biosolids were barged and dispersed at sea.

Through consideration of the existing facilities and the anticipated flows and loadings to be handled in the future, the report includes an evaluation of the needs at the Southwest WPCP. It noted that the required ultimate capacity of the Southwest WPCP was dependent on an accurate estimation of the actual regionalization that would occur under the DVRPC plan. A moderate estimate of growth and regionalization was chosen to raise the capacity of the Southwest WPCP from 136 mgd to 210 mgd. Full regionalization and healthy growth of the population would have ultimately resulted in a capacity of 515 mgd at the Southwest WPCP. The report contends that several modifications to the activated sludge process were considered to provide adequate treatment for the anticipated flows; however, the evaluation concentrated on the Unox Process in which pure oxygen is used in the aeration process. This evaluation included a pilot plant study of the Unox Process; a report on this pilot study is appended to the Southwest Report. Consideration was given to additional sludge treatment facilities including the two processes listed below. However, it was determined that the existing biosolids disposal facilities were adequate through 1990.

- Anaerobic digestion of primary and waste-activated sludge
- Anaerobic digestion of primary sludge and aerobic digestion of waste activated sludge

The report goes on to make a recommendation of facilities to meet the future demands (210 mgd) at the Southwest WPCP based on the Unox Process. Construction cost estimates and preliminary outline plans conclude the report.

2.5.1.3 Report on Design Studies, Southeast Water Pollution Control Plant, for the Philadelphia Water Department, January 1973

The "Report on Design Studies, Southeast Water Pollution Control Plant" prepared for the PWD is the final of the three design reports commissioned to evaluate the needs, alternatives, and design of improvements at the three water pollution control plants. The Southeast Report follows the format and basic content of the previous two reports with the same goal of meeting more stringent wastewater treatment parameters for a population expected through the year 2020. The Southeast WPCP and its service area are sandwiched between the Northeast and Southwest WPCPs and their respective service areas. The service area is well-defined and is not expected to experience any growth during any proposed regionalization. Therefore, it predicts a minimal expected increase in wastewater flows.

The population and wastewater projections that were presented in the Northeast Report are reprinted in the Southeast Report; however, the discussion on regionalization is minimal, because the increase in wastewater flows is expected to be slight. The flow to the Southeast WPCP at the

time the report was written was 136 mgd, and the expected 1990 flow was only 140 mgd. The primary improvements considered are in response to meeting higher quality effluent requirements, as detailed in the previous reports. A description of the existing facilities is presented. This facility provided primary treatment through the removal and grinding of screenings, grit removal, flocculation, and sedimentation before discharging into the Delaware River. As noted in the Southwest Report, the pumping station pumps the Southeast WPCP's sludge to the Southwest WPCP for further treatment and eventual dispersal at sea.

Because only a minimal increase in plant capacity was expected, the improvements to the Southeast WPCP were considered in response to the need to provide secondary treatment. Several systems were evaluated to determine the most effective secondary treatment process that would meet the additional treatment standards. The following systems were considered:

1. Physical-chemical treatment pilot study in accordance with the Z-M Process
2. Activated sludge study using air aeration
3. Activated sludge study using oxygen aeration (Unox Process)

Although both the activated sludge processes using air and oxygen met the required standards for treatment, the oxygen aeration system provided more consistent results. Therefore, the improvements at the Southeast WPCP were designed using the Unox Process for secondary treatment using oxygen aeration.

The report notes that the dispersal of digested biosolids at sea might not be a viable disposal option in the future and considers several alternative biosolids management options to be added to the Southeast WPCP facilities. The conclusion of these considerations is the recommendation to employ heat treatment for the conditioning of combined primary and thickened waste-activated sludge, followed by vacuum filtration and incineration at the Southeast WPCP. It is also noted that a final proposal and decision on the disposal of the biosolids is contingent upon several studies which were still underway at the time. The report concludes with a description of proposed facilities and processes, construction cost estimates, and preliminary outline plans.

2.5.1.4 Revisions to the Wastewater Flow and Strength Projections for the Northeast and Southwest Water Pollution Control Plants, for the Philadelphia Water Department

In the early 1980s, the PWD reassessed the flow and wastewater strength projections for the Northeast and Southwest Water Pollution Control Plants. The Reports on Design Studies, published in 1972 and 1973, projected greater population growth than that reported in the 1980 census. (See Plant Project Reports above.) This current data was used within the Capital Improvement Plan in determining the impact of reduced population on the process elements that were not yet under construction in 1983, when the revised report on wastewater flow and strength projections was submitted. Of the four remaining process elements considered for the Northeast WPCP, two were in the wastewater treatment train and two in the biosolids train. The modifications to the treatment processes in the wastewater train were to the existing primary and final sedimentation tanks. The remaining biosolids processing elements were modifications to the existing sludge digestion facility and a new biosolids dewatering facility. Consideration was given

to alternatives that ranged from complete remodeling of the units to abandonment. Since the biosolids dewatering facility was to be new construction, it could be sized for revised flow and biosolids projections.

This revised report concluded that $4.3 million dollars could be saved at the Northeast WPCP if the following revisions were implemented:

- Plant flow - 210 mgd
- Wastewater strength
  - BOD_5 - 200 mg/l
  - SS - 270 mg/l
- Meter vaults and connecting sewers - Phase II
  - Utilize existing conduit
- Existing primary sedimentation tanks
  - Modify all existing tanks
- Existing final sedimentation tanks
  - Modify existing Tanks 1-4
  - Abandon Tanks A-D
- Existing digestion facility
  - Modify four existing tanks
  - Demolish remaining four tanks
- New biosolids dewatering facility
  - Construct new facility utilizing centrifuge equipment

Southwest WPCP recommended revisions included:

- Plant flow - 200- mgd
- Wastewater strength
  - BOD_5 - 117 mg/l
  - SS - 214 mg/l

- New biosolids dewatering facility
  - Construct new facility utilizing centrifuge equipment

2.5.1.5 Facility Plan, City of Philadelphia, Combined Sewer Overflow Control, Prepared for Philadelphia Water Department, Water Pollution Control Division, by Watermation, Inc., July 1976

The "Facility Plan for the Combined Sewer Overflow Control System" evaluated the existing system and, in light of the reasons enumerated below, made recommendations for the Philadelphia Water Department to implement a centralized computer control system that would monitor and manipulate the overflow regulators within the combined sewer system. This report and subsequent improvements were precipitated by the following issues:

1. Philadelphia's NPDES permit issued February 13, 1975, stated that the Combined Sewer overflow (CSO) points "serve as combined sewer reliefs necessitated by storm water entering the sewer system and exceeding the hydraulic capacity of the sewers and/or the treatment plant and are permitted to discharge only for such reason. There is at this time no specific effluent limitations on these discharges."

2. The net positive impact of the improvements to the three Water Pollution Control Plants provided by the addition of secondary treatment facilities would have been diminished due to dry weather and wet weather overflows.

3. Minimizing dry-weather overflows would facilitate achievement of the national goal to provide secondary treatment to all dry-weather wastewater flow.

4. Tidal inflow through the existing regulators would be reduced.

5. Water quality and public use of the surrounding rivers and streams would be enhanced.

At the time this report was written, there were 176 regulators within the Philadelphia Combined Sewer System. These regulators accounted for an estimated 15 percent of the total waste loadings, dry and wet weather, discharged by the Philadelphia wastewater system. Furthermore, it was noted that 88 regulators were tidally affected and problems at some sites contributed an estimated 3 percent of the average daily flow to the Philadelphia wastewater system through inflow. These regulators were occasionally blocked or malfunctioning and required further action. The impact of the regulators and their dry- and wet-weather overflow was expected to be exacerbated by the proposed expansions and improvements at the three wastewater treatment plants to provide secondary treatment. With secondary treatment resulting in a significant increase in pollutant uptake, it was estimated that the proportion of wastewater effluent loadings

from the overflow of the combined sewers would increase to 30 percent of the total wasteload of the wastewater system.

The Facility Plan included a cost/benefit analysis and seven alternatives to meet the goals stated above:

1. Continuation of Present Activities (No Action)

2. Sewer Separation

3. Operational Control of the Existing System
   a) Manual Methods
   b) Manual Methods plus Monitoring
   c) Automated Control and Monitoring

4. Storage and Subsequent Treatment

5. Direct Treatment of Overflows

6. Dual use of Treatment Facilities

7. Combinations of the Above

The automated control and monitoring system was chosen as the most cost-effective method available to meet the intended result and was evaluated at length in the text of the report.

The recommendation of the Facility Plan includes a plan to consolidate the number of regulators from 176 to a more reasonable number. Measuring devices would be set up in each remaining regulator to monitor rainfall, tide depth, combined and interceptor sewer levels. New gate control devices, such as oil hydraulic cylinders or new float control devices, would be installed in each regulator to permit automatic operation by the regulator control center computer in response to systemwide monitoring data. This system would also give the operator the capability of storing flows within the trunk sewers, thus maximizing system storage. It was expected that the remote monitoring system would also optimize the maintenance efforts of the PWD staff by allowing the dispatching of maintenance crews to problem sites more effectively.

The CSO program discussed above was later modified and implemented in the Northeast Drainage District as a result of the 1978 Consent Decree between the City and the EPA.

The Facility Plan includes a schedule to have the system installed and operable within six years. However, the Facility Plan was developed with research conducted almost 20 years ago. As a result, the PWD does not believe it necessarily reflects current conditions within the CSO system.

Since 1982 almost $1.0 million has been spent on the rehabilitation of the regulators and tide gates. During the same period of time, the PWD has increased its emphasis on day-to-day operation and maintenance activities.

2.5.1.6 201 Facility Plan for Sludge Management - Final Report, for the Philadelphia Water Department, by Greeley & Hansen Engineers, June 1984

The "201 Facility Plan for Sludge Management" was precipitated by the need for an effective biosolids management system that would replace ocean dispersal, which had been terminated in 1980. Furthermore, a new biosolids management system was needed to treat and dispose of an expected increase in biosolids load due to the improved wastewater treatment processes that had been installed at the Philadelphia WPCPs in response to more stringent regional water quality standards. When completed, the improved treatment processes were expected to generate 465 dry tons of sludge per day.

This report includes an evaluation of 10 alternative systems for biosolids management and utilization, including two separate methods of biosolids dewatering and five basic biosolids processing technologies:

- Composting
- Incineration
- Co-incineration with solid waste in a watergrate furnace
- Co-incineration with solid waste in a residue fusion process (Ecorock)
- Landfilling

The evaluation of the alternatives included cost and environmental considerations, a value engineering workshop, and consideration of public comment which was solicited during the review process. The selected plan includes the following provisions:

1. Sludge from the Southeast WPCP would continue to be pumped via an existing pipeline to the Southwest WPCP where it would be mixed with the Southwest WPCP sludge and anaerobically digested. Sludge at the Northeast WPCP would be anaerobically digested and thickened before being barged to the Southwest WPCP to receive further treatment.

2. The digested biosolids from the three water pollution control plants would be dewatered to a solids concentration of 20 percent in centrifuges and composted at a centralized facility at the Southwest WPCP. The dewatered biosolids would be mixed with wood chips and piled for a period of 21 days where drawn air and heat would produce an aerobic digestion process to eliminate any remaining pathogens. Afterwards, the mixture would be cured before wood chip removal and preparation of the biosolids for a variety of utilizations.

At the time the plan was written, the biosolids utilization efforts were expected to meet the following demands:

Marketing as a commercial soil conditioner	50 percent
Application to local programs within Philadelphia	20 percent - 40 percent
Strip mine reclamation throughout Pennsylvania	10 percent - 30 percent

The report also contends that additional utilization techniques would be developed because the above uses would be stabilized or diminished as the program progressed.

It was estimated that the proposed systems would cost a total of $225,000,000. The plan would be financed through EPA construction grants and an increased charge to Philadelphia's customers of approximately $37.00 per year.

An environmental assessment of the plan concluded that no significant adverse impacts would result from its implementation.

2.5.2 Sewer System Evaluation Survey (SSES) Reports

Public Law 92-500 required that excessive infiltration and inflow be identified and eliminated from wastewater systems that are seeking federal funding for improvements to the collection and treatment facilities. This law seeks to ensure that public monies are most effectively spent by eliminating extraneous flow from the system which would otherwise increase the amount of treatment capacity, capital, and operating expenditures. In pursuit of federal funding for the planned upgrades of the three water pollution control plants from primary to secondary treatment and expanded capacity, the Philadelphia Water Department undertook an infiltration and inflow (I/I) study titled "Infiltration/Inflow Analysis, Philadelphia Sewer System," dated February 5, 1975. This study indicated the presence of infiltration and inflow in each of the three wastewater service areas within Philadelphia and led to three subsequent sewer system evaluation surveys (SSESs). Each of the three service areas were extensively studied by separate consulting engineering firms over the next five years in order to identify the sources of excessive I/I PADER subsequently concurred with the PWD in its determination that elimination or reduction of infiltration and inflow was not cost-effective.

2.5.2.1 Sewer System Evaluation Survey, Northeast Drainage District, City of Philadelphia, December 1981

The SSES of the Northeast Drainage District included the following tasks:

- Flow monitoring to identify areas with possible excessive infiltration

- Physical survey to identify manholes and line segments with possible excessive infiltration
- Rainfall simulation to identify inflow sources in the separated sewer system
- Internal inspection of the sewers to identify infiltration sources
- Sewer system evaluation report to determine the excessive I/I sources and to develop a rehabilitation program

The flow monitoring efforts quantified an estimated 74.6 million gallons per day (mgd) of annual average infiltration (32.3 mgd considered excessive), 294 million gallons per year (mgy) of annual inflow (122 mgy considered excessive), and 5.5 mgd of tidal inflow from 15 regulating chambers (4.4 mgd considered excessive). The physical survey included the inspection of 3,700 manholes and recommended the internal inspection 282,000 linear feet of sewer line. The rainfall simulation identified 2,243 sources of inflow with an estimated annual flow of 118 mgy. Over 197,000 feet of sewer were inspected as a follow-up to the manhole inspection. The final report recommended improvements to the collection system that would result in the removal of approximately 8 mgd of infiltration and 100 mgy of inflow at an expected cost of $2.1 million, of which $1.86 million would be funded through federal grants (1981 dollars).

This study identified leakage from the water distribution system into the wastewater collection system as a source of infiltration. Furthermore, this report recommends additional study of leakage in the water distribution system and a permanent wastewater monitoring system to track the effectiveness of the recommended rehabilitation program.

2.5.2.2 Sewer System Evaluation Survey, Southeast Drainage District, City of Philadelphia, August 1981

The approach to the SSES in the Southeast Drainage District was performed in two steps:

1. Flow monitoring to identify areas with possibly excessive infiltration
2. Detailed investigation 1) to identify line segments and point sources with excessive infiltration, and 2) to develop a program for rehabilitation of the sources involved.

Flow monitoring concluded that the collection system in the Southeast service area was subject to an estimated 67.5 mgd of total infiltration and 11.2 mgd of exfiltration. Of the infiltration, an estimated 57.0 mgd was attributable to non-point sources (37.0 mgd considered excessive) and 10.5 mgd due to tidal and pump station foundation infiltration (10.0 mgd considered excessive). The study went on to recommend a rehabilitation program to eliminate the excessive infiltration at a cost of $1.9 million with an expected savings of $2.9 million over twenty years.

This study also identified leakage from the water distribution system, which accounts for a large portion (estimated at 80 percent) of the infiltration in the collection system. Additional study of the water system leakage was not authorized under this SSES.

2.5.2.3 Sewer System Evaluation Survey, Phase II Evaluation of Sewer Infiltration/Inflow, Southwest Drainage District, City of Philadelphia, June 1983

The Southwest Drainage District was evaluated for I/I through a six-stage process:

- Finalization of the plan of action
- Initial evaluations and system flow monitoring
- Physical survey
- Rainfall simulation (separate sewer system only)
- Preparatory sewer cleaning and internal inspections
- Economic analysis and final report

The evaluation of the collection system included an analysis of the water use records, groundwater monitoring, the inspection of 4,800 manholes and 47,000 feet of sewer line, and the televising of 59,000 feet of sewer line. These efforts resulted in the identification of an estimated 4.9 mgd of infiltration (4.5 mgd excessive) and 9.2 mgd of inflow (7.1 mgd excessive). The report recommends a rehabilitation program to remove the excessive I/I flows at a cost of $315,000 of which it was expected $275,000 would be funded through federal grants.

2.5.3 Land Use Planning and Zoning

The two primary guidance documents for growth and development in the City of Philadelphia are the Comprehensive Plan (1960) and the Zoning Code, (1962) as amended (Chapter 14 of the Philadelphia Code).

Since 1960, the City, in lieu of making one single revision to these documents or functional has chosen to develop district or functional area plans for certain neighborhoods. Plans for districts such as Roxborough - Manyunk, North Philadelphia, Center City, and West Philadelphia has been completed.

Systematic revisions to the City's Zoning Code have been ongoing since the 1970's as a cooperative effort between City Council and the City of Philadelphia Planning Commission. As an example, the Center City area went through zoning revisions about two years ago.

The City of Philadelphia Planning Commission has served for many years as the authority responsible for establishing comprehensive (land use) planning. As established by Act 537, the role and responsibility of the wastewater management agencies is to develop and implement plans for the handling of sewage in conformance with existing and proposed land use.

The following sections summarize development plans that were prepared by the Planning Commission for several regions of the City that exhibited a high potential for redevelopment in the 1980s.

In general, these development plans are not very specific in what will be done, but they identify the potential and some opportunities for growth. Refer to Figure 2.5-1, Land Use Planning Areas, for a delineation of the planning areas referenced in this section.

2.5.3.1 Eastwick Urban Renewal Plan Review, Philadelphia City Planning Commission, Completed April 1982, Adopted August 1982

This report details how this once semi-rural community is now an active area comprised of 10 different neighborhoods. The report expounds on the major accomplishments that had already been implemented at the time it was written:

1. The installation of almost 20 miles of new streets with water mains and sewers
2. More than 4,200 new housing units
3. Two new public schools
4. More than three dozen industrial and related buildings

The report also delineates the allowable land use of the Eastwick Area. According to the text, there were:

1. Nine hundred acres of land designated for residential and related uses

2. Seven hundred fifty acres of land designated or scheduled to be zoned for industrial, commercial, industrial-related, and airport-related commercial use

3. Eight hundred fifty acres of land designated for airport clear zone, streets, and I-95 right-of-way purpose

Finally, the report notes that while 1,600 acres of this land have been developed, 700 acres (30 percent of the redevelopment area) of land remain for potential development. At the time of writing, it was estimated that it would take at least 10 more years before the development project would be close to completion.

2.5.3.2 North Delaware Waterfront District Plan, Philadelphia City Planning Commission, 1982

This report details the existing and recommended land use of this heavily urbanized and predominantly industrial 3,400-acre area. The report states that there were 208 industrial firms in this district and 10,000 persons residing in the district. It also notes the following:

1. Industrial land use covers one-third of the district.

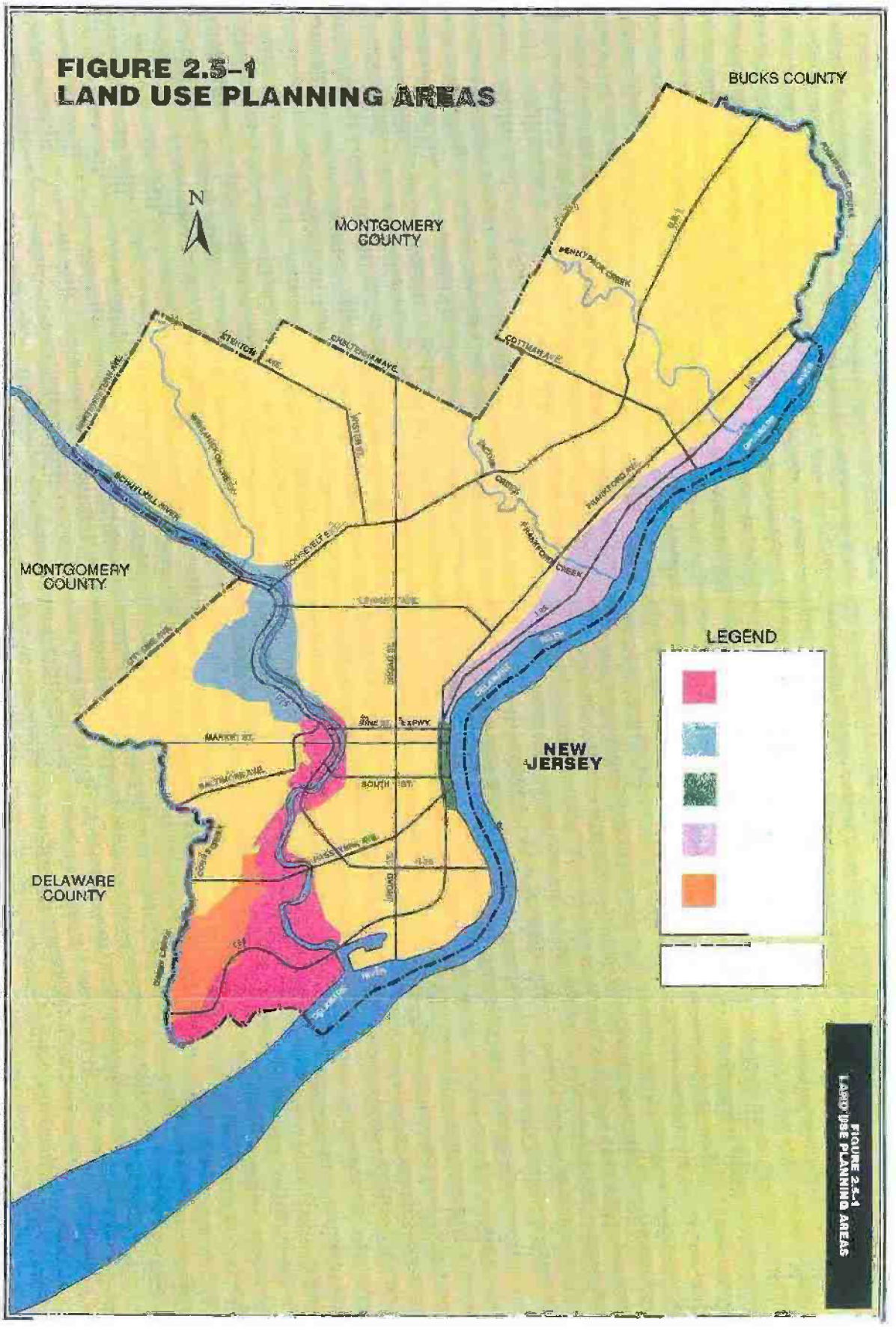
FIGURE 2.5-1
LAND USE PLANNING AREAS
BUCKS COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
DELAWARE COUNTY
NEW JERSEY
N
LEGEND
FIGURE 2.5-1
LAND USE PLANNING AREAS

2. Three hundred twenty-five acres of the district are zoned manufacturing/ commercial.

3. The district is almost fully developed with only one-tenth of the land classified as vacant.

The report recommends declaration of the following goals:

1. Maintain manufacturing employment and promote business expansion.
2. Attract new industrial and port-related development.
3. Promote new residential and commercial development.
4. Maintain and enhance existing residential communities.
5. Provide opportunities for the public to enjoy the special beauty of the waterfront.

The report does not include specific recommendations as to how to implement the above goals.

2.5.3.3 Central Riverfront District Plan, Philadelphia City Planning Commission, 1982

This report details the present and future conditions of this 200-acre area centered around Penn's Landing. The present conditions show that there were 30 acres of under-utilized railyards and obsolete piers, 24 acres used for public open space, and 40 acres of developable land area to the west.

The report states that at one time the Delaware and Schuylkill River waterfronts were almost entirely devoted to port and port-related uses. The report notes that a large portion of the waterfront remains as port uses; however, due to modern cargo handling technology, many of these facilities are obsolete and a significant amount of land used by supporting industries is no longer needed and is available for development. The report expounds that there are new opportunities for residential and commercial development within this district. It also states that full development of this area will result in the construction of approximately 5,000 to 6,000 housing units and the creation of a major new commercial and retail center. According to the report, these improvements were expected to take 10 to 15 years to complete.

2.5.3.4 Upper Schuylkill Waterfront District Plan, Philadelphia City Planning Commission, September 1984

This report details the existing and recommended land use of this 2,700 acre district. According to the report, there were 1,735 acres of recreational area, 500 acres for transportation, approximately 245 acres of vacant land, 116 acres of institutional lands, and 95 acres of manufacturing/commercial land. Furthermore, this district included 1,200 households, with a total of 3,461 persons.

The report recommended the declaration of the following goals:

1. Promote commercial and industrial revitalization and expansion to increase general employment and maintain current employment.

2. Attract new business consistent with developing the district to its full potential.

3. Maintain and enhance existing residential communities.

4. Provide more opportunities for the public to enjoy the special beauties of riverfront recreation.

5. Maintain and improve open space, and recreational and cultural resources.

The report did not detail specific recommendations to meet these goals.

2.5.3.5 The Future of Center City - Three Scenarios, Philadelphia City Planning Commission (no date noted)

This report presents three growth scenarios that discuss the demand for housing in Center City; it predicts that the surrounding (ring) neighborhoods will not experience a significant change. It expects that there will be an increased preference for urban living and, consequently, lower-scale infill housing in some areas will rise. According to this report, the Center City ring in 1980 had 26,000 households. Between the three scenarios, they project that Center City will experience an increase of between 600 and 8,000 new households, and the Center City ring will gain between 300 and 4,000 new households.

2.5.3.6 Lower Schuylkill Waterfront District Plan, Philadelphia City Planning Commission, 1983

This report states that this district contains 7,700 acres of land, including 330 acres of land zoned for residential and recreational use and 1,975 acres of land categorized as undeveloped land; two-thirds of the land is devoted to manufacturing, utilities, warehousing, the airport, rail rights-of-way, streets, and ports.

The report recommends the pursuit of the following goals:

1. Promote new residential development in Center City and West Philadelphia.

2. Enhance opportunities for public enjoyment of the Schuylkill and Delaware Rivers.

3. Maintain industrial employment and encourage business expansion.

4. Attract new business development.

The report does not offer specific recommendations on how to meet the above goals.

2.5.3.7 Zoning Remapping in Philadelphia, Philadelphia City Planning Commission, November 1984

This report details the zoning and remapping planned for Philadelphia and the reasons behind them. The report states that in 1983 there were 157 neighborhoods representing 60 percent of the City's land area. This referencing system has been replaced in 1989 by 165 neighborhoods with 54 zoning classifications: 31 residential, 10 commercial, and 9 industrial classifications, in addition to 4 special classifications. This report describes each of the classifications and where they are used.

2.5.4 Investing in Philadelphia - The 1991-1996 Capital Program, Philadelphia City Planning Commission (no date noted)

This report describes the appropriation and allocation of money for the improvement, development, and renewal of Philadelphia. According to the report, three of the investment areas for the capital program are Neighborhood Improvement, Economic Development, and Infrastructure Renewal, to which Philadelphia planned to allocate $1,049,000,000, $944,000,000, and $683,000,000, respectively, during this six-year period.

The report states that for the budget year under Neighborhood Improvement, $27,515,000 is appropriated for Recreation Facilities, $24,878,000 for housing and blight removal, and $2,666,000 for commercial centers. Furthermore, appropriations under Economic Development include $11,175,000 for industrial development, $3,729,000 for the Civic Center, and $1,500,000 for Penn's Landing. Finally, allocations under the Budget Year Infrastructure Renewal include $19,751,000 for recreation and cultural facilities, $6,381,000 for detention facilities, and $2,385,000 for sanitation.

2.5.5 Municipal Wasteload Management Reports (Chapter 94), City of Philadelphia, for the Pennsylvania Department of Environmental Resources, 1987-1991

The Municipal Wasteload Management Reports are prepared annually for the Pennsylvania Department of Environmental Resources (PADER) by the Philadelphia Water Department (PWD) in response to the requirements of Chapter 94 of the Rules and Regulations of the Department. Chapter 94 requires owners and operators of sewage facilities to properly manage their wasteloads. The goals are to prevent overloading of sewage facilities, limit additional connections to overloaded sewage systems, and improve opportunities to reclaim and recycle wastewater and sludge. The Municipal Wasteload Management Reports are required by PADER to monitor Chapter 94 requirements. Each report includes the following annual data:

- Pumping Station Capacity
- Outlying Municipality/Authority Flow
- Specific Plant Measurements for Flow and Organic Loading
- Organic Loading Graphs

- Hydraulic Loading Graphs
- Collector System
- Sewer Maintenance
- Industrial Pretreatment Program

Municipal Wasteload Management Reports for 1987 through 1991 have been reviewed and are referenced in Sections 4.2, 4.3, and 4.4 of this report.

2.5.6 COWAMP/208 Water Quality Management Plan for Southeastern Pennsylvania, Prepared for the Delaware Valley Regional Planning Commission and Pennsylvania Department of Environmental Resources, by Chester-Betz Engineers, April 1978

As required by the Clean Water Act of 1977, the "COWAMP/208 Water Quality Management Plan for Southeastern Pennsylvania" was prepared for the DVRPC and PADER by Chester-Betz Engineers to help maintain "clean water" in Southeastern Pennsylvania while also taking into consideration the present and future needs of the citizens of the region. The Comprehensive Water Quality Management Plan/208 (COWAMP/208) began in Southeastern Pennsylvania in 1974 as a regional water quality management program funded by the EPA and PADER. COWAMP/208 aims to develop a regional waste treatment management plan to protect surface and groundwater from pollution. The contents of the "COWAMP/208 Water Quality Management Plan for Southeastern Pennsylvania" include:

- Description of the Planing Framework
- Description of the Study Area
- Water Quality Assessment
- Discussion on Pollution Control: Problems, Policies, and Programs
- The Recommended Plan
- Public Participation
- Environmental Assessment Statement

2.5.7 Pennsylvania State Water Plan, SWP-4, Sub-basin 3, Lower Delaware River, Prepared By Office of Resources Management, Bureau of Water Resources Management, Pennsylvania Department of Environmental Resources, July 1983

The State Water Plan (SWP) provides a comprehensive evaluation of the State's water resources in the early 1980s, projects the condition of the water resources using concurrent trends, and provides recommendations to ensure proper management of the Commonwealth's water resources. The plan is evaluated at a regional level, and in this case, the region under consideration is the Lower Delaware River Basin. The primary waterways within this area are the Schuylkill River and the Lower Delaware River, which supply water to some or all of Philadelphia, Delaware, Chester, Montgomery, Berks, Schuylkill, Carbon, Lehigh, Bucks, Lancaster, and Lebanon Counties.

The SWP concentrates upon 1) the uses of the water resources in the Lower Delaware River Basin including domestic, economic, and recreational, and 2) how these uses impact the continued presence of adequate, high-quality water within the region. The SWP details the condition of both surface water and groundwater and projects future conditions based upon existing trends. The Plan contends that the existing trends are not acceptable or sufficient to guarantee an adequate quality water resource for the future. The report goes on to recommend that "decision makers" utilize this plan in concurrent and future processes to promote responsible resource management while maintaining consistency on a regional basis.

The SWP concentrates upon water supply and utility management and offers these five basic water supply recommendations.

1. Conservation
2. Water metering
3. Purchase of water from suppliers with excess capacity
4. Reduction of leakage
5. Regularization of the water supply

Although the SWP does consider water quality, it is not specific in its evaluation or recommendations for the Philadelphia wastewater collection or treatment systems. The SWP does note that the Philadelphia water and Philadelphia wastewater distribution and disposal systems direct a significant amount of flow from the Lower Schuylkill River to the Lower Delaware River; however, a proposal to rectify this situation or an indication that this is a critical situation is not provided within the plan. The information and water quality analyses within the plan will prove helpful and will be utilized within the planning considerations of the Philadelphia Wastewater System.

3.0 ASSESSMENT OF CURRENT SITUATION

3.1 PHYSICAL DESCRIPTION OF PLANNING AREA

The following sections provide a description of the physical characteristics of the planning area for this report that are germane to our planning analyses. Physical parameters such as geology, soils, wetlands, and surface waters either have a direct impact or are directly impacted by the effectiveness of the wastewater systems. The evaluation of the wastewater systems and recommendations drawn from those analyses will relate to the descriptions provided here.

3.1.1 Regional Geology

The geology of the study area for the Act 537 Plan is pertinent to the potential impacts on groundwater quality. Furthermore, groundwater quality will affect surface water quality as it percolates into surface streams as base flow. These considerations can be of particular interest when considering on-lot disposal systems (OLDS) or land application disposal techniques.

Geologic factors such as rock type, inclination, intergranular spacing, faults, joints, folds, bedding planes, and solution channels define the characteristics of the storage, transmission, and utilization capacity of groundwater. The bedrock characteristics have an immediate and overriding impact on the quality of the natural groundwater. For example, the more soluble geology structures will allow more material and compounds to be dissolved in the groundwater. As the dissolution of the geology structures increases, the porosity of the rock and ultimately the flow rates of the groundwater also increase, thus inhibiting the natural purification benefits of filtration and assimilation.

There are three rock classifications that will be used in this section to describe the geologic characteristics of the planning area: igneous, metamorphic, and sedimentary. A brief description of these classifications is presented here for clarity of the following discussion.

Igneous Rock Classifications

Igneous rocks are classified on the basis of two features: mineral composition and the texture of the rock. The igneous rocks that can be found in this planning area include pegmatite, granite, and basalt.

- Pegmatite is a very coarse-grained, light-colored igneous rock. Individual crystals frequently exceed one inch in diameter. Quartz, feldspar, and mica can easily be seen.

- Granite is a coarse-grained, light-colored igneous rock composed of mineral quartz, feldspar, mica, and hornblende.

- Basalt is a fine-grained, dark-colored igneous rock. In this area, basaltic rocks are usually found cutting across metamorphic rocks as intrusive sills or dikes. Further metamorphosis can change this rock into Amphibolite or Amphibole gneiss.

Metamorphic Rock Classifications

Metamorphic rocks are formed when existing rock masses are subjected to intense pressures and/or high temperatures. The metamorphic rock types that are found in this area are schist, phyllite, slate, gneiss, and quartzite:

- Schist is a dark metamorphic rock made up of flaky crystals large enough to be seen by the naked eye.
- Slate has crystals that are too small to be seen with the naked eye, and it appears to be quite uniform in composition.
- Phyllite is another metamorphic rock with crystals the size between those of a schist and slate.
- Gneiss contains crystals even larger than those in a schist. In the gneiss, various minerals have become segregated into distinct bands.
- Quartzite is a very hard metamorphic rock resulting from a sedimentary bank composed primarily of quartz, that was subjected to metamorphic pressures and/or temperature.

In certain locations, a thick unit of the metamorphic rock quartzite chickies is exposed. Quartzite chickies is a very hard, chemically stable rock that is resistant to breakage. The quartzite unit is surrounded by softer and more easily weathered limestones, dolomites, and phyllites.

Sedimentary Rock Classifications

A sedimentary rock is one that has been formed by the sedimentation and compaction of material eroded from previously existing geologic formations. In this area, limestone and dolomite are predominant.

- Limestone is a chemically precipitated sedimentary rock made up of the mineral calcite (composed of calcium carbonate).
- Dolomite is a chemically precipitated sedimentary rock that is similar to limestone, but is dominated by dolomite (calcium magnesium carbonate) rather than calcite.

Most of Philadelphia lies within the Coastal Plain Physiographic Province with the northwest portion of the City and a small section of the northeast jutting into the Piedmont Uplands section of the Piedmont Province. The delineation of the Coastal Plain and Piedmont Physiographic Provinces, as well as the predominant geologic structures within the planning area can be seen on Figure 3.1-1, Regional Geology Map, and Table 3.1.1. The key to the Geologic Formations is shown on Figure 3.1-1.

Coastal Plain Province

The Coastal Plain Province of the Lower Delaware River is a rectangular-shaped strip bordering the Delaware River for approximately 32 miles with an average width of 2 miles. Elevations in the Coastal Plain range from less than 10 feet along the Delaware River to slightly more than 40 feet at the northwest edge of the Province. The origin and condition of the geologic structures within the Coastal Plain are controlled by the alluvial action in the Delaware River and Bay. The sediments distributed by these bodies of water have resulted in an undisturbed sequence of unconsolidated and semi-consolidated sands, clays, and gravels that range in age between the Cretaceous and Quaternary Periods. The sequence of unconsolidated formations in the Philadelphia area is in ascending order, the Raritan and Majority Formations (Cretaceous in age), followed by the Pensauken and Cape May Formations (Quaternary in age). The Cretaceous Formations are unexposed in the planning area but present in the shallow subsurface. These formations provide an important source of industrial groundwater for the Philadelphia metropolitan area. The thickness of the deposits increases in a southwesterly direction from 0 feet to 400 feet at the Delaware River.

These unconsolidated sediments cover an extension of the consolidated Piedmont basement complex, which is composed of schist and granite members of the Wissahickon Formation. The Piedmont basement is covered by a thin layer of residual clay resulting from the weathering of the parent material. Local streams have downcut through the sediments of the Pensauken Formation in many places and exposed the Wissahickon Formation.

The Pensauken and Cape May Formations of the Coastal Plain consist primarily of sand, gravel, and clay. These formations have a typical thickness of 30 to 40 feet in Bucks County and Philadelphia County and they completely cover the underlying Cretaceous sediment. Together with the underlying upper sand member of the Raritan Formation that often lies in direct contact, these sands form the most exclusive aquifer in the Philadelphia area.

Piedmont Providence

The Piedmont Uplands Section is the most southerly section in the Pennsylvania portion of the Piedmont Province. Here, the more resistant rocks of the Piedmont Uplands give way to the less resistant Coastal Plain sediments. A distinct drop in elevation occurs at this point from the Piedmont hill elevations of about 150 feet above mean sea level (msl) to about 40 feet (msl) at the Coastal Plain Section.

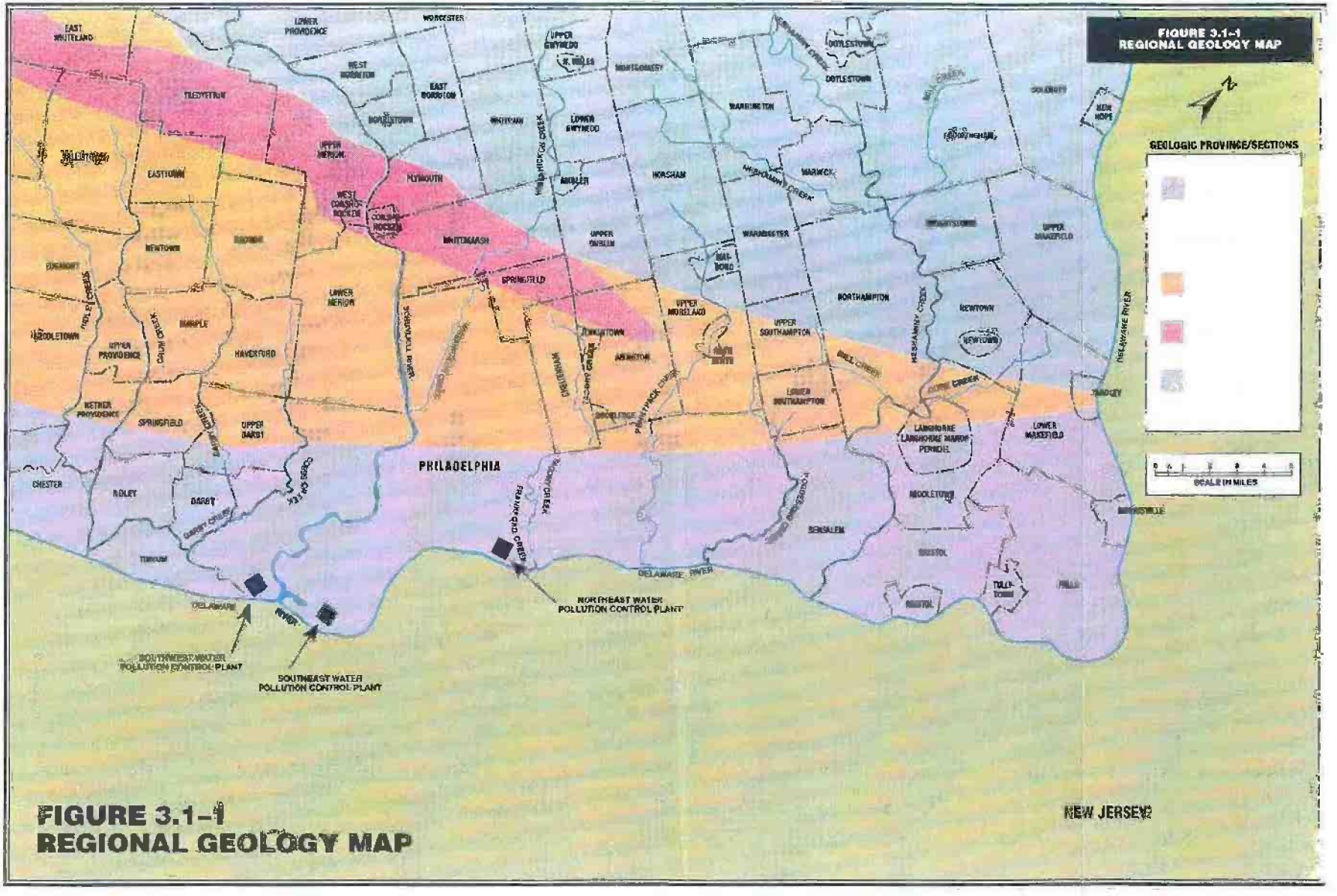

FIGURE 3.1-1
REGIONAL GEOLOGY MAP

BCM

TABLE 3.1.1

KEY TO GEOLOGIC FORMATIONS SHOWN IN FIGURE 3.1-1

Xs	**Probably Lower Paleozoic**	**Serpentinite**
	Includes serpentine, steatite, and associated products of alteration of peridotites and pyroxenites	
Xw	**Probably Lower Paleozoic** Oligoclase mica schist - Includes some hornholes gneiss members and some auger gneiss and quartz-rich and feldspar-rich members showing various degrees of granitization	**Wissahickon Formation**
Xhg	**Probably Lower Paleozoic** Includes rocks of probable 4-sedimentary origin; may be equivalent to Precambrian Hornblende gneiss	**Hornblende gneiss**
Xgr	**Probably Lower Paleozoic** Includes Springfield Granodiprite (granitite Wissahickon) and related rocks	**Granite gneiss and granite**
Qp	**Quaternary, Pleitocene** Sands and gravel with clay and silt at the base locally; includes areas of recent alluviation and swamp deposits	**Pensauken Formation**
Tpb?	**Triassic** Brunswick and Gettysburg - Red to brown, fine- to coarse-grained quartose sandstone with red shale interbeds; interbedded shale and limestone conglomerate and quartz pebble conglomerate	**Brunswick Formation or Gettysburg Formation**
Tbm	**Tertiary, Pliocene** High-level terrace deposits; sand and gravel with some silts	**Bryn Mawr Formation**
Qt		**Trenton gravel**
Kp	**Cretaceous** Highly colored clay with some sand	**Patapsco Formation**
Cch	**Cambrian** Chickies - Light gray, hard, massive, scolithus - bearing quartzite and quartz schist; interbedded dark slate at top; conglomerate at base.	**Chickies Formation**

Principal streams draining the Piedmont Upland Section of the sub-basin are the Brandywine, Red Clay, White Clay, Crum, Ridley, Chester, Darby, and French Creeks. Other streams including the Pennypack and Wissahickon Creeks originate in the Triassic Lowland and flow through the Upland Section.

As mentioned above, portions of northeast and northwest Philadelphia extend into the Piedmont Uplands Section. This Piedmont Uplands Section then continues northward into the southern portions of Bucks and Montgomery Counties and extends westward through Chester, Lancaster, and York Counties.

The Piedmont Uplands is underlain by three predominant rock types: igneous and metamorphic crystalline rocks (mostly granite and gneiss); metamorphic sedimentary rocks (schist, phyllite, and quartzite); and slightly metamorphic carbonate rocks (limestone and dolomite). The rocks exposed in this physiographic section within Philadelphia are shown on Figure 3.1-1.

The oldest rocks within the Piedmont Uplands are the complex crystalline assemblages of Precambrian granite and gneiss. These are exposed along the folds axis as a result of internal structural deformation. In the southern part of Chester County and extending into the Philadelphia planning area, the granite-gneiss complex is known as Baltimore gneiss. The gneiss is believed to be similar to a gneiss exposed in Baltimore, Maryland, hence the name. Baltimore gneiss can be observed at many places in the Philadelphia area. It trends across Wissahickon Creek north of Bells Mill Road and can also be seen at a large quarry in Glen Mills.

It is thought that, originally, the rocks of Baltimore gneiss were largely igneous in origin with smaller portions of sedimentary origin. The highly metamorphosed gneiss is composed of alternating mineral bands. Individual bands may vary in thickness from less than one inch to several feet. In many places, the gneiss has been cut by igneous intrusions, which results in a formation that is extremely variable in character.

The Baltimore gneiss complex south of Chester Valley is overlain by the metamorphic rocks of the Glenurn series. The Glenurn series includes the Wissahickon Formation and isolated bodies of serpentinite, pegmatite, metagabbro, and metamorphosed granitic rocks. The Wissahickon Formation is the most extensive formation of all of the metamorphic rocks exposed in the Piedmont Uplands.

The outcrop belt of the Wissahickon Formation is bordered on the north by the sequence of Cambria and Ordovician quartzites and carbonates of the Chester Valley. From a structural standpoint, the rocks of the Piedmont Uplands are probably the most complex of any in the southeastern Pennsylvania. Detailed analysis of folds, faults, and other structures indicates that these formations have been subject to at least two very intensive deformations.

This complex structure, combined with generally poor outcrop exposures, makes the Piedmont one of the most poorly understood geologic areas in Pennsylvania. This section of the report relies heavily on the information presented in the State Water Plan.

3.1.2 Regional Soils

The general properties of soils help to determine their suitability for on-lot disposal and land disposal technologies. Poor soil suitability may result in these disposal systems polluting ground and surface waters, thus creating an unacceptable health hazard.

The soils of the Philadelphia Act 537 planning area have been delineated by a very broad interpretation of their hydrologic characteristics. This delineation is based upon Soil Associations, as can be seen on Figure 3.1-2, Regional Soils Map, and includes:

- C2a: Chester-Glenelg Association - Soils formed in materials from igneous and metamorphic rocks; includes substrate of schists, gneiss, porcelonite, metahyolite, and metabasalt.

- E3a: Howell-Fallsington Association - Soils formed in unconsolidated water alluvial materials.

The soils associated with the Piedmont Uplands Physiographic Section primarily have a B hydrologic rating and, therefore, moderate rates of infiltration can be expected. This section has slopes averaging from 15 to 20 percent and soil depths of 50 to 70 inches. Soils within the Coastal Plain Province along the Delaware River are influenced by their substrate of marine clay and sand and give rise to soils formed by unconsolidated alluvial deposits that exhibit slow rates of infiltration. It should also be noted that the dense population, development, and impervious coverage within the City of Philadelphia have a significant impact on the hydrology, runoff potential, and non-point pollution to the surrounding surface waters. The infiltration rates of the planning area are, therefore, generally very slow.

Soil Impact on On-Lot Disposal Systems

In the Philadelphia Act 537 planning area, the soils were delineated by using the Bucks and Philadelphia Counties Soil Surveys developed by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS), in cooperation with the Pennsylvania Department of Environmental Resources, State Conservation Commission.

The specific exposed soil types have been delineated and evaluated for those areas where it has been determined that a high density of recognized on-lot disposal systems (OLDS) exists. These areas are further discussed under Section 4.1, On-Lot Disposal Systems. Figure 4.1-1 shows the areas within the City with the highest concentration of OLDS. Below is a description of each of these types of soils present in Philadelphia. Table 3.1.2 lists significant soil properties and their approximate acreage within Philadelphia.

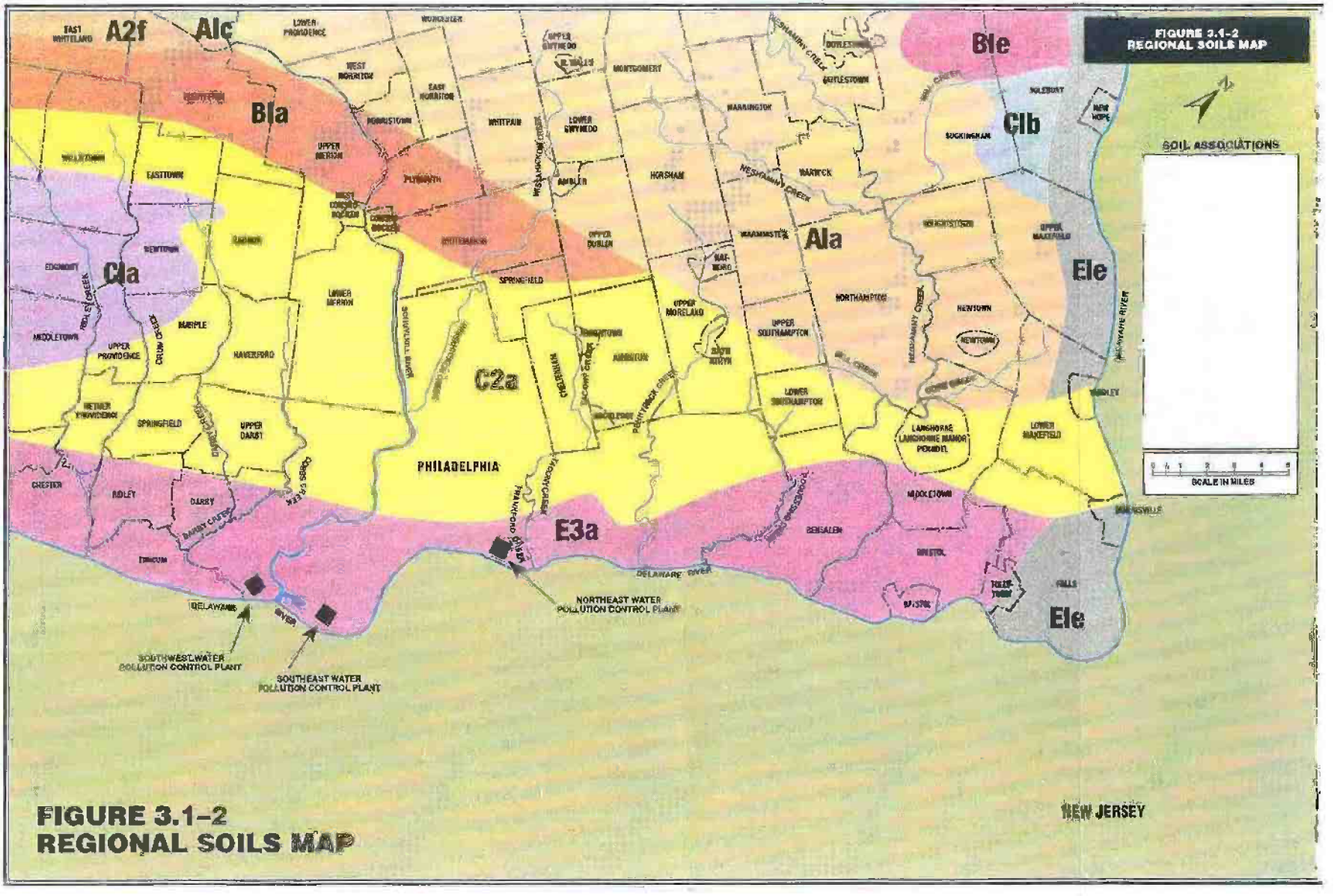

FIGURE 3.1–2
REGIONAL SOILS MAP

TABLE 3.1.2

APPROXIMATE ACREAGE AND SELECTED PROPERTIES OF SOILS WITHIN PHILADELPHIA

Soil	Depth to Bedrock (ft)	Map Symbol	Acreage	Permeability	PADER Soil Series	Suitability for On-Lot Sewage Disposal
Alluvial Land	Properties are too variable to estimate	Ae	150	Properties are too variable to estimate		Severe: subject to flooding
Chester silt loam, 3- to 8-percent slopes	5 to 10	CeB	925	0.63 - 2.00		Slight
Chester silt loam, 8- to 15-percent slopes	5 to 10	CeC	220	0.63 - 2.00		Moderate slope
Duncannon silt loam, 0- to 3-percent slopes	<4	DuA	605	0.63 - 2.00		Slight
Duncannon silt loam, 3- to 8-percent slopes	<4	DuB	265	0.63 - 2.00		Slight
Hatboro silt loam	5 to 10	Ha	720	0.63 - 2.00		Severe: seasonal high water table; flooding
Manor loam, 3- to 8-percent slopes	4 to 12	MaB	1,060	2.00 - 6.30		Slight: hazard of groundwater contamination
Manor loam, 8- to 15-percent slopes	4 to 12	MaC	1,170	2.00 - 6.30		Moderate: hazard of groundwater contamination; slope
Manor loam, 15- to 25-percent slopes	4 to 12	MaD	695	2.00 - 6.30		Severe: slope
Manor extremely stony loam, 8- to 25-percent slopes	4 to 12	MbD	740	2.00 - 6.30		Severe: stoniness; slope

BCM

TABLE 3.1.2 (Continued)

Soil	Depth to Bedrock (ft)	Map Symbol	Acreage	Permeability	PADER Soil Series	Suitability for On-Lot Sewage Disposal
Manor and Chester extremely stony loams, 25- to 50-percent slopes	4 to 12	McE	1,270	2.00 - 6.30		Severe: stoniness; slope
Marsh	Properties are too variable to estimate	Mh	505	Properties are too variable to estimate		Severe: high water table; flooding
Rowland silt loam	31/2 to 6	Ro	475	0.63 - 2.00		Severe: flooding
Urban land	Properties are too variable to estimate	Ub	43,315	Properties are too variable to estimate		Too variable to rate; requires onsite investigation
Urban land-Chester complex, 0 to 8 percent slopes	Properties are too variable to estimate	UdB	23,245	Properties are too variable to estimate		Slight
Urban land-Chester complex, 8 to 15 percent slopes	Properties are too variable to estimate	UdC	2,000	Properties are too variable to estimate		Moderate: slope
Urban land - Howell complex	Properties are too variable to estimate	Uh	4,155	Properties are too variable to estimate		Severe: moderately slow permeability
Water			175	N/A		N/A
Miscellaneous soils			550	N/A		N/A
TOTAL			**82,240**			

"Soil Survey of Bucks and Philadelphia Counties, Pennsylvania", USDA, Soil Conservation Service, July 1975.

Alluvial Land

Alluvial land usually lies within the floodplain of rivers, streams, and gullies. It consists of frequently flooded, somewhat poorly drained soils that formed in alluvium. These areas are commonly cut by shallow stream channels. They are very long and narrow and range from 5 to 25 acres in size. Most nonfarm land uses on this soil type are limited by flooding and wetness.

Chester Series

The Chester Series consists of deep, well-drained, nearly level to very steep soils on uplands. Those soils are on sides and tops of ridges. The areas are elongated or irregular in shape and 3 to 50 acres or more in size. They formed in loamy material weathered from gneiss and schist. The Chester silt loam with 3- to 8-percent slopes can be found on the sides and tips of ridges. This soil has good drainage and gentle slopes; therefore, it is usually good for most nonfarm uses. The Chester silt loam with 8- to 15-percent slopes can be found on the sides of ridges. The slope often limits most nonfarm uses of this soil.

Duncannon Series

The Duncannon series consists of deep, well-drained, nearly level to gently sloping soils on uplands. These soils are on upper elevations in areas of low relief. They are formed in silty, wind-deposited sediment that overlie shales, sandstone, and occasionally other material. The Duncannon silt loam with 0- to 3-percent slopes can be found in areas of low relief on broad uplands. Areas characterized with this soil series are often oval or elongated in shape and 3 to 25 acres in size. This soil has good drainage and nearly level slopes; therefore, it is only slightly limited for most nonfarm uses. The Duncannon silt loam with 3- to 8-percent slopes is also found in areas of low relief in broad uplands. These areas are elongated or irregular in shape and 3 to 20 acres or more in size.

Hatboro Series

The Hatboro series consists of deep, poorly drained, nearly level soils on floodplains. These soils are mainly along small meandering streams. They formed in loamy alluvium that washed from upland soils underlain by gneiss, schist, and diabase. The Hatboro silt loam with 0- to 3-percent slopes is usually found on smooth or slightly concave floodplains. Areas of this soil type are elongated and narrow and 3 to 50 acres or more in size. The hazards of flooding and a high water table limit most nonfarm uses of this soil.

Manor Series

The Manor Series consists of deep, well-drained, gently sloping to very steep soils on uplands. These soils are mainly found on side slopes and ridge tops. They are formed from loamy material of weathered schist and gneiss. The Manor loam with 3- to 8-percent slopes can be found on hilltops and ridgetops. Areas are oval or elongated and 3 to 10 acres or more in size. This soil has good drainage and gentle slopes; therefore, it is only slightly limited for most nonfarm uses.

The Manor loam with 8- to 15-percent slopes can be found on sides of ridges and hills. Areas are elongated in shape and 3 to 50 acres or more in size. Slope limits most nonfarm uses of this soil. The Manor loam with 15- to 25-percent slopes can be found on the sides of ridges and hills and adjacent to drainageways. Slope limits most nonfarm uses of this soil. The extremely stony Manor loam with 8- to 25-percent slopes can be found on sides of hills and ridges and on short slopes adjacent to narrow floodplains. Areas are elongated in shape and 5 to 75 acres or more in size. Slope and stoniness limit most nonfarm uses of this soil. The Manor and Chester Series have extremely stony loams with 25- to 50-percent slopes. The proportion of soils varies in individual areas. These soils are found mainly on ridges and short-side slopes adjacent to creek floodplains. Areas are elongated in shape and 5 to 100 acres or more in size. The slope and stoniness limit most nonfarm uses of these soils.

Marsh Series

The Marsh Series is often found along shorelines subject to ponding or tidal overflow, or in depressions where runoff collects. The soil material is variable, but it consists mostly of loamy to clayey marine and alluvial deposits. This soil is always very wet and conducive to the development of wetlands. Areas are irregular in shape and range from 5 to 100 acres or more in size. Most nonfarm uses are limited by flooding and wetness.

Rowland Series

The Rowland series consists of deep, moderately well-drained to somewhat poorly drained, nearly level soils on floodplains. These soils are found mainly along small meandering streams. They formed in loamy alluvium that washed from upland soils and are underlain by red and brown shale and sandstone. Flooding from the seasonal high water table and moderately slow permeability limit most nonfarm uses of this soil.

Urban Land

Urban land is the most widely found soil in the planning area and is commonly found in highly built-up areas of Philadelphia County. Most urban land is found on terraces of the Uplands and Coastal Plain; however, some can be found in the floodplain. The soils and foundation materials are highly variable. The use of urban land with 0-to 8-percent slopes to prepare an area for development precludes its use for most other purposes. The Urban Land - Chester complex with 0- to 8-percent slopes is about 60 percent urban land, 33 percent Chester soil, and 5 percent included soils. It is found in semibuilt-up areas, mainly in the gneiss and schist ridge and valley areas of Philadelphia County. Areas are irregular in shape and 5 to 2,500 acres or more in size. Drainage is good and slopes are nearly level to gentle; therefore, this complex is only slightly limited for most nonfarm use. Onsite investigation is needed, however, in open areas to determine the hazards and degree of limitation for specified uses. The Urban Land - Chester complex with 8- to 15-percent slopes is about 60 percent urban land, 35 percent Chester soils, and 5 percent included soils. It is in semibuilt-up areas, mainly in the gneiss and schist ridges and valleys of this County. Areas are irregular in shape and 5 to 500 acres in size. Slope limits most nonfarm uses. The Urban Land - Howell complex with 0- to 15-percent slopes is 60 percent urban land, 35

percent Howell silt loam, and 5 percent included soils. It is located in semibuilt-up areas on terraces of the Coastal Plain. Areas are irregular in shape and 5 to 3,000 acres or more in size. Slow permeability limits nonfarm uses of this complex.

3.1.3 Delineation of Wastewater Service Areas

The PWD maintains three large water pollution control plants (WPCPs) to provide wastewater treatment to the residents, industries, and institutions of the City of Philadelphia and 10 outlying municipalities. As can be seen on Figure 3.1-3, the City of Philadelphia, for the purposes of this report, has been subdivided into three subareas based on the service areas of each of these three WPCPs. The WPCPs are the most significant wastewater treatment facilities within the planning area, both in terms of capital investment and capability of influencing the quality of the receiving waters. Therefore, the WPCPs and their respective service areas are the natural subareas upon which to base evaluation of the facilities, capabilities, and future needs.

The regional service areas of each of the water pollution control plants are shown in Figure 3.1-4, 3.1-5 and 3.1-6.

3.1.4 Delineation of Sewered/Unsewered Areas

The City of Philadelphia has one of the oldest wastewater collection and treatment systems in the United States. It has been extensively developed since the turn of the century. It follows that a vast majority of the City area is serviced by sewers. There are some large open areas, such as Pennypack and Fairmount Parks among others, that are not serviced by sewers.

The Philadelphia Health Department estimates that 2,450 out of 674,900 residences, about 0.4 percent, continue to utilize on-lot disposal systems (OLDS) in very localized areas. The sewered/unsewered areas within the City are delineated on Figure 3.1-7. The evaluation of OLDS is provided in Section 4.1, On-Lot Disposal Systems.

Generally speaking, those areas that have the greatest density of OLDS are those majestic dwellings in and adjacent to the park and in the far reaching northeast and northwest areas of the city. The areas of OLDS concentrations that are adjacent to surface streams and in some sections of the Northeast are low-lying, with elevations below 200 feet. However, in the Chestnut Hill/Manayunk/Roxborough area, the elevations are somewhat higher, and in some cases, greater than 400 feet.

3.1.5 Surface Water Resources

There are two major rivers and six creeks that comprise the surface waters of the City of Philadelphia. There are also minor streams and tributaries below the streets of the City that have been incorporated into the present-day storm drain system. Early maps of the City indicate creeks like Chickhansink, Moyanokin, Kingsessing, Cohoquinock, Wischanemunk, Gunners Run, and the Dock, all of which no longer appear as surface water courses.

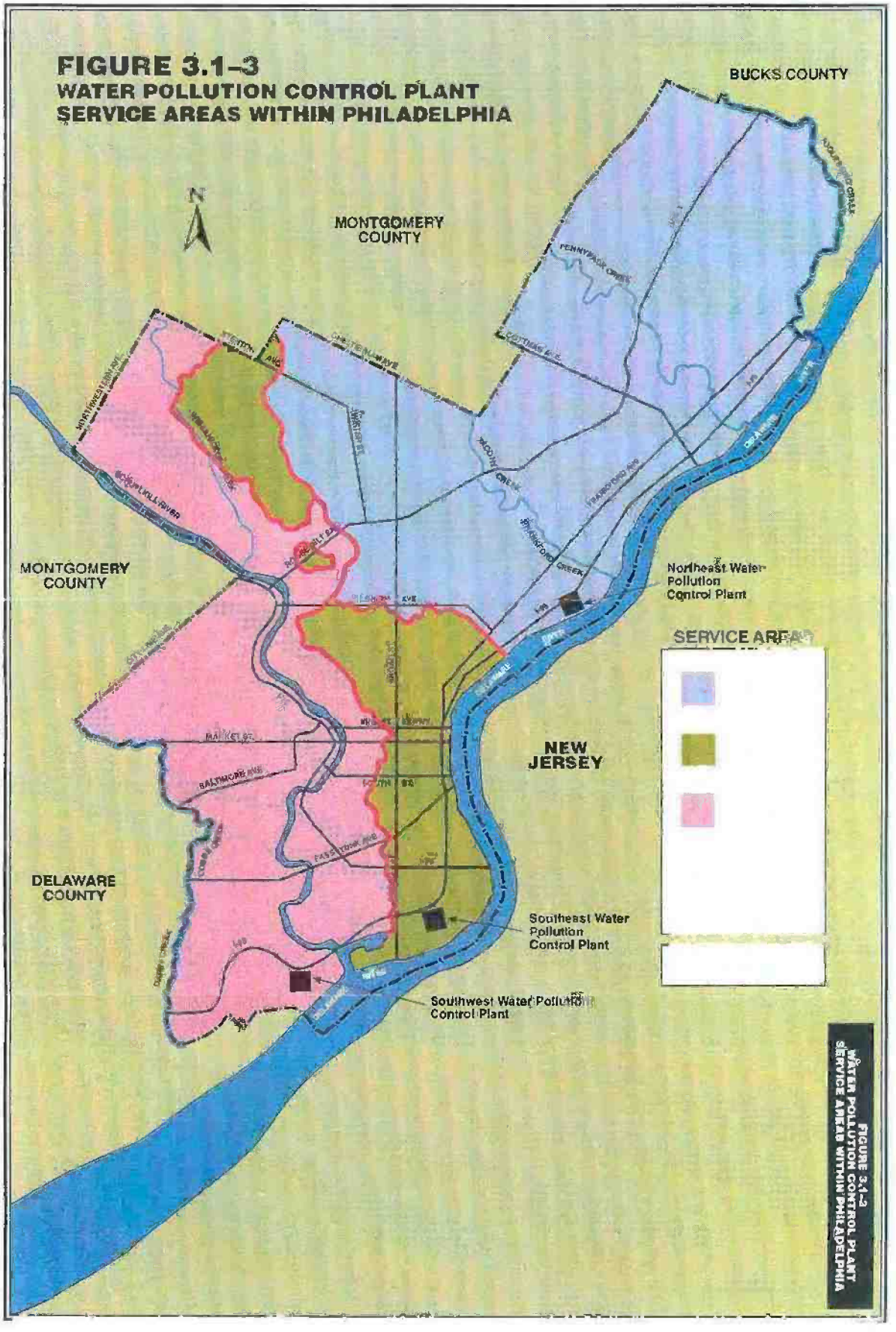
FIGURE 3.1-3
WATER POLLUTION CONTROL PLANT
SERVICE AREAS WITHIN PHILADELPHIA
BUCKS COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
NEW JERSEY
DELAWARE COUNTY
Northeast Water Pollution Control Plant
Southeast Water Pollution Control Plant
Southwest Water Pollution Control Plant
SERVICE AREAS
FIGURE 3.1-2
WATER POLLUTION CONTROL PLANT
SERVICE AREAS WITHIN PHILADELPHIA

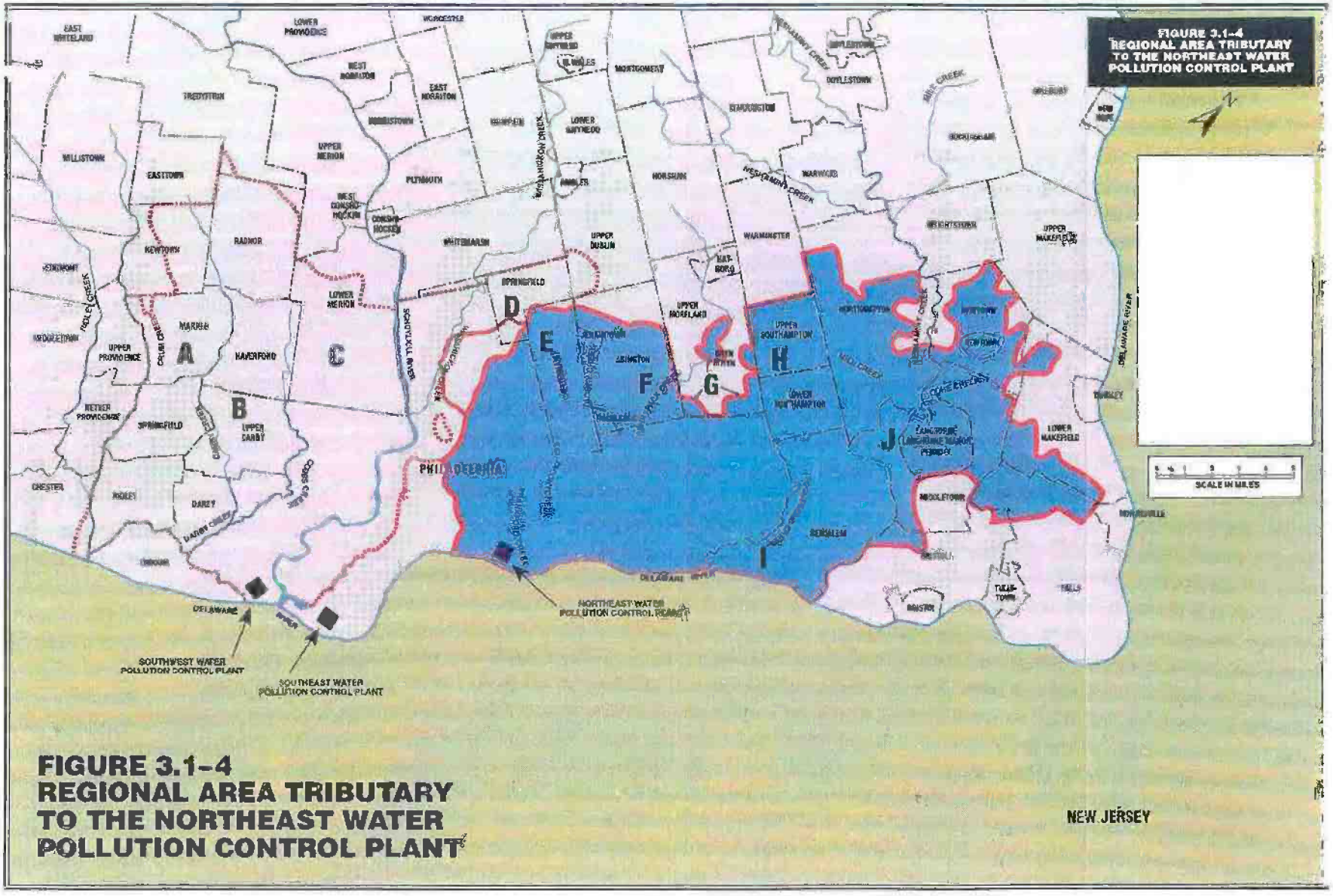

FIGURE 3.1-4
REGIONAL AREA TRIBUTARY TO THE NORTHEAST WATER POLLUTION CONTROL PLANT

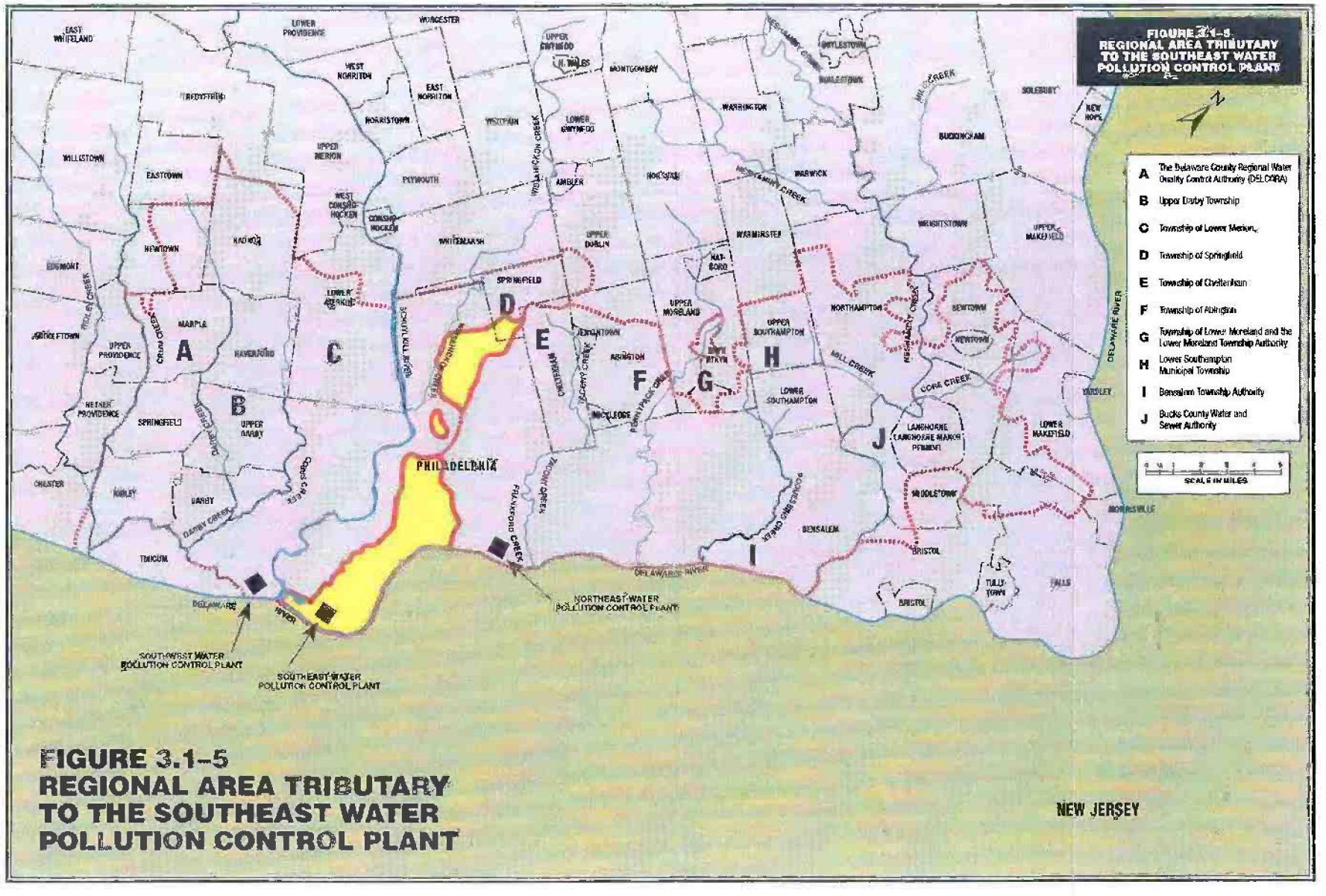

FIGURE 3.1-5
REGIONAL AREA TRIBUTARY TO THE SOUTHEAST WATER POLLUTION CONTROL PLANT

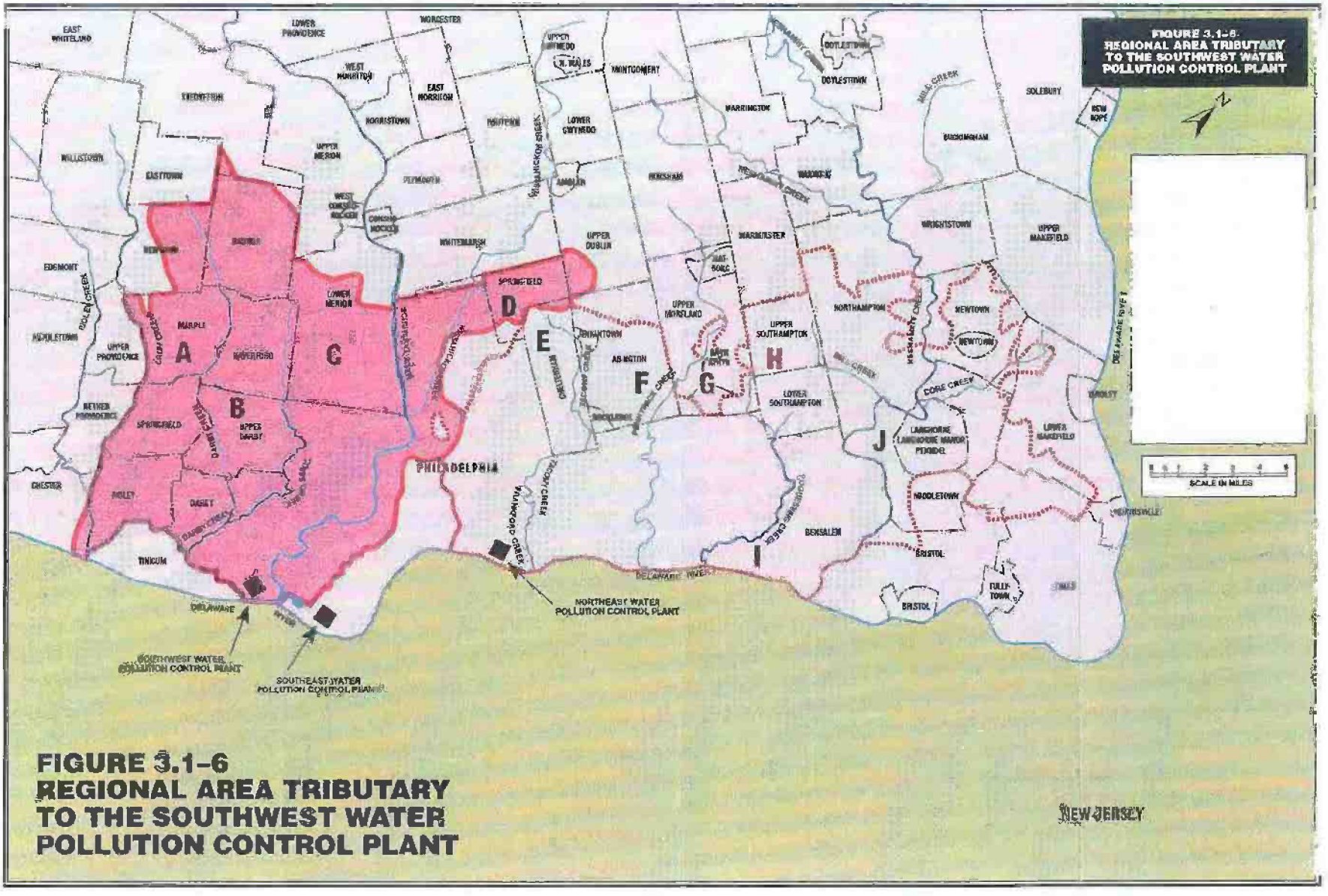

FIGURE 3.1–6
REGIONAL AREA TRIBUTARY TO THE SOUTHWEST WATER POLLUTION CONTROL PLANT

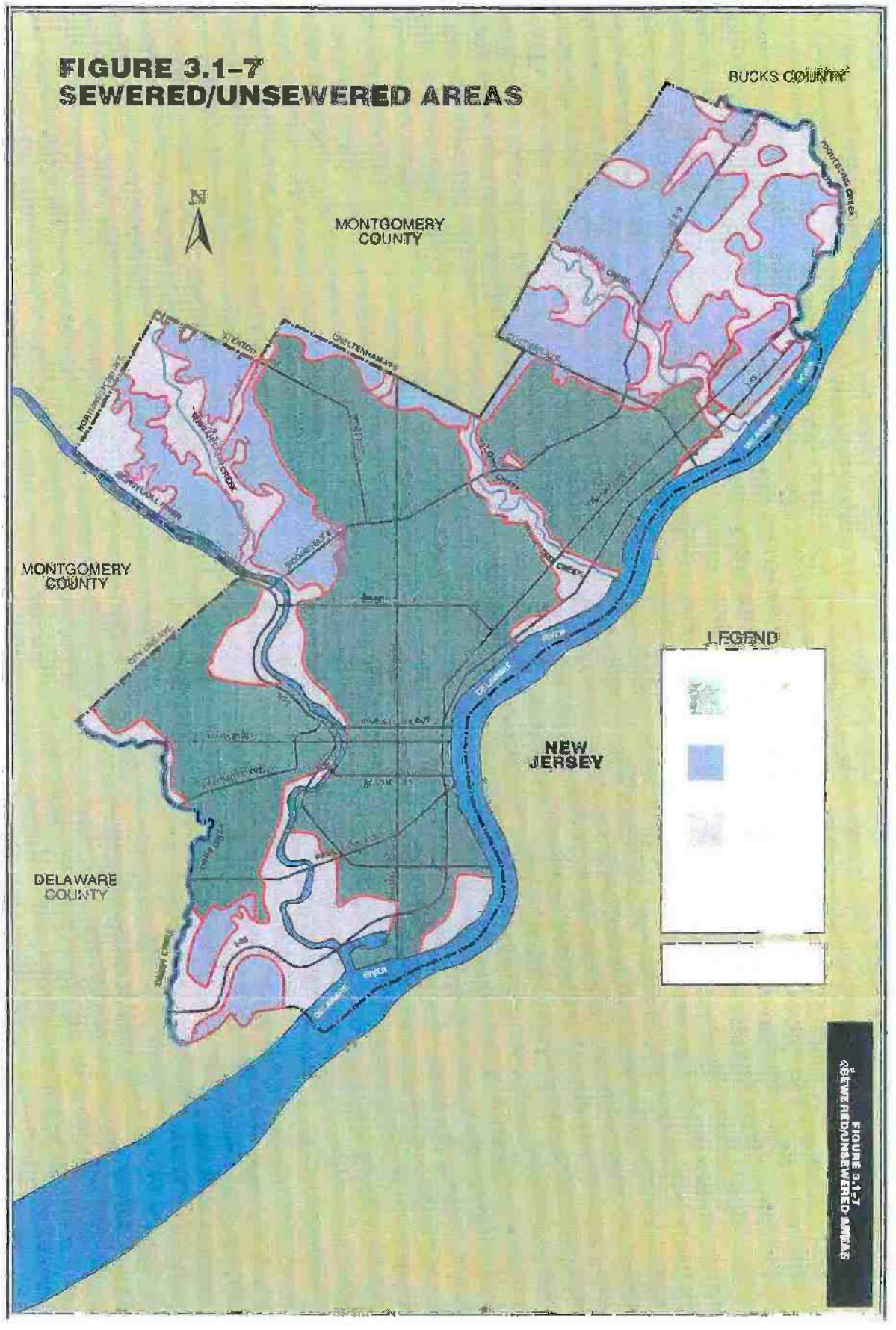
FIGURE 3.1-7
SEWERED/UNSEWERED AREAS
BUCKS COUNTY
N
MONTGOMERY COUNTY
MONTGOMERY COUNTY
DELAWARE COUNTY
NEW JERSEY
LEGEND
DELAWARE RIVER
FIGURE 3.1-7
SEWERED/UNSEWERED AREAS

Although the Delaware and Schuylkill Rivers are the main sources of the City's water supply, 0.08 percent (530) of the City's 675,000 dwelling owners have reported that they utilize groundwater as a potable water supply. Additionally, a number of industries withdraw groundwater for non-potable purposes. Furthermore, it should be noted that all treated wastewater is discharged to the Delaware.

3.1.5.1 Delaware River

The Delaware River is Pennsylvania's only major undammed river; it borders the City of Philadelphia on the east and south. Its sub-basin has the highest water usage in the state and is the receiving body for most of the point discharges in the region. Although the river currently provides high-quality fishing for bass, walleye, pike, muskie, migrating shad, striped bass, catfish, river sturgeon, blueback herring, carp and eels, in the 1940s, reported dissolved oxygen (DO) levels of zero virtually eliminated marine life.

The Delaware Estuary is delineated by tidal freshwater in the Philadelphia-Wilmington-Trenton-Camden metropolitan area. This reach of the Delaware River is 85 miles long from Trenton, New Jersey, to Liston Point, Delaware, and flows through the nation's fifth largest urban area. The region has one of the greatest concentrations of heavy industry in the world and is the second largest oil refining and petrochemical complex in the United States. Although manufacturing is declining in the area, it is still a major factor affecting water quality. The estuary's ports form the largest freshwater port in the world, the largest U.S. port in terms of international tonnage, and the second busiest port in the U.S. in total tonnage. The lower Delaware region has a population exceeding 5.7 million people, greater than 40 of the 50 states. Historically, the Delaware Estuary has been one of the most polluted waterways in the country, but it has experienced remarkable recovery in the last decade, making it one of the premier water pollution control success stories in the country. Because of the urban-industrial character of the area and the historical use of the waterway, toxics remain a concern.

The headwaters of the Delaware are located in the Catskill Mountains in Schoharie County, New York. It begins with the confluence of the East and West Branches near Hancock and flows 330 miles to the Atlantic Ocean. The Delaware River drainage basin is 13,000 square miles and spans Delaware, New Jersey, New York, and Pennsylvania. The river system is used as the water supply for almost 10 per cent of the U.S. population. Three dams in the Upper Delaware River Basin provide water for New York City. These reservoirs receive runoff from 917 square miles, about 40 percent of the drainage area of the basin in New York State, and have a combined usable capacity of 271 billion gallons. In 1931, the United States Supreme Court issued a decree in regard to the diversion of water from the Delaware Basin to New York City. This decree, amended in 1954, authorizes New York City to make diversions for its water supply, but requires that a minimum flow of 1,750 cfs must be maintained at Montague, New Jersey. The decree provided for a court-appointed Delaware River Master to control releases and monitor New York City's reservoir system. During severe drought conditions, it is impossible to divert the full 800 mgd for New York City's needs and still meet minimum flow requirements for the Lower Basin. A drought operation formula has been adopted for use during these periods.

The Delaware River Basin Commission (DRBC), an interstate-federal compact agency, is charged with regulating the quantity and quality of water in the basin. The objectives of the DRBC in regard to quantity are:

- To assure satisfactory minimum-sustained streamflows at key locations during critical drought periods
- To limit the intrusion of seawater in the tidal Delaware River Estuary
- To see that the stream system is replenished after critical drought periods

Water quality standards set by the DRBC protect a safe and satisfactory condition for :

- Agricultural, industrial, and public water supplies
- Wildlife, fish, and aquatic life
- Recreation
- Navigation
- Controlled and regulated waste assimilation

Effluent quality standards dictate limits for all dischargers. All wastewater must receive a minimum of secondary treatment and be disinfected before discharge to the Delaware River. Limits have been set for both wastewater treatment facilities and industrial dischargers in regard to suspended solids, oil and grease, dissolved oxygen, temperature, pH, phenols, odor, synthetic detergents, radioactivity, fecal coliform, total dissolved solids, turbidity, and BOD_5. In addition, guidelines have been adopted that limit the concentrations of oil, persistent pesticides, and other toxic substances including arsenic, barium, cadmium, chromium (hexavalent), lead, mercury, selenium, and silver.

3.1.5.2 Schuylkill River

Of all the rivers in southeastern Pennsylvania that are tributary to the Delaware River Estuary, the Schuylkill River is the largest and has the highest water reuse of all sub-basins in the state. The Schuylkill drainage basin is 80 miles long and 25 miles wide, with a drainage area of 1,909 square miles above the confluence with the Delaware River. The Schuylkill River has its headwaters in Schuylkill County. The river forms the boundary between the City of Philadelphia and Montgomery County from Northwestern Avenue to City Line Avenue and flows generally south through the City to the Delaware River Estuary.

The upper portion of the river has been severely degraded by acid mine drainage and serious organic and nutrient pollution. Historically, some of the tributaries in this area have been known to run black with coal fines. There has been an effort to control sediment loads in the river and its tributaries, and the water quality has improved significantly over the last 30 years.

Dischargers to the lower Schuylkill include wastewater treatment plants, oil refineries, chemical industries, manufacturing operations, and the Limerick Nuclear Power Plant. The lower portion of the river from Fairmount Dam to the Delaware is an estuary with a range of tidal fluctuations of about 5.5 feet. Although there is a great diversity of fish above Fairmount Dam, many problems have been experienced in that portion of the river within the Philadelphia city limits. Combined sewer overflows during heavy rainfall affect water quality between Fairmount Dam and Grays Ferry Bridge. In the past, dissolved oxygen levels have been at or above saturation levels. Many of the problems in this area are caused by heated and oxygen-consuming waste discharges.

3.1.5.3 Wissahickon Creek

Wissahickon Creek is a tributary of the Schuylkill River and has a drainage area of 63.8 square miles. Its source is in the northern portion of Montgomery County. The Wissahickon enters the City from the northwest and converges with the Schuylkill River at Fairmount Park. Dischargers to the Wissahickon include wastewater treatment plants and industrial dischargers such as manufacturing, chemical, and pharmaceutical companies.

3.1.5.4 Pennypack Creek

Pennypack Creek is a major tributary of the Delaware River Estuary. With headwaters in Montgomery County, it flows from the county line in the Northeast section of Philadelphia to the Delaware River. Sewage treatment plants and non-point contamination from the Pennsylvania Turnpike have an effect on water quality.

3.1.5.5 Poquessing Creek

Poquessing Creek is the northeastern boundary of the City. It originates in Lower Bucks County and flows east to the Delaware River. The overall water quality of Poquessing Creek has been satisfactory with high levels of dissolved oxygen in the summer months. Periodically, ammonia-nitrogen values exceed 0.5 mg/l and high suspended solid levels have been recorded during storm events.

3.1.5.6 Tacony Creek

Tacony or Frankford Creek originates in Montgomery County in the Jenkintown/Glenside area. It flows to the Delaware River through the northcentral region of the city. The water quality of Tacony Creek is comparable to the Poquessing Creek. Combined sewer overflows during heavy rains can contribute to periodic high levels of bacterial contamination.

3.1.5.7 Cobbs Creek

The headwaters of Cobbs Creek are in the Haverford section of Delaware County. It is a tributary of Darby Creek and forms the southwest boundary of the City. Cobbs Creek can also be adversely affected by combined sewer overflows during wet-weather events.

3.1.5.8 Mingo Creek

Mingo Creek lies in the southern tip of the City, west of the Schuylkill River. It is a relatively small stream that does not flow beyond the City limits, and much of it has been controlled in storm drain culverts and lined channels. The creek no longer follows its original course. It is a discharge point for some large industrial users.

3.1.5.9 Parks and Recreation

The main recreational uses of the surface waters within the City are fishing and boating. Although City regulations prohibit swimming in any of the rivers, creeks or streams without Fairmont Park Commission approval, there is some unapproved swimming at undesignated points. Pollution and safety considerations make this a dangerous activity. The waterfront areas of the Delaware have been targeted for commercial, residential and recreational development. This resurgence represents significant economic benefits from investments in water pollution control facilities. The Upper and Middle Delaware segments are part of the National Wild and Scenic Rivers System. Some portions of the Schuylkill have been selected for inclusion in the Pennsylvania Scenic River Inventory. The areas adjoining many of the rivers and streams in the City have been developed as parks and recreational sites with facilities for picnicking and other outdoor activities. For instance, Fairmount Park is the largest city park in the world. Both the Schuylkill River and Wissahickon Creek flow through this area. Cobbs Creek and Pennypack Creek have park land along their shores. The Tacony Creek flows through Juniata Park. The major Parks within Philadelphia are delineated on Figure 3.1-8. Neighborhood parks are not included.

3.1.6 Wetlands

Wetlands can be defined as areas of land that retain water long enough to promote the formation of hydric soils and support the growth of aquatic plant life. The consideration of wetlands is important due to their ability to retain water and their use as a habitat for unique species of wildlife that depend on them for food and reproduction. As one of the oldest metropolitan areas in the United States, Philadelphia is almost entirely developed, with the majority of the wetlands that once existed within the City having since been drained. However, as indicated on the National Wetlands Inventory maps, dated from March 1972 to August 1981, there remain a few scattered areas of wetlands throughout Philadelphia. These areas have been mapped and are indicated in Figure 3.1-9, Wetlands Location Map. This report limits its concern to areas of wetlands in the vicinity of high-density on-lot disposal systems, the water supply facilities, and the WPCPs.

There are three primary types of wetlands found within the City: palustrine, lacustrine, and riverine. These are classified according to geomorphology, hydrology, biology, and chemistry. Palustrine wetlands systems are nontidal freshwater wetlands systems that host a wide variety of emergent vegetation such as trees, shrubs, and moss. These wetlands retain storm water runoff from surrounding areas and periods of high groundwater. Unlike palustrine wetlands systems, lacustrine systems are often in the form of ponded basins. These ponded basins may be fed by storm water, runoff, or groundwater, where the emergent wetlands vegetation grows along the

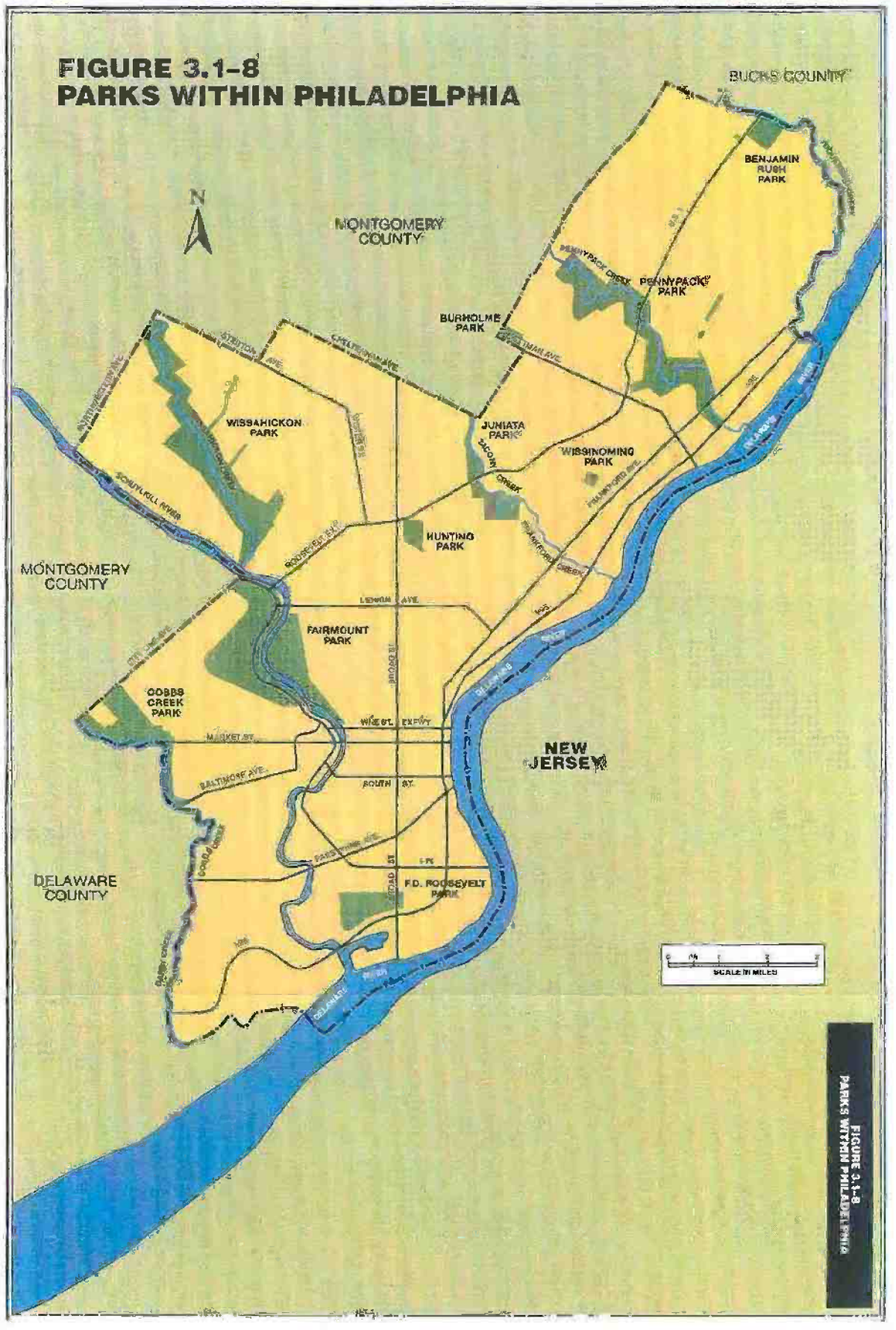
FIGURE 3.1-8
PARKS WITHIN PHILADELPHIA
BUCKS COUNTY
MONTGOMERY COUNTY
BENJAMIN RUSH PARK
PENNYPACK CREEK
PENNYPACK PARK
BURHOLME PARK
WISSAHICKON PARK
JUNIATA PARK
WISSINOMING PARK
SCHUYLKILL RIVER
HUNTING PARK
MONTGOMERY COUNTY
FAIRMOUNT PARK
COBBS CREEK PARK
NEW JERSEY
DELAWARE COUNTY
F.D. ROOSEVELT PARK
SCALE IN MILES
FIGURE 3.1-8
PARKS WITHIN PHILADELPHIA

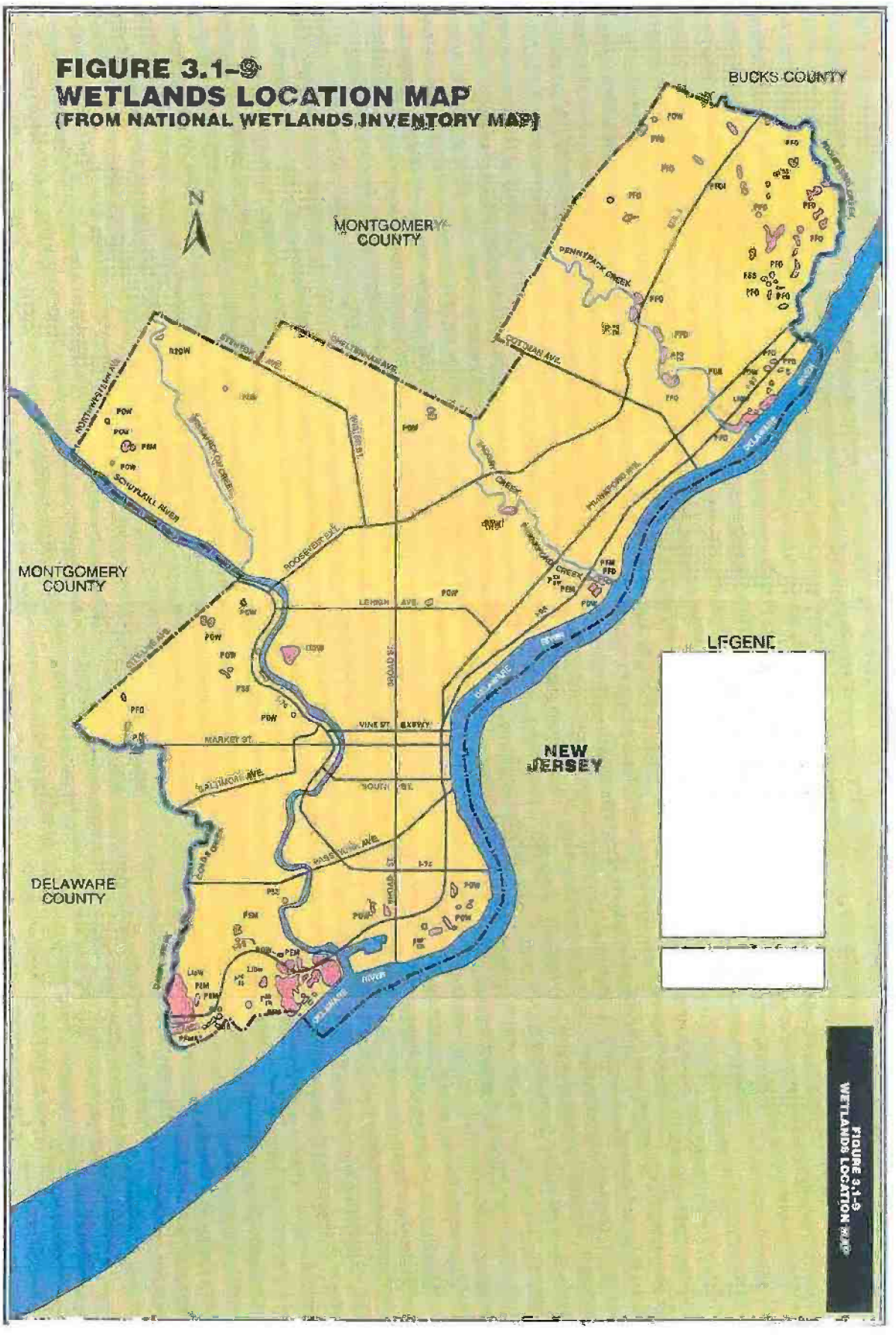
FIGURE 3.1-9
WETLANDS LOCATION MAP
(FROM NATIONAL WETLANDS INVENTORY MAP)
BUCKS COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
DELAWARE COUNTY
NEW JERSEY
LEGEND
SCHUYLKILL RIVER
DELAWARE RIVER
PENNYPACK CREEK
PUTNAM AVE.
SHELBOURNE AVE.
STENTON AVE.
ROOSEVELT BLVD.
LEHIGH AVE.
BROAD ST.
VINE ST. EXPWY.
MARKET ST.
BALTIMORE AVE.
SOUTH ST.
PASSYUNK AVE.
PFO
PEM
PSS
POW

edges of these bodies of water. Usually there is a free exchange of water between lacustrine systems and the surrounding groundwater. Riverine wetlands systems occur along streams and rivers and are fed by runoff and groundwater sources. Riverine systems usually have adjacent wetlands of other types into which freshwater seepage occurs.

Due to Philadelphia's urban environment, there are not many large wetlands areas, but there are several significant areas that must be taken into consideration due to their proximity to the WPCPs and areas with on-lot sewage disposal systems.

There are apparent wetlands areas in the vicinity of Philadelphia's WPCPs, as identified in the National Wetland Inventory maps, that will have to be considered during planning efforts including modifications of the existing plants. These wetlands may have a potential impact on any plans for expansion or modifications of the WPCPs. The wetlands that are in the vicinity of the WPCPs are described in Table 3.1.3. It is also important to note, however, that field delineations will be necessary to verify the presence and exact location of wetlands prior to final design.

While contemplating sewer extensions into areas of high density on-lot disposal systems, wetlands will be germane to a variety of planning considerations due to the potential impact on construction methods and costs, or the location of certain wetlands that may influence sewer layout and/or feasibility.

The remainder of the wetlands in Philadelphia are located primarily in Pennypack Park, Fairmount Park, and adjacent to Wissahickon Creek. These wetlands are principally riverine and palustrine systems. There are also a few scattered palustrine wetlands systems to the southeast of the Northeast Philadelphia Airport that will probably not have an impact on wastewater-related projects.

3.1.7 Water Supply System

The Delaware and Schuylkill Rivers are the primary source of raw water for the City of Philadelphia. Heavy industrial and port facilities and a densely populated urban area result in high water usage. The Philadelphia Water Department treats and supplies approximately 342 mgd of water to the City of Philadelphia and sells an additional 16 mgd to the Bucks County Water and Sewer Authority, located northeast of the City.

3.1.7.1 Water Treatment Plants

PWD maintains three water treatment plants to meet the needs of the City. Treatment is generally the same in all three facilities and the process usually consists of sedimentation, pre-chlorination, chemical treatment, flocculation, sedimentation, filtration, and post-chemical treatment. All three plants have reservoirs to accommodate an approximate 1-day storage capacity.

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TABLE 3.1.3
SIGNIFICANT WETLAND AREAS AS SHOWN ON THE NATIONAL WETLANDS INVENTORY MAP
FIGURE 3.1.5

Location	Size	Type	Significance	Remarks
Adjacent to Northeast Sewage Treatment Works	94 Acres	Palustrine	Former sludge dewatering lagoon	Open water
Adjacent to Northeast Sewage Treatment Works	3.4 Acres	Palustrine	Close to water pollutino control plant	Forested
Adjacent too Southwest Sewage Disposal Works	559.8	Lacustrine/ Plaustrine	Former sludge dewatering lagoon	Open water
Adjacent to Southeast Sewage Disposal Plant	9.6 Acres	Palustrine	Former sludge dewatering lagoon	Open water
In vicinity of Byberry Rd. at Philadelphia County border	8.6 Acres	Palustrine	Adjacent to on-lot disposal area "A"	Broad-leaved deciduous trees
In vicinity if Byberry Rd. at Philadelphia County border	0.9 Acres	Palustrine	Within on-lot disposal area "A"	
In vicinity of the intersection of Norwalk Rd., Morefield Rd., and Krewstown Rd.	9.2 Acres	Palustrine	Adjacent to on-lot disposal area "B"	Broad-leaved deciduous trees
Upper Roxborough Reservoir	23 Acres	Facilitates palustrine	Adjacent on on-lot disposal area "D"	

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The Belmont Water Treatment Plant is located on Belmont Avenue, south of City Line Avenue. The water is pumped from the Schuylkill River and serves that portion of the City west of the river. This plant treats an average of 60 mgd.

The Queen Lane Water Treatment Plant is located on West Queen Lane, in the East Falls section of the City. This plant also pumps water from the Schuylkill River and treats an average of 100 mgd. It serves the northwest portion of the City and a large section of North Philadelphia east of the Schuylkill River and north of Callowhill Street. The Queen Lane Plant is totally automated.

The Samuel Baxter Water Treatment Plant is on State Road in the Torresdale section of the City and serves the eastern half of the City, bounded on the west and north by the Schuylkill River, Roberts Avenue, and Tabor Road, and to the east by the City limits. Areas served jointly by the Baxter and Queen Lane Treatment Plants include Hartwell Lane in Chestnut Hill, East Mt. Airy, and West Oak Lane. The source of supply is the Delaware River. This plant treats an average of 200 mgd. The Baxter Plant maintains a taste and odor control lab for all three plants.

3.1.7.2 Water Quality and Quantity

The three water treatment plants have a combined rated capacity of 543 mgd and a total peak capacity of 681 mgd. COWAMP projections indicate that this supply will be sufficient to meet the needs of the City through the year 2020. Philadelphia water meets or exceeds all physical, chemical, radiological, and bacteriological water quality standards established by EPA under the Safe Drinking Water Act. Three laboratories monitor water quality to ensure compliance with all limits. A City ordinance requires fluoridation of the finished water supply.

In addition, the PWD's Planning and Research Unit is involved in a corrosion control study to determine a uniform strategy to reduce corrosion in the City's distribution system. The effectiveness of the chemical inhibitors used by the PWD to minimize corrosion will be evaluated on the basis of infrastructure protection, lead dissolution, water quality, and costs. A future study will examine alternatives for reducing the corrosion rates by using a variety of chemical inhibitors and other schemes.

The PWD has reduced the level of trihalomethanes (THMs) in the finished product by changing the chlorination points in all three water treatment plants. THM levels in water treated by PWD have consistently been below the EPA Maximum Contaminant Level.

3.1.7.3 Operations and Maintenance

The PWD maintains the water treatment plants, pumping stations, and related systems in 89 separate facilities. There are 3,300 miles of water mains, ranging in diameter from 3 inches to 93 inches, with an average age in excess of 70 years. The oldest mains are circa 1820. The distribution system also includes 500,000 service connections, an estimated 3,000 to 4,000 miles of service lines, 83,600 valves, 27,800 pressure fire hydrants, and 15 pumping stations in a 130 square mile service area. The PWD has a preventive maintenance program that includes routine dismantling, cleaning, repairing, and inspection of pumps within the system. A large-valve

inspection and overhaul program was implemented in 1988. The PWD Load Control oversees the maintenance and renewal of large-diameter water mains, pumps, storage basins, reservoirs, tanks, and treatment plant facilities when their capacity is impacted.

In an effort to reduce customer under-registration, a 10-year program to replace 400,000 5/8-inch mechanical meters is in progress. Old meters are being replaced with magnetic meters that are more accurate, easier to read, less costly to repair, and hermetically sealed.

Safety in the water treatment plants is a concern of PWD. In addition to "Right to Know" training, other chemical safety training is available. All new employees are issued safety manuals. Alarm systems, inspections, and periodic meetings are additional efforts employed to maintain safety in the treatment facilities.

Employees are encouraged to improve their technical skills through seminars and training films on various topics offered in-house, and they have the opportunity to attend other types of training programs offered by private corporations.

3.1.7.4 Conservation Efforts

Philadelphia has revised its Plumbing Code to require DRBC mandated conservation plumbing fixtures, including the 1.6 gallon water closet.

In an effort to reduce the water in the system that is not accounted for, PWD has pursued a systemwide leakage detection and repair program for decades. The percentage of unaccounted for water has varied between 31 percent and 39 percent over the last 15 years. The Leak Detection Program conserves water and reduces operating costs. In addition, it is cost-effective in minimizing property damage suits, poor public relations, emergency repairs, expansion of treatment facilities, and water pressure problems. In 1983, the program was accelerated as the water industry realized the efficacy of such a program. PWD maintains a unit that specializes in leak detection and flow measurement and is responsible for leakage abatement. Using electronic listening devises to pinpoint the source of leaks in the distribution system, this unit has been able to significantly reduce leakage and effect measurable cost savings.

A Capital-Improvement Program provides funds for infrastructure replacement and rehabilitation. The rate of capital expenditures has increased significantly over the past 15 years to address a growth rate of 1.8 percent in main breaks per 1,000 miles. The prioritized list of projects is incorporated into a 6-year capital program that is revised on a yearly basis to include the latest information.

Hydrant abuse programs are another means to conserve water. To combat the problem of illegal openings, the PWD has installed locking devices on many fire hydrants. In addition, the Public Affairs Division operates an aggressive hydrant abuse education campaign each summer. This multimedia campaign targets both children and adults. It is anticipated that over a period of years, this program will result in reductions of pumped water, peak demands, low-pressure episodes, and the costs of treatment and pumping.

3.1.7.5 Other Sources of Water Supply

Within the City, some residents utilize wells as their source of supply or obtain water from neighboring municipalities. Moreover, there are users within the City who are not hooked up to either the public water or sewer systems. Presently, there are approximately 530 wells within the City limits. Wells are not confined to any particular section of the City, but scattered throughout the entire area. Table 3.1.4 is a summary of well distribution as identified by PWD's "Sewer Only" accounts. Approximately one-third of these accounts are non-residential.

3.1.7.6 Types of Water Usage

The City of Philadelphia is 99 percent metered. Meter size is the basis for billing rates in most cases. The Water Revenue Bureau of the Department of Revenue identifies several categories of water usage: residential, commercial, large industrial, charitable, public, and senior citizens. Charitable users are institutional in nature and include hospitals and universities. State, County, and City properties are grouped under the public category. Senior citizens in the City receive a 25 percent discount on their water bills, and their accounts are coded to designate that status.

3.1.7.7 Potable Water Storage

PWD has the option to respond to extreme drought conditions by drawing its supply from both the Delaware and the Schuylkill River systems, which is a significant advantage held in reserve, should this condition ever occur. Each of the three water treatment plants has an approximate one-day storage capacity without pumping from the rivers. Finished water pumping and storage capacity provide a short-term reserve margin. The current total storage capacity is 932 mg, of which 503 mg is filtered water storage. The treated water storage capacity to be realized upon completion of East Park Reservoir Basin rehabilitation is 814 mgd.

In 1984, a good-faith agreement was executed among the states dependent on the Delaware River that defines new patterns for dividing of the Basin's resources during drought periods. The agreement has a provision calling for expansion and improvement of impoundment storage capacities to provide larger reserves against protracted droughts. The City is studying methods to increase storage capacity, including expansion of the Francis E. Walter Reservoir on the Lehigh River Basin of the Delaware River for flow augmentation; however, the cost of implementing a storage expansion program is an important factor to be considered.

3.2 CONTRIBUTING MUNICIPALITIES/AUTHORITIES

The size and scope of Philadelphia's wastewater system is a result of the regional approach to water quality management that was prevalent from the 1940s through the 1960s. At that time it was felt that the most efficient method of providing wastewater treatment was through large, centrally located treatment facilities with extensive and complex collection systems and service areas. In the past 20 years, conventional wastewater planning has deviated from this philosophy, recognizing that smaller, localized treatment facilities and on-lot disposal systems, where

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TABLE 3.1.4

WELL DISTRIBUTION

	Area	No. of Wells
A	Center City	19
B	South Philadelphia	58
C	Southwest Philadelphia	13
D	West Philadelphia	77
E	Lower North Philadelphia	35
F	Upper North Philadelphia	54
G	Bridesburg/Kensington/Richmond	44
H	Roxborough/Manayunk	13
I	Germantown/Chestnut Hill	21
J	Olney-Oak Lane	39
K	Near Northeast	17
L	Far Northeast	62
	Total	**452**

*Total identified in "Sewer Only" accounts

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appropriate, provide adequate treatment and afford groundwater and small stream recharge, which is generally not true of the larger regional facilities. The three Design Reports on the WPCPs within Philadelphia, dating from March 1972 to October 1973, reflect the planning convention of the time; Philadelphia has agreements with 10 outlying municipalities/authorities to accept, convey, treat, and dispose of their wastewater. Although the regional concept has not expanded as projected in the Design Reports, the relationship between Philadelphia and these ten municipalities/authorities continues with benefit to all.

When evaluating Philadelphia's wastewater system, it is essential to understand the intermunicipal relationship that Philadelphia has and the wastewater flows it accepts from 10 of its neighboring municipalities/authorities. Philadelphia has had a long-standing relationship with these municipalities/authorities that will continue to have a direct impact on the City's wastewater facilities. The municipalities/authorities listed below are considered in this report regarding service areas, intermunicipal agreements, wastewater flows, and fees:

- Township of Abington
- Bensalem Township Authority
- Bucks County Water and Sewer Authority
- Township of Cheltenham
- The Delaware County Regional Water Quality Control Authority (DELCORA)
- Township of Lower Merion
- Township of Lower Moreland and the Lower Moreland Township Authority
- Lower Southampton Municipal Authority
- Township of Springfield, Montgomery County
- Upper Darby Township

The terms of these relationships are detailed in contractural agreements executed between the City and each municipality and authority. The information presented in the following sections outlines the terms agreed to within these agreements. The agreements themselves are available at the PWD for further service.

3.2.1 Service Areas

The areas of each of the above-mentioned, outlying municipalities, serviced by the PWD have been delineated on Figure 3.2-1, Contributing Outlying Municipalities/Authorities. The areas of each of these municipalities/authorities and their contributions to the service areas of each of the three water pollution control plants are presented in Table 3.2.1.

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TABLE 3.2.1

AREAS CONTRIBUTED TO PHILADELPHIA WASTEWATER SYSTEM BY OUTLYING MUNICIPALITIES/AUTHORITIES

Tributary Area	Northeast (acres)	Southeast (acres)	Southwest (acres)
Philadelphia	42,500	13,200	27,200
Suburban			
Abington	4,500	-----	-----
Bensalem	4,400	-----	-----
Bucks County	45,000	-----	-----
Cheltenham	8,300	-----	-----
Lower Moreland	900	-----	-----
Lower Southampton	7,700	-----	-----
Springfield	-----	300	4,500
DELCORA	-----	-----	52,200
Lower Merion	-----	-----	12,100
Upper Darby	-----	-----	7,800
Total Suburban	70,800	300	76,600
Total	113,300	13,500	103,800
Total Area Served	230,600		

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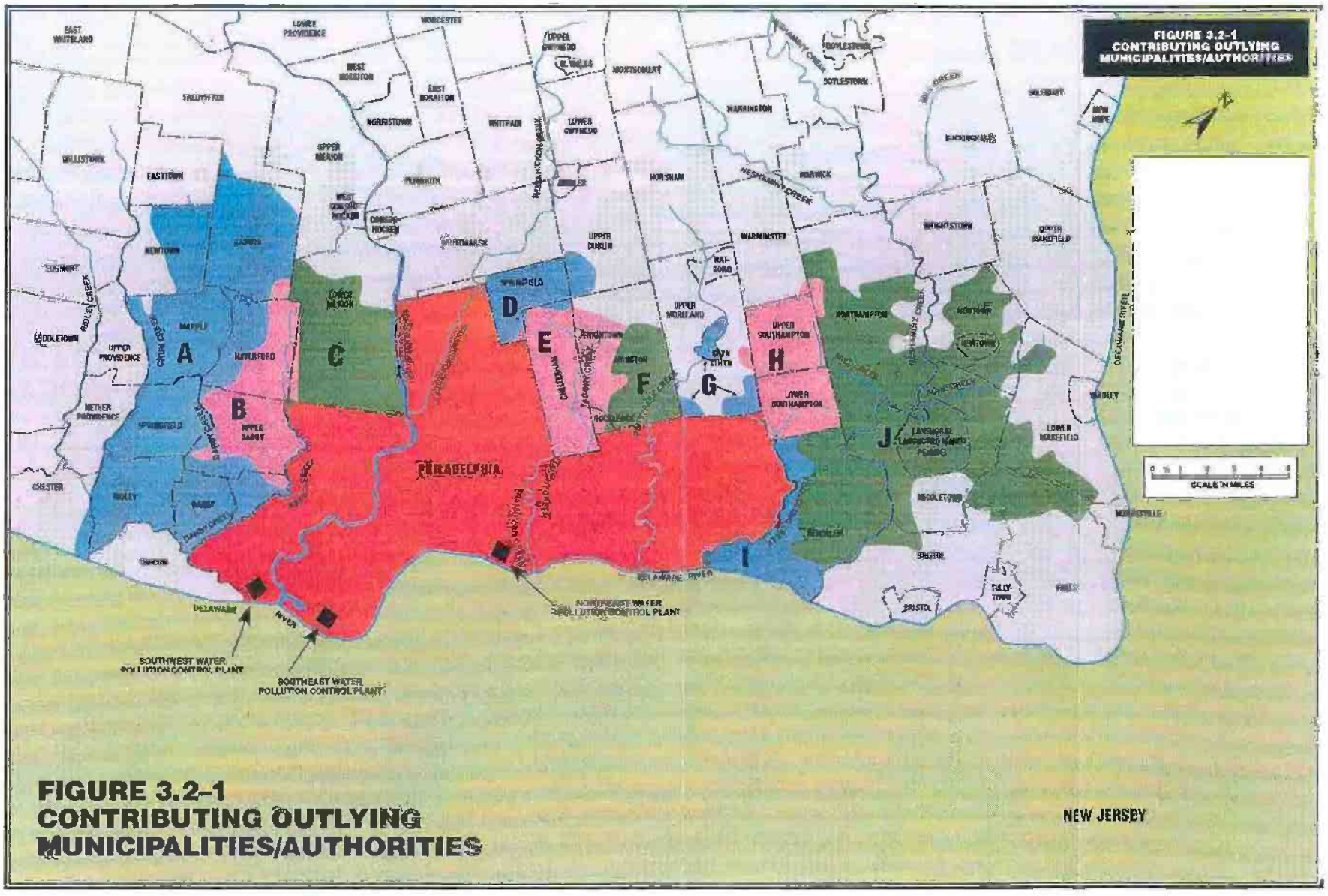

FIGURE 3.2–1
CONTRIBUTING OUTLYING
MUNICIPALITIES/AUTHORITIES

The Philadelphia system, as defined by the intermunicipal agreements, is presented below to fully describe the service areas of each of the three water pollution control plants. Because drainage areas do not necessarily correspond to political boundaries, there is some overlap of municipalities in each agreement and authorities may involve more than one municipality. Furthermore, sections of some municipalities will be covered by an agreement of another municipality/authority even though that municipality may have an agreement of its own.

Township of Abington - The drainage area to the Northeast WPCP is the area of the watershed of Pennypack Creek in the Township of Abington, the Borough of Rockledge and, a portion of the Tacony Creek watershed in the Borough of Rockledge, and the Abington portion of the Tacony Creek watershed adjoining Rockledge.

Bensalem Township Authority - The drainage area includes the area of Bensalem Township, which is within the Poquessing Creek watershed.

Bucks County Water and Sewer Authority - The agreement between Philadelphia and the Bucks County Water and Sewer Authority covers those areas within the Authority that are serviced by the Neshaminy Interceptor system and the Totem Road Pumping Station within the Neshaminy Creek watershed. This area includes all or parts of the following municipalities:

Bensalem Township
Bristol Township
Falls Township
Hulmeville Borough
Langhorne Borough
Langhorne Manor Borough
Lower Makefield Township
Lower Southampton Township
Middletown Township
Newtown Borough
Newtown Township
Northampton Township
Penndel Borough

Township of Cheltenham - The drainage area includes those areas that are in the Tacony Creek watershed in the Township of Cheltenham, Township of Abington, Borough of Jenkintown, and a certain portion of the City of Philadelphia whose wastewater flows through the sewers of Cheltenham, thence into the City's sewers.

The Delaware County Regional Water Quality Control Authority (DELCORA) - This agreement covers an extensive area under the unified responsibility of DELCORA, including those areas in the Darby, Crum, Ridley, and Chester Creek watersheds. This area once coincided with the service area boundaries of the Muckinipates, Central Delaware County, Darby Creek Joint, and Radnor-Haverford-Marple Authorities. The municipalities included in this agreement in whole or in part include the following:

Borough of Norwood
Borough of Glenolden
Borough of Swarthmore
Haverford
Radnor
Newtown

Borough of Morton
Borough of Rutledge
Borough of Prospect Park
Borough of Ridley Park
Township of Darby
Township of Upper Darby
Township of Ridley
Township of Springfield
Township of Marple
Township of Nether Providence
Upper Providence
Tinicum
Borough of Eddytone
Borough of Norwood
Borough of Folcroft

Township of Lower Merion - This agreement includes all of the Township and parts of Radnor, Haverford, and Narberth that are within the drainage basin of the Schuylkill River.

Township of Lower Moreland and the Lower Moreland Township Authority - The areas serviced by this agreement are specified on Figure 3.2-1, they and include some areas in Lower Moreland within both the Pennypack and Poquessing Creeks watersheds.

Lower Southampton Municipal Authority - Those areas of Lower Southampton that are within the Poquessing Creek watershed are covered under this agreement.

Township Springfield, Montgomery County - Areas of Springfield, Cheltenham Township, Upper Dublin Township, and Whitemarsh Township that are within the Wissahickon Creek watershed are covered by this agreement.

Upper Darby Township - Those portions of Upper Darby that are not included in the DELCORA agreement are covered by this agreement.

3.2.2 Contractual Agreements

As is standard practice and required by the Philadelphia Home Rule Charter, Philadelphia has entered into legal agreements with the organizations from which it accepts wastewater for treatment and disposal. These agreements establish the term of the relationship, connection points between Philadelphia's collection system and that of the municipality/authority, limits to the amount of flow and loadings, financial reimbursement, and other requirements that must be undertaken by the municipality/authority for the PWD's facilities to remain eligible for state and federal funding. Philadelphia made a concerted effort in the late 1980s to reestablish its relationships with the outlying municipalities/authorities by drafting new agreements with most of these neighbors to ensure that the most recent state and federal concerns were being addressed by each of the organizations involved. A summary of the current status of the intermunicipal agreements is shown on Table 3.2.2.

Except for the agreements with Springfield Township, Philadelphia has set up two basic types of agreements to contract wastewater transport, treatment, and disposal services with the outlying municipalities/authorities. They differ primarily in the length of the term and the type of commitment to long-term capital improvements, with which each outlying municipality/authority wishes to be involved. It is advantageous to the City to enter into longer term agreements for long-term needs and allocation of resources; therefore, these agreements are encouraged. However, some municipalities feel more comfortable with shorter term agreements that can be more easily adapted to evolving needs and treatment requirements. The issue of making the appropriate contribution to capital improvements and the resultant repayment of bond obligations is handled separately for these two types of agreements. The long-term agreement usually includes a capital contribution paid up front, based on the proportion of the contracted capacities and present value of the facilities. With the capital contribution, the fees paid by the outlying municipality/authority for conveyance, treatment, disposal, and maintenance do not include a contribution to the repayment of bond obligations. This agreement also includes a commitment by the outlying municipality/authority to contribute to improvements and expansions as required by state and federal statutes. The standard length of term for a long-term agreement is 35 years with a 5-year notification of intent to dissolve the relationship. While not including an up-front capital contribution, the short-term agreements include a charge for the current bond repayment obligation. These shorter agreements are generally for 7 years with a 6-month notification of intent to dissolve the agreement.

All agreements, long-term and short-term, begin with the recognition that the outlying municipality/authority has a need to dispose of its wastewater and that the PWD has the capacity and desire to fulfill this need. Furthermore, the City commits to setting aside the required capacity and the outlying municipality/authority commits to paying for the treatment and PWD's future ability to maintain such capability. There are other common conditions in the agreements that will become evident upon review of the agreement summaries; however, one stands out and deserves mention. Each agreement (save those for DELCORA and Springfield) includes a recognition of and commitment to the problem of biosolids management. With the increasing pressure to find programs and alternatives for safe biosolids management, the City made it a significant condition of the agreements to seek a cooperative effort on the part of all of the wastewater system users.

The agreement between the City and the Township of Abington is a typical short-term agreement, and similarly, the agreement with the Bensalem Township Authority is a typical long-term agreement. These two agreements will be presented in some detail as examples and have been included in Appendix B. The other agreements that follow will be described according to the ways in which they concur or deviate from these two typical agreements. Springfield is dealt with on its own merits since it is not in the format of either of these typical agreements.

Township of Abington - This agreement was executed in May 1983, and it is a standard short-term (7-year) agreement. It includes the following pertinent terms:

- The City and the Township agree to apply jointly for available grants or loans pursuant to improvements to the PWD wastewater collection, treatment, and disposal facilities. To this end, the Township is committed to adhering to several measures necessary to be eligible for such funding, such as: perform a Sewer System Evaluation Study of the Township's collection system, initiate a User Charges System consistent with EPA guidelines, initiate an Industrial Pretreatment Program at least as stringent as Philadelphia's, and adhere to the terms of the Federal Facilities Cost Recovery Program.

- The Township agrees to pay quarterly fees to the City based on measured and/or estimated flows including charges related to depreciation and return on existing facilities; operations and maintenance; replacement, repairs, and removal facilities; employee benefits; overhead; and non-direct expenses.

- The ownership and responsibility for the City's and Township's collection and treatment facilities remains within the authority of the current owners. Basically, each municipality is responsible for those facilities within its borders; however, the City reserves the right of inspection and sampling of facilities within the Township.

- The agreement establishes the allowable quantities of flow and loadings that may be discharged into the PWD system and the locations where this discharge may occur. Furthermore, the Township is required to install metering chambers for the measurement of flow being discharged, and assures the rights of the City to monitor and sample such flow.

- The Township is restricted from discharging harmful substances into the Philadelphia system, and is liable for any damages caused by any caustic substances that are discharged into the system.

- The Township is committed to Philadelphia's biosolids management program.

- Finally, the agreement sets procedures for inspections and audits; arbitration of disputes; claims, insurance, and related matters; term; no joint ownership; severability; successors; and assigns and waivers.

- An addendum to the agreement cites specific issues such as flow and payment amounts and is discussed further in Section 3.2.3, Wastewater Flows, Loadings, and Fees. It also details conditions for the flows from some homes in Philadelphia that drain to sewers in the Township and thence into the City's sewers.

Bensalem Township Authority - The agreement between the Bensalem Township Authority and Philadelphia is a typical long-term (35-year) agreement that was executed in May 1988. The pertinent details of this agreement are set forth as an example of a long-term agreement.

- The City agrees to set aside the amount of capacity required by the Authority in return for a capital contribution for those PWD collection and treatment facilities installed prior to July 1, 1986, and a second payment for those facilities installed between July 1, 1986, and March 31, 1988. Furthermore, the Authority agrees to pay its proportionate share of future improvements, renewals, replacements, and new facilities as needed, except for new facilities that would be intended solely for the increase of marketable capacity of the plant.

- The agreement includes provisions for the Authority to pay additional fees if it exceeds the flow and loading quantities set forth in the agreement. Furthermore, the Authority must make improvements to its own system if it routinely fails to meet its flow and loadings limits.

- The Authority agrees to pay wastewater treatment charges on a quarterly basis including operations and maintenance, management fees, and direct and indirect expenses.

- Requirements for meters, flow estimations, and sampling necessary to calculate the above charges are also set forth.

- The Authority also agrees to enter into an Interjurisdictional Pretreatment Agreement and co-develop a biosolids utilization program for Bensalem.

- Finally, as set forth in the short-term agreement previously described, the agreement sets terms for the following issues, including inspections and audits; arbitration of disputes; claims, insurance, and related matters; no transfer of rights; term (35 years with a 5-year notice to dissolve the relationship); ownership, management, and control of the plant facilities; severability; successors; and assigns, waivers, and notices.

Bucks County Water and Sewer Authority - In the same vein as the Bensalem Agreement detailed above, the Bucks County Water and Sewer Authority has entered into a long-term agreement with Philadelphia. This agreement was executed in February 1988, and those items that deviate from the Bensalem agreement are presented below:

- The Authority is to pay the City a capital contribution for those wastewater collection and treatment facilities installed up to July 1, 1986, and an additional capital contribution is to be paid for those facilities installed between July 1, 1986, and December 31, 1987.

- The Authority agreed to build, with its own funds, a new pumping station (Totem Road Pumping Station) and force main (State Road Force Main) to facilitate the flow of wastewater from the Neshaminy watershed to the PWD collection system (see Section 4.2.1 Description of Collection System for

further details on the State Road Force Main). The Authority is to own, maintain, and operate the new facilities within Bucks County and the new force main in the City. The City owns and maintains the telemetering devices (modem and data logger) for the system within Bucks County.

- In addition to the establishment of a biosolids utilization program, as previously described, the Authority is to support the community education program concerning the disposal of biosolids and to seek out individuals and groups that would benefit from such an educational program.

- Otherwise, this agreement contains basically the same conditions detailed in the Bensalem Agreement.

Township of Cheltenham - The agreement between the City and Cheltenham, executed in 1987, parallels the short-term agreement with Abington with the following exceptions:

- Philadelphia recognizes that Cheltenham has separate wastewater agreements with Abington and Jenkintown and the intent of this agreement is not to affect these separate agreements.

- Cheltenham recognizes the importance of an effective biosolids management program, and it is committed to full cooperation with the City's biosolids management programs; however, the agreement contains the caveat stating that Cheltenham will not be forced at any time to accept more than its proportionate share of biosolids from the City for management.

The Delaware County Regional Water Quality Control Authority (DELCORA) - The DELCORA agreement is a typical long-term agreement and has a format similar to that described under the Bensalem agreement. This agreement was executed in March 1974 and varies from the Bensalem agreement in the following ways:

- DELCORA agreed to construct and operate, at its own expense, the Eastern Delaware Conveyance System, which is comprised of a pumping station located in the vicinity of the abandoned wastewater pollution control plant of the Darby Creek Joint Authority and a 66-inch force main that terminates at the PWD's Southwest WPCP.

- The City agreed to expand the Southwest WPCP and reserve 50 mgd of capacity for DELCORA.

- Metering and sampling procedures were established similar to those in the Bensalem agreement.

- A complex formula for DELCORA's capital contribution to the expansion of the Southwest WPCP is also presented. The amount of DELCORA's contribution is proportional only to the benefit that is gained by DELCORA's constituent municipalities.

- The City is named as DELCORA's agent for applications for state and federal funding of plant expansion.

- There are conditions times for interim allowable flow and loadings for before and during construction of the aforesaid improvements.

- The agreement has a provision that each party will adhere to state and federal regulations and take the necessary measures to remain eligible for funding; however, it is not explicit about what measures each will have to take.

- Due to the age of the agreement (pre-ban on ocean disposal of biosolids - 1980), it is not explicit about DELCORA's cooperation on biosolids management.

Township of Lower Merion - The Lower Merion Agreement is the most recently executed agreement and corresponds closely to the long-term format established in the Bensalem agreement. The agreement was executed in March 1992 and contains the following exceptions from the Bensalem agreement:

- This agreement contains extensive conditions on payment and grievance procedures associated with the calculation of fees. These conditions include the right of the Township to file objection letters if it does not feel comfortable with the method of calculation of fees.

- Lower Merion has separate wastewater agreements with Radnor, Haverford, and Narberth, and this agreement is not to interfere with these separate agreements.

- Apart from the points of connection defined in an addendum to the agreement, the agreement recognizes a number of homes within Lower Merion that discharge directly into the PWD collection system in City Line Avenue. These connections are to remain based on the conditions detailed in the agreement.

Township of Lower Moreland and the Lower Moreland Township Authority - This short-term agreement between the PWD and the Township and Authority was executed in October 1987. The agreement is similar to the Abington agreement, except as noted below:

- The City and Lower Moreland agreed to adhere to the terms of their previous agreement, dated January 27, 1983, through July 1, 1989.

- The City agreed to design and construct an "Express Sewer" from the boundary with Lower Moreland within Welsh Road to the Darlington Run Interceptor. The interceptor was constructed 15 inches in diameter, some 2,200 linear feet in length, and was paid for by Lower Moreland. The ownership and responsibility for the interceptor remains with the City.

- Lower Moreland agreed to set aside funds in escrow to cover the estimated cost of the Express Sewer and a connection fee.

Lower Southampton Municipal Authority - The long-term agreement between Philadelphia and Lower Southampton closely parallels the Bensalem agreement. There are no significant deviations between these two agreements. The Lower Southampton agreement was executed in December 1988 and provides for a capital contribution from Lower Southampton to the City for those wastewater facilities installed before July 1, 1985, and a similar payment for those facilities installed from July 1, 1985, to March 31, 1989.

Township of Springfield, Montgomery County - The relationship between the Township of Springfield and the City of Philadelphia is not defined in the standard long- or short-term agreements discussed above. Rather the wastewater relationship was established in an agreement in January 1947 and has been amended several times since. This is more of an evolving relationship with additional needs and conditions being addressed through revision of the original agreement. As the oldest standing relationship the City has with a municipality, some of the conditions are unique to Springfield. The original agreement and subsequent revisions are outlined here to establish a basic understanding of the wastewater relationship between these two neighbors:

Original Agreement, January 1947 - The original agreement establishes the need on the part of Springfield to dispose of wastewater from the Erdenheim and Cheltenham sections of the Township, and the capability and desire of Philadelphia to accommodate this need. This agreement predates the construction of the Southwest and Southeast WPCPs that currently accept this wastewater; therefore, this agreement provides for Philadelphia to convey and discharge the raw wastewater downstream of the Fairmount Water Works. This avoids the potential contamination of a portion of the City's water supply from Springfield's wastewater. The agreement also establishes the limits of flow, responsibilities to construct collection facilities, limits the service area within Springfield, and limits the types of wastewater that can be discharged into the Philadelphia collection system. Furthermore, Philadelphia agreed to reserve capacity in the proposed collection system improvements and WPCPs for continued service of Springfield's wastewater. Other conditions for access, metering, and payment are established as well as the standards for release from claims, successors, and assigns. One condition which is established in this agreement that is significantly different from the agreements with the other outlying municipalities/authorities is that of settlement of disputes. The other agreements include a standard for the establishment of an Arbitration Board to be formed that would settle any dispute between the City and the other party. The agreement with Springfield dictates that any disputes between the two participants be settled by the Philadelphia Director of Public Works. The term

of that agreement was 25 years with a required 5-year notice given by either party to terminate. The flow limits set at the time of the initial agreement were:

- 3.6 cfs maximum flow rate
- 1.6 mgd maximum daily flow

Revision No. 1, March 1955 - This revision reaffirms that most of the conditions of the January 1947 agreement remain in full effect. The primary changes to the original agreement include:

- A reduction in the original allocation of maximum daily flow from 1.6 mgd to 1.5 mgd at the original point of connection while reallocating the 0.1 mgd difference to another point of connection. This revision also includes an additional 0.2 cfs to the maximum flow rate. This additional flow originates in an area within Springfield Township adjacent to Norwood Avenue. With these revisions, this addendum results in the following flow limits:

  - 3.8 cfs maximum flow rate
  - 1.6 mgd maximum daily flow

- Springfield agreed to pay its *pro rata* share of the construction of the Southwest and Southeast WPCPs and associated facilities.

- Disputes between the two parties are to be resolved by the Philadelphia Water Commissioner.

- The revision reaffirms the termination date of the agreements to be January 1972 (25 years from the original agreement) with the additional proviso that it would continue unless terminated by either party by the conditions established in the original agreement.

Revision No. 2, March 1961 - This revision merely extends the area to be serviced by the Philadelphia wastewater facilities to include portions of Upper Dublin Township, Whitemarsh Township, and three sections of Cheltenham Township. The agreement does not allocate additional capacity to Springfield beyond what was already agreed to.

Revision No. 3, March 1967 - Further increases the service area within Upper Dublin Township.

Revision No. 4, March 1974 - Further expands the agreement service area to include the Arlington Section of the Township of Whitemarsh. Furthermore, the revision includes a variety of improvements to the collection system of Springfield and Philadelphia. This agreement also increases the allocation for Springfield to:

- 4.0 cfs maximum flow rate
- 2.15 mgd maximum daily flow

Revision No. 5, February 1989 - This revision expands the agreement service area to include 53 homes in the "Eagle View" development within Springfield. A 1986 agreement between Whitemarsh Township and Springfield Township increased the allowable flow rate from Whitemarsh, through the Andorra Gauging Station, to 0.28 mgd. Philadelphia is not a party to this agreement.

Amendments to the existing agreement between Philadelphia and Springfield have been ongoing are still pending.

Upper Darby Township - As with the Lower Southampton Municipal Authority Agreement, this long-term agreement between the City and Upper Darby closely follows the format established in the Bensalem agreement. The agreement with Upper Darby was executed in August 1988 and provides for a capital contribution from Upper Darby to the City for those wastewater facilities installed before July 1, 1985, and a similar payment for those facilities installed from July 1, 1985, to March 31, 1989.

3.2.3 Wastewater Flows, Loadings, and Fees

The specific flows and loadings defined in the intermunicipal agreements are germane to the planning efforts of this document since the City must abide by those limits and be prepared to supply these wastewater services for the foreseeable future. Likewise, cost of treatment, cost of disposal, repayment of bond obligations, etc., are all relevant to the amounts of flow that the PWD accepts from its neighboring municipalities/authorities. Philadelphia must provide adequate capacity, as detailed in these agreements, while ensuring that all parties are contributing equitably to the cost of operation of the wastewater system.

Tables 3.2.3 and 3.2.4 provide the relevant information needed to identify Philadelphia's short- and long-term obligations, rights, and charges. For planning purposes, the short-term agreements are assumed to continue since there is no indication that any of the municipalities/authorities are considering alternative treatment and disposal systems.

The actual flow and loadings (BOD_5 and Total Suspended Solids) have been tabulated for 1990 and 1991 to evaluate the compliance record of the 10 outlying municipalities with their respective agreements. Table 3.2.4 includes the tabulation and a comparison to the contractual amounts stipulated in the current agreements.

3.3 WASTEWATER MANAGEMENT AGENCIES

In addition to protecting the public health, safety, and welfare, the goal of a comprehensive sewage facilities plan is to protect the waters of the Commonwealth and prevent future sewage disposal problems. For this reason, it is necessary to consider all organizations that discharge wastewater within the planning area and their impact on projected future wastewater needs. For the purposes of this plan, those agencies that must be considered are the PWD, the contributing municipalities/authorities that discharge to the Philadelphia wastewater collection and treatment facilities, and those private (non-municipal) users within the City that have their own National Pollution Discharge Elimination System (NPDES) sewage permits.

TABLE 3.2.2

SUMMARY OF INTERMUNICIPAL AGREEMENTS

	Agreement						Flow			Annual Loadings	
Municipal/Authority	Type	Last Amendment	Expiration Date	Status	Renewal Status	Plant	Maximum Annual Avg. (mgd)	Maximum Daily Avg. (mgd)	Maximum Instantaneous (cfs)	BOD (K lb/day)	S.S (K lb/day)
Abington	Short Term	1983	1990	Continuing	Negotiating	N.E.	4.453	--	9.25	*	*
Bensalem	Long Term	1988	2023	In Effect		N.E.	6.13	--	11.74	5,340	3,734
BCM&SA	Long Term	1988	2023	In Effect		N.E.					
Stage 1+							10.00	--	14.00	13,400	13,400
Stage 2++							20.00	--	62.00	--	--
Cheltenham	Short Term	1987	1992	Continuing	Negotiating	N.E.	13.38	--	20.75	*	*
DELCORA	Long Term	1974	2009	In Effect		S.W.	50.00	--	155.00	--	--
Lower Merion	Long Term	1992	2027	In Effect		S.W.	14.50	--	31.57	6,871	7,250
Lower Moreland	Long Term	1987	1994	In Effect		N.E.					
Stage 1 (7/89-7/94)							0.50	1.216	3.84	174**	182**
Stage 2 (7/94-7/99)							0.80	1.756	5.44	305**	318**
Stage 3 (Post 1999)							1.00	2.056	5.94	392**	408**
Lower Southampton	Long Term	1988	2023	In Effect		N.E.	7.14	--	15.79	3,651	3,651
Springfield (Erdenheim)	Long Term	1989	1972	Continuing	Negotiating	S.W	2.25	--	4.20	--	--
Springfield (Wyndmoor)						S.E.	1.00	--	1.93	--	--
Upper Darby	Long Term	1988	2020	In Effect		S.W.	17.00	--	35.00	6,831	7,439

* - Capacity Charge; see next table.
** - Welsh Road Express sewer connection.
\+ - Preconstruction of Neshaminy Manor force main.
++ - Post construction of Neshaminy Manor force main (current limits).

TABLE 3.2.3

CONTRIBUTING MUNICIPALITY CHARGES (AS OF 10-1-90)

Municipality/ Authority	Capital Contributions		Annual Lump Sum	Volume Charge (per Mcf)	Capacity Charge (cfs)	S.S. Charge (per Klb)	BOD Charge (per Klb)	Exceedance Charges		
	Net Cost*	Pro Rata Cost**						Flow (per 100,000 gal)	S.S. (per Klb)	BOD (per Klb)
Abington	---	---	$312,000	$0.5227	$5,640	$109.00	$110.94	---	---	---
Bensalem	$4,400,000	$153,320	$33,000	$0.5227	$5,640	$109.00	$110.94	$3,700	$480	$900
Bucks County	$11,900,000	$373,000	$28,000	$0.5227	$5,640	$109.00	$110.94	$3,700	$480	$900
Cheltenham (current provisos)	---	---	$626,000	$0.4651	$3,031	$109.00	$110.94	---	---	---
DELCORA			-0-	$0.5434	$2,893	$189.49	$139.91			
Lower Merion Neill Drive P.S.	$6,463,000	$205,000	$44,000	$0.5494	$2,914	$191.05	$140.22	$3,700	$480	$900
	---	$314,704		$1.1603	$5,778	$191.05	$140.22	---	---	---
Lower Moreland	---	---	$73,000	$0.5227	$5,640	$190.00	110.94	$3,800	$50	$96
Lower Southampton	$4,646,000	$277,820	$35,000	$0.5227	$5,640	109.00	$110.94	$3,700	$480	$900
Springfield										
(Erdheim)	---	---	169,000	0.7119	$4,175	$191.05	$140.22	---	---	---
(Wynmoor)	---	---	$91,000	$0.7144	$5,673	$226.98	$79.82			
Upper Darby	$5,356,000	$144,120	$19,000	$0.5494	$2,914	$191.05	$140.22	$3,700	$480	$900

*Net cost to City for wastewater facilities, systems and equipment completed prior to agreement date.
**Cost for wastewater facilities, systems, and equipment allocated to service of municipality after agreement date.

TABLE 3.2.4

CONTRIBUTING MUNICIPALITY
COMPLIANCE COMPARISON FOR FLOWS, LOADINGS & AGREEMENTS

Township		Flow			Suspended Solids			Biological Oxygen Demand			
		Total Annual Volume (mg)	Average Daily Flow (mgd)	Agreement (mgd)	Annual Total (Klb)	Average Daily Load (Klb/day)	Agreement (Klbs/year)	Annual Total (Klb)	Average Daily Load (Klb/day)	Agreement (Klbs/year)	Compliance
Abington											
	1990	279.15	0.76	4.45	428	1.17	Cap. Chg.	371	1.02	Cap. Chg.	Yes
	1991	257.68	0.71	4.45	395	1.08	Cap. Chg.	344	0.94	Cap. Chg.	Yes
Bensalem											
	1990	1,415.62	3.88	6.13	2,554	7.00	3,734	3,146	8.62	5,340	Yes
	1991	1,330.55	3.65	6.13	3,169	8.68	3,734	3,661	10.03	5,340	Yes
Bucks Co. Water & Sewer Authority											
	1990	5,975.18	16.37	20.00	8,086	22.15	13,400	8,485	23.25	13,400	Yes
	1991	5,949.28	16.30	20.00	7,692	21.07	13,400	7,411	20.30	13,400	Yes
Cheltenham											
	1990	2,271.87	6.22	13.38	2,510	6.88		2,203	6.04		Yes
	1991	2,440.18	6.69	13.38	2,681	7.35		2,360	6.47		Yes
DELCORA											
	1990	15,183.97	41.60	50.00	14,357	39.34		11,693	32.04		Yes
	1991	14,732.06	40.36	50.00	15,658	42.90		12,461	34.14		Yes
Lower Merion											
	1990	3,296.02	9.03	14.50	4,060	11.12		3,569	9.78		Yes
	1991	3,262.89	8.94	14.50	4,873	13.35		3,857	10.57		Yes

TABLE 3.2.4 (Continued)

Township	Flow			Suspended Solids			Biological Oxygen Demand			
	Total Annual Volume (mg)	Average Daily Flow (mgd)	Agreement (mgd)	Annual Total (Klb)	Average Daily Load (Klb/day)	Agreement (Klbs/year)	Annual Total (Klb)	Average Daily Load (Klb/day)	Agreement (Klbs/year)	Compliance
Lower Moreland										
1990	140.96	0.39	0.80	252	0.69	318	211	0.58	305	Yes
1991	228.97	0.63	0.80	448	1.23	318	363	0.99	305	No
Lower Southampton										
1990	1,629.80	4.47	7.14	2,008	5.50	3,651	1,641	4.50	3,651	Yes
1991	1,405.98	3.85	7.14	1,908	5.23	3,651	1,521	4.17	3,651	Yes
Springfield (Erdenheim)										
1990	862.19	2.36	2.25	882	2.42		782	2.14		No
1991	892.88	2.45	2.25	915	2.51		810	2.22		No
Springfield (Wyndmoor)										
1990	314.80	0.86	1.00	209	0.57		166	0.45		Yes
1991	301.35	0.83	1.00	201	0.55		160	0.44		Yes
Upper Darby										
1990	4,332.96	11.87	17.00	4,675	12.81	7,439	4,488	12.29	6,831	Yes
1991	5,345.66	14.65	17.00	9,544	26.15	7,439	6,986	19.14	6,831	No
Grand Totals										
1990	**35,702.52**	**97.82**		**40,021**	**109.65**		**36,754**	**100.70**		
1991	**36,147.48**	**99.03**		**47,483**	**130.09**		**39,933**	**109.40**		

3.3.1 Philadelphia Water Department

As discussed in Section 2.4.4, the Home Rule Charter authorizes the Philadelphia Water Department to operate the Philadelphia water supply and wastewater collection, treatment, and disposal systems with responsibilities including maintenance, repair, upgrade, expansion, and regulation of user rates. PWD supplies water to the City and a portion of Bucks County, a population comprised of approximately 1.74 million people, and wastewater services to the City and to 10 outlying municipalities/authorities in Montgomery, Delaware, and Bucks Counties, a population of approximately 2.29 million people. The current condition, use, and maintenance of the two systems operated by the PWD is good. Furthermore, the current management of PWD is attentive to the need for preserving, modifying, and expanding the facilities as required to service its customers in such a way as to comply with current environmental regulations.

The PWD is managed by a Commissioner appointed by the Managing Director of the City with the approval of the Mayor. The Commissioner appoints two deputies with the approval of the Managing Director. All other employees of PWD are appointed under provisions of the City's Civil Service Regulations. The senior management of PWD also includes the General Manager of the Administration and Human Resources Division, the General Manager of the Public Affairs Division, and the Divisional Deputy City Solicitor, Water and Utilities.

Other City Departments have responsibilities involving PWD. The Department of Revenue performs all functions relating to meter reading, customer accounts, and collections through the Water Revenue Bureau. The Director of Finance has overall responsibility for fiscal administration as chief financial, accounting, and budget officer of the City, and the City's Law Department handles all legal matters affecting PWD.

As of this writing, of the approximately 2,287 persons employed by PWD, 167 are upper management, supervisory, and senior engineering and administrative personnel. The Water Revenue Bureau of the Revenue Department employs approximately 464 persons whose positions are funded by PWD.

3.3.2 Contributing Municipalities/Authorities

Besides Philadelphia, ten municipalities and authorities gain their wastewater service through the Philadelphia wastewater system. Each of these organizations has its own priorities, needs, and plans, which are memorialized in their respective intermunicipal agreements with the City. The evaluation of the Philadelphia wastewater system and its needs are based on these agreements which were discussed in Section 3.2, Contributing Municipalities/Authorities.

3.3.3 Industrial Dischargers with Individual NPDES Permits

Within the City limits, there are more than 30 industrial users who treat their own process wastewater and, in some cases, sanitary wastewater and have been issued NPDES permits by PADER. These users discharge into the Delaware and Schuylkill Rivers; Frankford, Pennypack, and Mingo Creeks, and Walton Run. During 1992, there were no enforcement actions taken

against any of these dischargers. A complete list of these users including NPDES permit numbers is contained in Appendix C.

3.4 EXISTING DEMOGRAPHICS, LAND USE, WASTEWATER FLOWS AND LOADINGS

This section will review demographic changes in the City's population from 1980 to 1990. Current population, land use, wastewater flows and loadings will also be the focus of this review. To facilitate both the review of existing data and the discussion of future conditions (Section 5.0), the City has been divided into 12 planning analysis sections as follows:

A - Center City
B - South Philadelphia
C - Southwest Philadelphia
D - West Philadelphia
E - Lower North Philadelphia
F - Upper North Philadelphia
G - Bridesburg/Kensington/Richmond
H - Roxborough/Manayunk
I - Germantown/Chestnut Hill
J - Olney/Oak Lane
K - Near Northeast Philadelphia
L - Far Northeast Philadelphia

These planning analysis sections are the same as those developed and used by the City Planning Commission and are delineated in Figure 3.4-1, Planning Analysis Sections.

Generally speaking, the following planning analysis sections are contained within the Southeast Water Pollution Control Plant Service Area: A - the eastern portion of Center City; B - the eastern portion of South Philadelphia; E - the majority of lower North Philadelphia; F - the majority of upper North Philadelphia; G - the majority of Bridesburg/Kensington/ Richmond; and the central portion of I - Germantown/Chestnut Hill.

The Southwest Water Pollution Control Plant Service Area includes these planning analysis sections: A - the western portion of Center City; B the western portion of South Philadelphia; C - Southwest Philadelphia; D - West Philadelphia; the western portion of F - Upper North Philadelphia; H - Roxborough/Manayunk; and the northwest and southeast portions of I - Germantown/Chestnut Hill.

The Northeast Water Pollution Control Plant Service Area includes: J - Olney/Oak Lane; K - Near Northeast Philadelphia; L - Far Northeast Philadelphia.

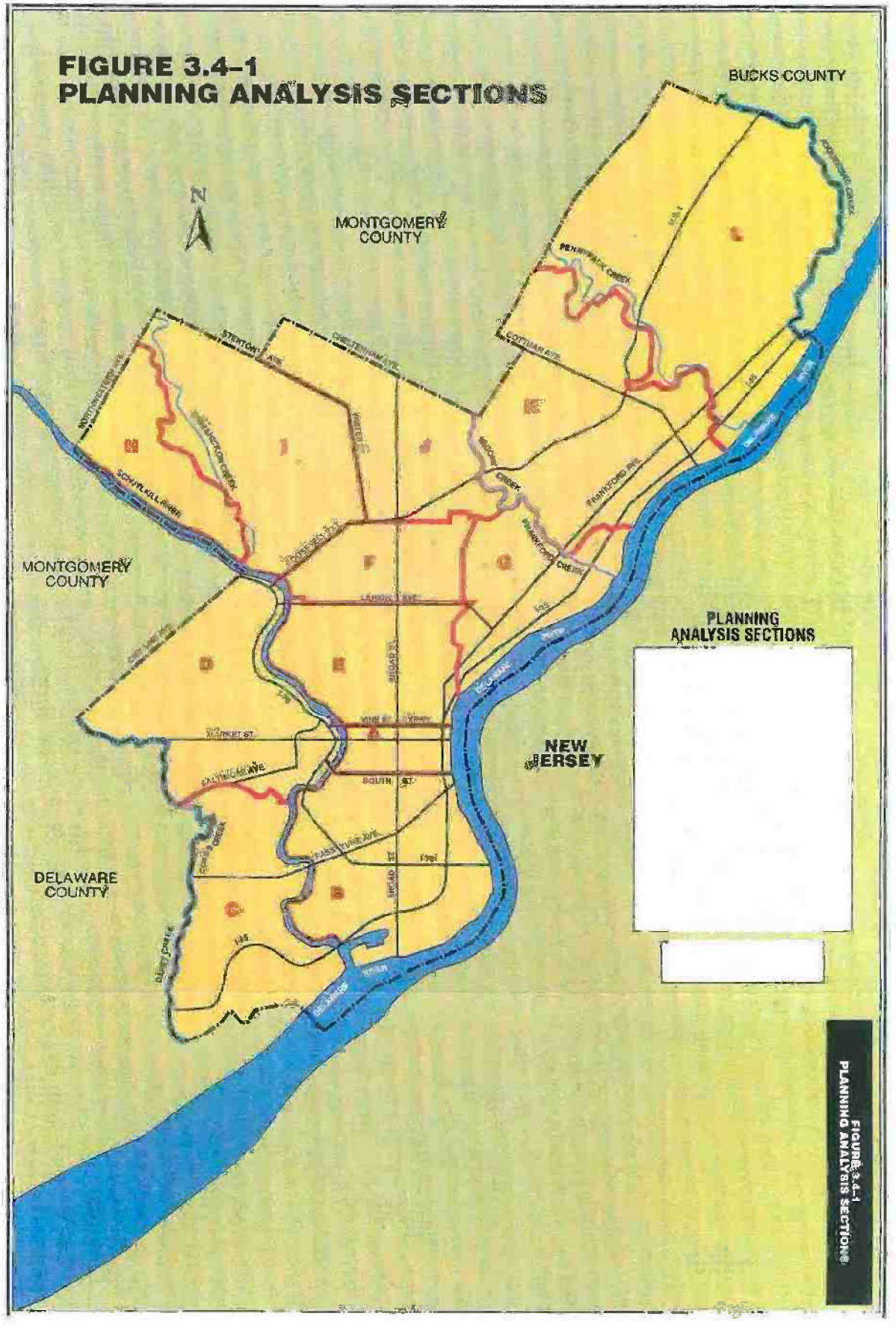
FIGURE 3.4-1
PLANNING ANALYSIS SECTIONS
BUCKS COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
DELAWARE COUNTY
NEW JERSEY
PLANNING ANALYSIS SECTIONS
FIGURE 3.4-1
PLANNING ANALYSIS SECTIONS

In this section, existing population data, land use data, and wastewater flows will be summarized for each of the 12 planning analysis sections and each of the water pollution control plant service areas.

The following sections rely on complete documentation of population, land use and housing data by census tract, planning analysis section and treatment plant service area for 1980, 1990 and 1996 as provided in Appendix D.

3.4.1 Existing Population and Trends

According to the U.S. Census, the City of Philadelphia experienced a decline in population from 1980 to 1990. In 1980, the population was 1,688,210 persons. In 1990, the population was 1,585,577, a decline of 6.1 percent. Population density also declined from 19.5 persons per acre to 18.3 persons per acre.

With the exception of the Center City Planning Analysis Section (A), every other section of the County experienced a decrease in population and a decrease in population density. Figure 3.4-2 Population Growth and Decline Areas 1980-1990 graphically indicates the location of these areas.

Table 3.4.1 summarizes the population trends from 1980 to 1990 for each of the 12 planning analysis sections. Lower North Philadelphia (E) experienced the greatest population decline (-14.1%) and the Far Northeast (L) experienced the least population decline (-1.7%). In contrast, Center City (A), the only section to grow in this period, experienced an increase (4.8%) in population. The Near Northeast (K) is physically the most populated planning analysis section in the City with 237,251 persons living within its boundaries.

Corresponding decreases in population density occurred from 1980 to 1990. In 1980, Lower North Philadelphia (E) was the most densely populated section, followed closely by Olney/Oak Lane. In 1990, Olney/Oak Lane (J), surpassed Lower North Philadelphia (E) as the most densely populated section of the City. Population density increased in the Center City (A) section from 27.3 persons per acre to 28.6 persons per acre. The Center City (A) section is the smallest, and had the most densely populated census tracts within the City in 1990. Figure 3.4-3, Population Density 1990, graphically shows the population density within the City in 1990.

Table 3.4.2 shows the compilation of the City population served by each of the three Water Pollution Control Plant Service areas based upon 1980 and 1990 census figures. The Northeast WPCP serves a total City population of 760,451 persons. The population in this service area declined by 35,134 persons from 1980 to 1990 (-4.4%). The Northeast WPCP serves the largest population (760,451 persons) and the largest area (approximately 42,959 acres) in the City. The Southeast WPCP serves a total City population of 338,873 persons and also experienced a population decline from 1980 to 1990 (-9.1%). The Southeast WPCP serves an area of approximately 15,203 acres. The Southwest WPCP serves a total City population of 486,253 persons over an area of 28,322 acres, which represents a decrease of 33,449 persons (-6.4%) from 1980.

FIGURE 3.4-2
POPULATION GROWTH AND DECLINE AREAS FOR 1980–1990

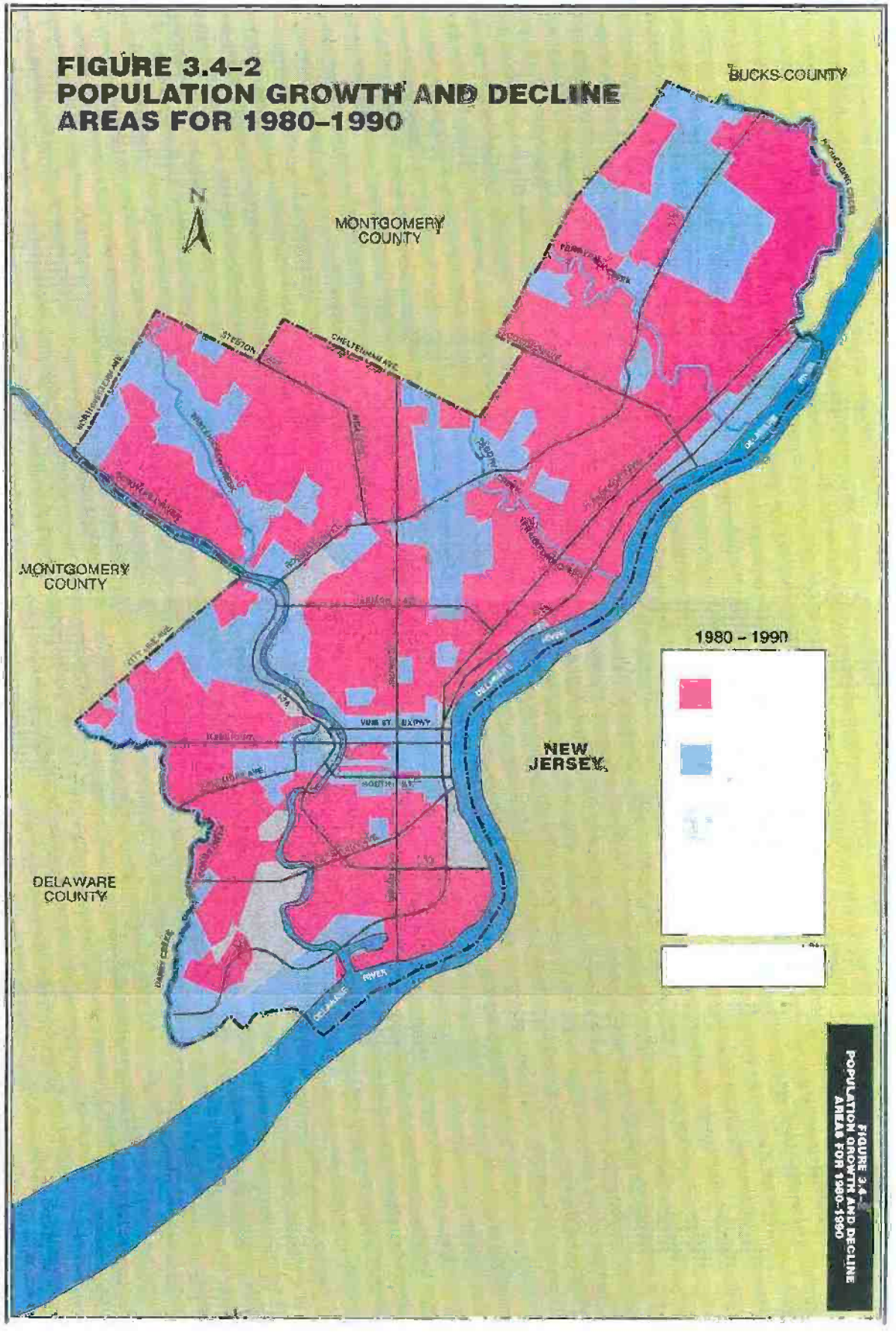

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TABLE 3.4.1

POPULATION TRENDS BY PLANNING SECTION
CITY OF PHILADELPHIA 1980 - 1990

TOTAL POPULATION AND DENSITY

Planning Analysis Section	1980 Total Population	1990 Total Population	Percent Change 80 - 90	Total Acreage	1980 Persons per Acre	1990 Persons per Acre
A	43,552	45,645	4.8	1,594	27.3	28.6
B	188,318	170,944	-9.2	8,691	21.7	19.7
C	86,328	81,885	-5.1	7,023	12.3	11.7
D	232,979	219,713	-5.7	8,888	26.2	24.7
E	170,611	146,491	-14.1	5,104	33.4	28.7
F	113,693	106,045	-6.7	3,827	29.7	27.7
G	100,865	94,715	-6.1	5,030	20.1	18.8
H	45,440	45,525	-6.4	4,002	11.4	11.4
I	110,455	103,266	-6.5	8,367	13.2	12.3
J	184,039	176,550	-4.1	5,584	33.0	31.6
K	248,559	237,251	-4.5	11,352	21.9	20.9
L	163,371	160,547	-1.7	17,021	9.6	9.4
Total:	**1,688,210**	**1,588,577**	**-6.1**	**86,483**	**19.5**	**18.4**

Source: U.S. Department of Commerce, Bureau of the Census.
BCM Engineers Inc.

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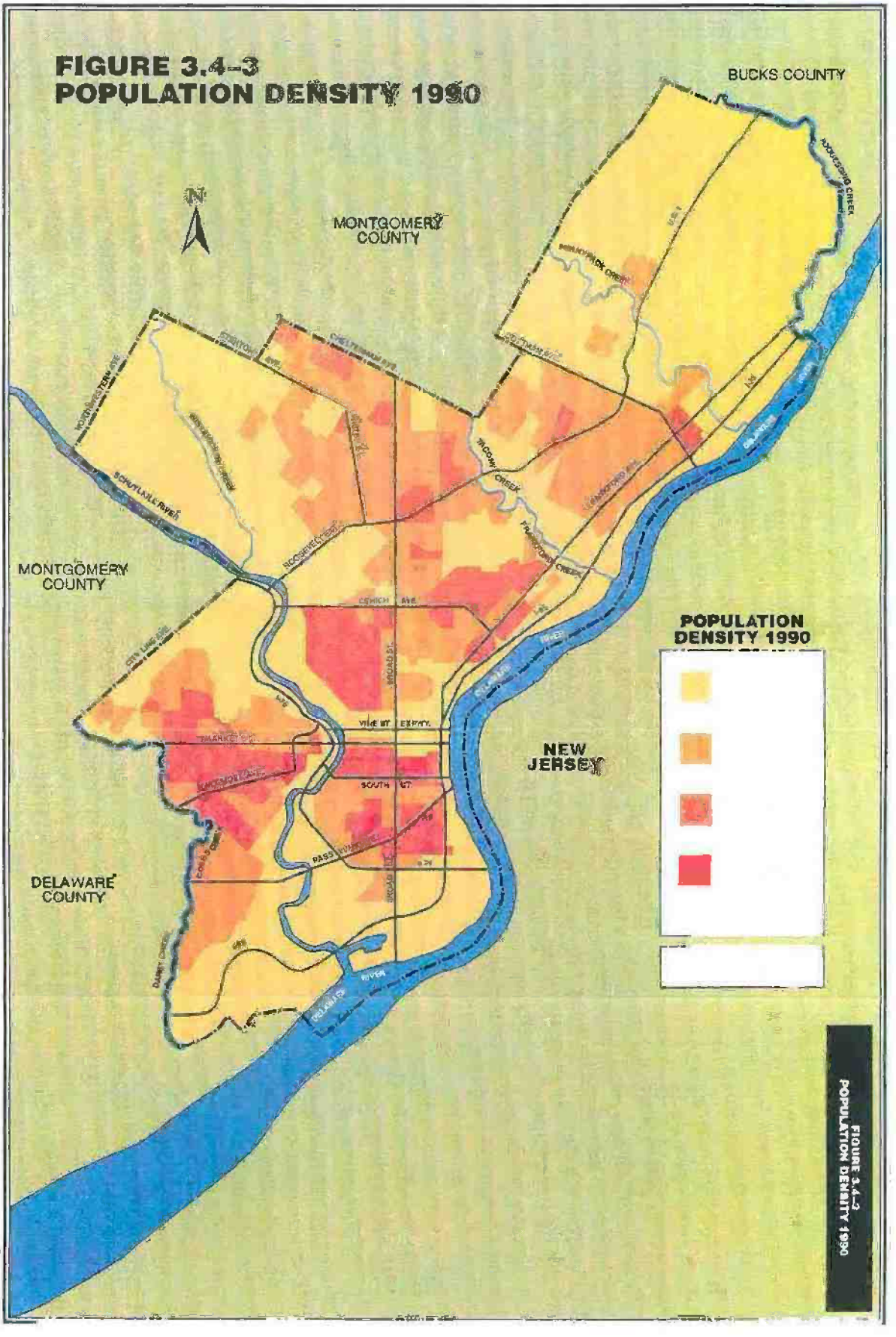
FIGURE 3.4-3
POPULATION DENSITY 1990
BUCKS COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
DELAWARE COUNTY
NEW JERSEY
POPULATION DENSITY 1990
FIGURE 3.4-3
POPULATION DENSITY 1990

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TABLE 3.4.2

POPULATION TRENDS BY WPCP SERVICE AREA

POPULATION AND DENSITY

WPCP Service Area	1980 Total Population	1990 Total Population	Percent Change 80 - 90	Service Area Acreage	1980 Persons Per Acre	1990 Persons Per Acre
NE	795,586	760,451	-4.4	42,959.3	18.5	17.7
SE	372,922	338,873	-9.1	15,202.6	24.5	22.3
SW	519,702	486,253	-6.4	28,321.8	18.3	17.2
	1,688,210	**1,585,577**	**-6.1**	**86,483.7**	**19.5**	**18.3**

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3.4.2 Existing Housing Trends

According to the U.S. Census, the City of Philadelphia experienced a modest decline (-1.5%) in the number of occupied dwelling units from 1980 to 1990. Table 3.4.3 summarizes the housing data by planning analysis section. Center City (A) and the Far Northeast (K) showed rather significant increases in the number of occupied dwelling units. Some 3,446 dwelling units were added in Center City and 5,981 were added in the Far Northeast from 1980 to 1990. Roxborough/Manayunk (H) and the Near Northeast (K) also posted modest increases.

The remaining eight planning analysis sections showed declines from 1980 to 1990. Upper (F) and Lower (E) North Philadelphia showed respective decreases of -10.1 percent and -8.3 percent, which is consistent with the decreases in population as noted in the previous section.

Table 3.4.4 shows that the area served by the Northeast WPCP experienced a decrease of just 232 dwelling units from 1980 to 1990. The area served by the Southeast WPCP showed a decrease of 5,566 dwelling units. The area served by the Southwest WPCP showed a decrease of 4,434 dwelling units.

One final statistic of interest is that the number of persons per dwelling unit in Center City (A) is significantly less than in other areas of the City. In 1990, the number of persons per dwelling unit in Center City was 1.3. The overall City average was 2.3 persons. Every planning district experienced decreases in dwelling unit density from 1980 to 1990 except Olney/Oak Lane (J), which remained constant (2.7 persons/dwelling unit), and Upper North Philadelphia (F), which increased from 2.6 persons/dwelling unit to 2.7 persons/dwelling unit.

3.4.3 Existing Land Use

As can be seen in Table 3.4.5 the City of Philadelphia encompasses 86,484 land acres. Land committed to residential use comprises the largest use category, totaling 36,961 acres (43%). A total of 25,942 acres of land is in institutional use (30%). Commercial land comprises 8,305 acres (9%), and vacant land totals 9,297 acres (11%). Industrial land accounts for 5,979 acres (7%).

The City's 12 planning analysis sections vary greatly in their land use composition. Table 3.4.5 characterizes land use for each of the 12 sections. It should be noted that much of the vacant land is comprised of environmentally sensitive areas such as wetlands and steep slopes and is undevelopable.

Table 3.4.6 provides a breakdown of the land use categories by wastewater treatment plant service areas. The land use of the planning analysis sections going to each WPCP is proportional to the land use of the total planning analysis section.

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TABLE 3.4.3

HOUSING TRENDS BY PLANNING ANALYSIS SECTION

CITY OF PHILADELPHIA 1980-1990

TOTAL HOUSING AND DENSITY/UNIT

Planning Analysis Section	1980 Total Housing Units	1990 Total Housing Units	Percent Change 80 - 90	1980 Housing Density Persons/ DU	1990 Housing Density Persons/ DU
A	30,370	33,816	11.3	1.4	1.3
B	78,522	74,987	-4.5	2.4	2.3
C	32,156	31,433	-2.2	2.7	2.6
D	97,226	94,940	-2.4	2.4	2.3
E	71,711	65,770	-8.3	2.4	2.2
F	43,855	39,406	-10.1	2.6	2.7
G	40,866	39,587	-3.2	2.5	2.4
H	18,247	19,430	6.5	2.5	2.2
I	48,224	46,851	-2.8	2.3	2.2
J	68,024	66,428	-2.3	2.7	2.7
K	99,929	100,289	0.4	2.5	2.4
L	55,981	61,962	10.7	2.9	2.6
Total	**685,131**	**674,899**	**-1.5**	**2.5**	**2.3**

Note: Complete tabulation by census tract provided in Appendix I.

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TABLE 3.4.4

HOUSING TRENDS BY WPCP SERVICE AREA

CITY OF PHILADELPHIA 1980 - 1990

WPCP Service Area	WPCP Service Area Acreage	1980 Total Housing Units	1990 Total Housing Units	Percent Change 80 - 90	1980 Housing Density Persons/ DU	1990 Housing Density Persons/ DU
NE	42,960	304,691	304,459	-0.1	2.6	2.5
SE	15,203	163,589	158,023	-3.4	2.3	2.1
SW	28,322	216,851	212,417	-2.0	2.4	2.3
Total	**86,484**	**685,131**	**674,899**	**-1.5**	**2.5**	**2.3**

Note: Complete tabulation by census tract provided in Appendix I.

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TABLE 3.4.5

PHILADELPHIA COUNTY LAND USE SUMMARY (ACRES)

Planning Analysis Section	Residential	Commercial	Industrial	Institutional	Vacant	Total
A	406	516	31	526	115	1,594
B	2,570	999	1,163	3,482	477	8,691
C	1,661	343	716	1,661	2,641	7,022
D	3,817	908	29	3,705	430	8,889
E	2,166	455	246	1,662	576	5,105
F	1,698	453	456	1,067	153	3,827
G	1,909	654	921	1,003	544	5,031
H	2,008	216	89	513	1,176	4,002
I	4,543	341	72	3,043	368	8,367
J	3,224	608	223	1,362	167	5,584
K	6,164	1,359	842	2,369	617	11,351
L	6,795	1,453	1,191	5,549	2,033	17,021
TOTAL	**36,961**	**8,305**	**5,979**	**25,942**	**9,297**	**86,484**

Sources: Land Use Maps, 1973 - 1981, Philadelphia Planning Commission
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TABLE 3.4.6

LAND USE BY WPCP SERVICE AREA (ACRES)

Northeast WPCP

Planning Analysis Section	Total Acreage	Residential	Commercial	Industrial	Institutional	Vacant
E	6	2	2	0	2	1
F	2,500	1,109	296	298	697	100
G	4,043	1,534	526	740	806	437
I	2,566	1,393	105	22	933	113
J	5,472	3,159	596	219	1,335	164
K	11,353	6,165	1,359	842	2,369	617
L	17,021	6,795	1,453	1,191	5,549	2,033
TOTAL	42,960	20,157	4,336	3,312	11,691	3,464

Southeast WPCP

Planning Analysis Section	Total Acreage	Residential	Commercial	Industrial	Institutional	Vacant
A	1,203	307	390	23	397	87
B	4,362	1,290	501	584	1,747	239
E	3,947	1,675	352	190	1,285	445
F	784	348	93	93	219	31
G	987	375	128	181	197	107
I	3,808	2,068	155	33	1,385	167
J	112	65	12	4	27	3
TOTAL	15,203	6,126	1,631	1,109	5,257	1,081

Southwest WPCP

Planning Analysis Section	Total Acreage	Residential	Commercial	Industrial	Institutional	Vacant
A	391	100	127	8	129	28
B	4,329	1,280	498	579	1,734	238
C	7,023	1,661	343	716	1,661	2,641
D	8,888	3,817	908	29	3,705	430
E	1,151	489	103	55	375	130
F	544	241	64	65	152	22
H	4,002	2,008	216	89	513	1,176
I	1,994	1,083	81	17	725	88
TOTAL	28,322	10,678	2,339	1,558	8,994	4,752

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Significant amounts of acreage are devoted to a number of large facilities. For example, the Philadelphia Naval Base, Philadelphia Naval Ship Yard, Veterans Stadium, and the Spectrum are located in Area B (South Philadelphia). Philadelphia International Airport is located in Area C (Southwest Philadelphia). The Northeast Airport, Holmesburg Prison, and Philadelphia State Hospital are located in Area L. Fairmount Park is located in Areas D (West Philadelphia), E (Lower North Philadelphia), I (Germantown/Chestnut Hill), F (Upper North Philadelphia, and H (Roxborough/Manayunk).

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4.0 EVALUATION OF EXISTING WASTEWATER FACILITIES

4.1 ON-LOT DISPOSAL SYSTEMS

Of the almost 675,000 residences in the City of Philadelphia, there are approximately 2450 with on-lot disposal systems (OLDS). These are individual onsite systems that do not discharge to the City's conveyance and treatment system. The greatest concentration of these systems is in the Roxborough/Manayunk, Germantown/Chestnut Hill, and Far Northeast sections, with others scattered throughout the City. The Philadelphia Department of Health (Health Department) is the agency that regulates OLDS and issues permits for new systems and repairs to existing malfunctioning systems.

Philadelphia has adopted regulations regarding OLDS from those of the Commonwealth of Pennsylvania as stated in Chapter 73 of Title 25 of the Rules and Regulations of the Pennsylvania Department of Environmental Resources (PADER). The regulations apply to all persons who wish to install individual or community sewage systems.

4.1.1 Identification of Areas with On-Lot Disposal Systems

In order to locate those areas with high densities of OLDS, the Water Revenue Bureau accounts for "water only" customers were reviewed and catalogued. It is assumed that users identified as "water only" do not discharge wastewater into the Philadelphia Water Department (PWD) collection and treatment system, and thereby utilize OLDS. In order to focus the discussion on areas of manageable size, those residences and streets without sewer accounts were plotted on a map of the City. The sections of the City that have significant OLDS densities have been grouped into seven areas, Areas A through G, and are delineated on Figure 4.1-1.

Philadelphia Health Department personnel were consulted to determine current policies and procedures in regard to new OLDS and handling complaints for failed systems. Health Department records for the last fifteen years were examined to locate areas where permits were issued for new OLDS and repairs to existing malfunctioning systems. This information was used to cross reference the "water only" account records to confirm the extent of on-lot disposal systems within the City. Table 4.1-1 catalogues the locations and other pertinent information about these seven areas. The remaining OLDS are scattered throughout the City. Appendix E includes the "water only" accounts, a list of streets in each section, new septic permit listings, and information on those properties with on-lot malfunctions.

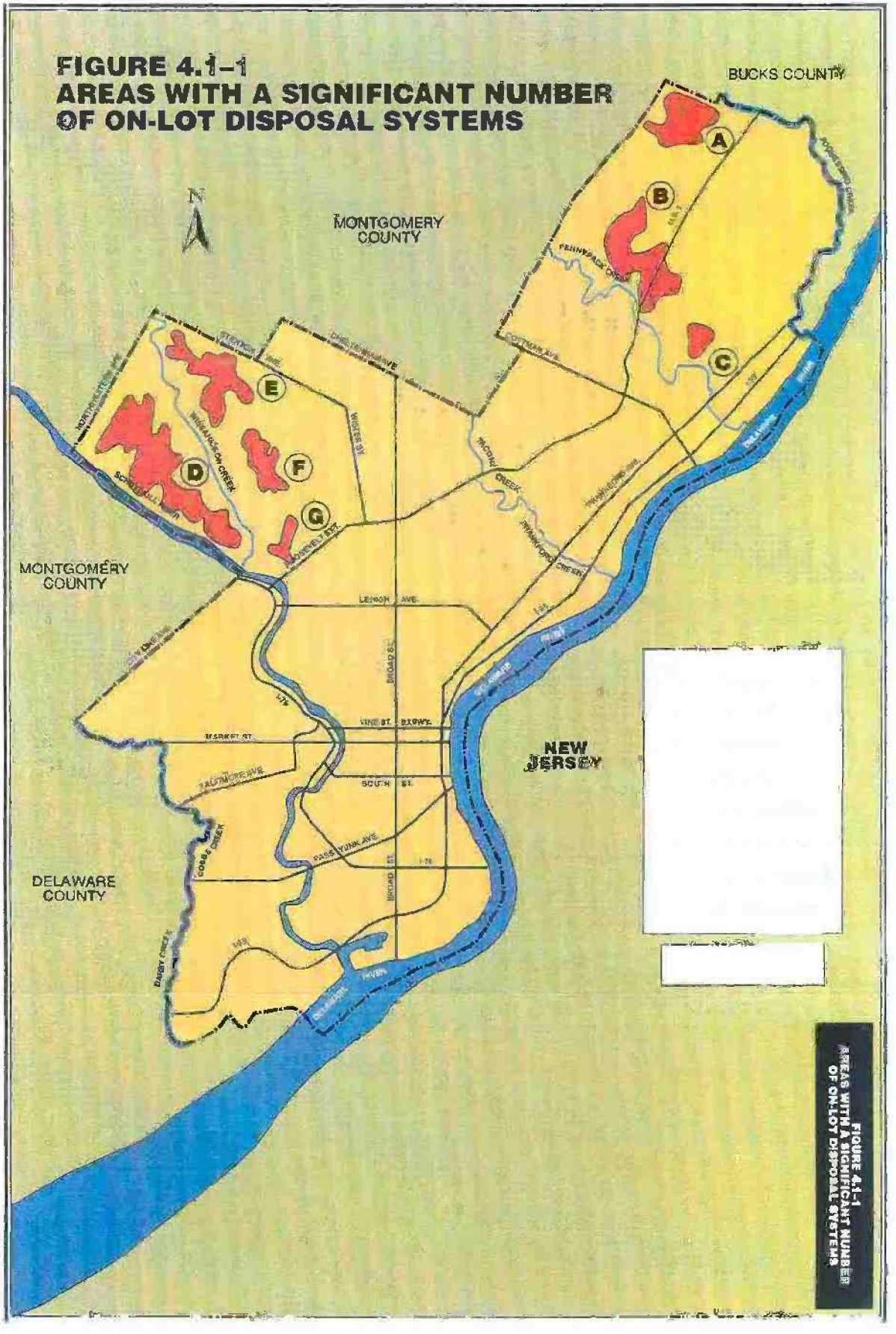
FIGURE 4.1-1
AREAS WITH A SIGNIFICANT NUMBER
OF ON-LOT DISPOSAL SYSTEMS
BUCKS COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
DELAWARE COUNTY
NEW JERSEY
A
B
C
D
E
F
G
FIGURE 4.1-1
AREAS WITH A SIGNIFICANT NUMBER
OF ON-LOT DISPOSAL SYSTEMS

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TABLE 4.1.1

OLDS LOCATIONS

Area	Planning Section	Approximate No. of Accounts *	Problems
A	Far Northeast	140	1%
B	Far Northeast	60	5%
C	Far Northeast	<10	0
D	Roxborough/Manayunk	575	3%
E	Germantown/Chestnut Hill	310	5%
F	Germantown/Chestnut Hill	90	1%
G	Upper North Philadelphia	30	3%

*From "water only" account records.

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4.1.2 Evaluation of Suitability for On-Lot Disposal Systems

Soil is capable of treating organic materials, inorganic substances and pathogens in wastewater by acting as a filter, exchanger, adsorber, and a surface on which many chemical and biochemical processes may occur. The combination of these processes acting on wastewater as it passes through the soil produces a water of acceptable quality for discharge into the groundwater under proper conditions.

Physical entrapment of particulate matter in the wastewater may be responsible for much of the treatment provided by soil. This process is most effective when the soil is unsaturated. If saturated soil conditions prevail, the wastewater flows through the larger pores and receives minimal treatment. However, if the soil is unsaturated and the wastewater flow into the soil distributed, filtration is enhanced because the wastewater is forced to flow through the smaller pores of the soil.

Numerous studies have shown that 2 feet to 4 feet (0.6 to 1.2 meters) of unsaturated soil is sufficient to remove bacteria and viruses and nearly all phosphorus to acceptable levels. The needed depth is determined by the permeability of the soil. Soils with high permeabilities may require greater unsaturated depths below the infiltrative surface than soils with low permeabilities.

Maximizing the use of OLDS under appropriate conditions is an environmentally sound treatment alternative. In those areas of appropriate subsurface and hydrological conditions, on-lot disposal provides an acceptable degree of treatment, helps maintain base flow in surface streams, and recharges aquifers. In many cases it is the most cost-effective means of sewage treatment/disposal. This method of sewage disposal is recommended whenever housing densities are low and conducive geologic and/or soil conditions exist.

Some of the factors that govern whether an area is suitable for on-lot systems include soils, geology, housing density, groundwater levels, and accessibility to public sewers. Even though an area has soils suitable for OLDS, soil tests are necessary to verify soil type, to ascertain soil porosity and percolation rates, and to analyze other site factors. Bedrock characteristics, for example, may affect natural groundwater quality. Furthermore, groundwater quality will eventually affect surface water quality as the water percolates into surface streams. The groundwater must be of sufficient depth below ground level to allow the wastewater to receive treatment as it percolates through the soil. If the groundwater is too high, the wastewater will receive inadequate treatment by the soil system. Accordingly, groundwater levels and other limiting conditions must be considered in evaluating suitability of sites for OLDS.

4.1.2.1 Soil Suitability

PADER has categorized the soil series mapped by the U.S. Soil Conservation Service for the Philadelphia area based on limitations for subsurface disposal of effluent. The soils are grouped by probable percolation rates, flood hazard, seasonal water table, shallowness, or special pollution hazards and may be classified into three general categories based on their suitability for OLDS:

1. "Suitable" soils are generally suitable for conventional soil treatment and disposal with subsurface absorption areas, depending on the percolation rate at the specific site.

2. "Marginal" soils are generally unsuitable for conventional systems, but may be suitable for alternative subsurface absorption areas, such as elevated sand mounds.

3. "Unsuitable" soils cannot be used for conventional or alternative OLDS.

The soil series that are found in Philadelphia were discussed in Section 3.1.2. The soils of the areas of the City that have high densities of OLDS are presented in Table 4.1.2, and show suitability for OLDS as categorized by PADER group, suitability, and percolation rate.

The greatest percentage of the soil in Areas A - G is Urban land, Chester complex with 0% - 8% slope. The next most predominant soil type in these areas is Urban land, Chester complex with 8% - 15% slope. There are small sections of Manor loam, Rowland silt loam, and Hatboro silt loam in these areas, but as can be seen from Table 4.1.2, these soil types are generally not well suited to on-lot systems.

Of the various soils series, Urban Land is by far the predominant type in the areas where OLDS are located, indeed, in the entire City. This type of soil has variable characteristics, including percolation rates, and is generally unsuitable for OLDS. However, prospective OLDS sites must be assessed individually to determine suitability.

4.1.2.2 Housing Density Considerations

Although the soils in a particular area may be adequate for on-lot systems, the capacity of the soil to absorb wastewater may be overtaxed if development in the area is too dense. Generally, in places where lots are two acres or larger with individual wells, OLDS have a minimal impact on the surrounding area. This is also true for one-acre lots, but it may be difficult to locate replacement locations for failing systems and still maintain adequate isolation distances from wells, structures, property lines, and other site features. In areas with one-half acre lots, OLDS generally should only be considered if public water is provided.

4.1.2.3 Alternative On-Lot Disposal Methods

In areas where the use of conventional septic systems is not recommended, an elevated sand mound or other alternative or experimental subsurface disposal system may be feasible. These alternatives provide various methods of on-lot disposal that may solve the problems created by soil limitations due to permeability, high seasonal water table, and bedrock characteristics. Generally, the alternative subsurface disposal system is designed to create a more suitable disposal field or a higher quality effluent, as is the case when using an aerobic treatment tank rather than a conventional septic tank.

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TABLE 4.1.2

SOIL SUITABILITY FOR OLDS

Soil Series	PADER Group	Description	Percolation Rate	Suitability
Hatboro	13	High flood hazard		Unsuitable
Manor	3	Mod. Deep, well drained	1" in 6-15 min	Suitable
Rowland	13	High flood hazard		Unsuitable
Urban Land			Variable	Unsuitable

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The currently approved and most predominant alternative on-lot system is the elevated sand mound, which can be considered in the following cases:

1. To solve an existing pollution or public health problem.

2. To overcome specific site suitability deficiencies, or as a substitute for systems on suitable lots.

3. To overcome specific engineering problems related to the site or its proposed use.

4. To utilize, under varying site conditions, an experimental design, either in whole or in part, that has been deemed successful by PADER.

When evaluating alternative on-lot systems, PADER requires that the following criteria be considered:

- Chemical and bacteriological characteristics of flow
- Materials of construction
- Volume and rate of sewage flow
- Characteristics and limitations of disposal site
- Design of absorption area
- Effect upon groundwater
- Other considerations as appropriate to comply with Act 537

4.1.2.4 Experimental On-Lot Disposal Methods

Current regulations also govern experimental on-lot disposal methods. These may be considered in any cases where elevated sand mounds are suitable and for the following purposes:

1. To evaluate new concepts or technology applicable to on-lot disposal.

2. To evaluate the applicability to on-lot disposal of established concepts or technologies having successful use in comparable applications in the field of engineering.

3. To demonstrate a design having successful use in other jurisdictions under environmental conditions similar to or more restrictive than those of the Commonwealth.

4. To utilize under varying site conditions, an experimental design, either in whole or in part, that has been deemed successful by PADER.

When properly designed, alternative and experimental on-lot systems are effective; however, they have two disadvantages. First, the design and construction costs are higher than conventional methods. Second, they may be considered aesthetically unacceptable due to their visibility or unusual appearance. The use of alternative and experimental on-lot systems is provided for in the January 22, 1983, revision of Chapter 73 of Title 25 of the Rules and Regulations of PADER.

The same evaluating criteria apply to experimental systems as to alternative systems. Other than elevated sand mounds, all alternative and experimental on-lot systems must receive approval from PADER and the Philadelphia Health Department.

4.1.3 On-Lot Disposal System Regulations

The Philadelphia regulations regarding OLDS adopted from those of the Commonwealth of Pennsylvania as stated in Chapter 73 of Title 25 of the Rules and Regulations of PADER apply to all persons who wish to install individual or community sewage systems.

The Commonwealth standards for septic tanks govern both capacity and construction. The minimum liquid capacity for any tank is 900 gallons. For single family dwellings, a minimum flow of 400 gpd must be used to determine tank capacity, with an additional 100 gallons for each bedroom over three. Construction specifications mandated by Chapter 73 address materials, wall thickness, covers, foundations, building standards, depths, inlet and outlet connections, treatment tank access, and inspections. The regulations include general site location and absorption area requirements, building sewers, treatment tanks, dosing and distribution requirements, construction of absorption areas, retaining tanks, and alternative systems.

4.1.3.1 Plumbing Regulations

The City ordinances governing septic systems which were a part of the Plumbing Code administered by the Philadelphia Department of Licenses and Inspections were rescinded in 1975 when they were superseded by PADER regulations. They regulated types of materials used, trenches, percolation tests, and loose wells (see page pits). Appendix E contains a copy of the regulations pertaining to septic systems. A summary has been included herein for informational purposes. Approximately 99 percent of the existing OLDS in the city were constructed in accordance with these regulations.

The materials section of the Plumbing Code covers pipes, field tiles, joints, and grading. Distribution pipes must be bell and spigot type of vitrified clay with water-tight joints. Pipes under driveways and other areas subject to heavy loads must be bell and spigot cast iron with leaded joints. Field tiles must be not less than 4 inches in diameter and shall be laid with 1/4-inch open joints. No cinders or ashes may be used for the field tile bed. This section of the Code also regulates open-joint protection, grade boards, and other grading requirements.

The regulations regarding trenches state that no disposal trench may be constructed in filled ground except by approval of the Health Department. The Plumbing Code sets criteria for determining seepage area as well as requirements for size and spacing of disposal trenches. There are certain standards for lines, including minimum number per field and maximum length. Depth

of cover and grade for tile lines is stipulated, as well as depth of filter material both under and over the tiles. A minimum of 150 square feet of effective absorption area (100 lineal feet) of 18-inch trench must be provided per dwelling unit.

Loose wells (seepage pits), although not an acceptable design for new installations, were regulated as to size, capacity, materials and location. They cannot be less than four feet inside diameter and must be provided with 18 inches of cover. The depth of the loose well is determined by the soil characteristics, but must be no less than ten feet below the inlet pipe. Other requirements include types of materials used for walls, wall thickness, depth of gravel or crushed stone to be used in the bottom, and location. Walls must be watertight to a depth of five feet below the ground surface. The distance between two loose wells shall be not less than ten feet.

The distance from the building to the septic tank must be not less than 10 feet, and from the building to the loose well, not less than 25 feet. There must be 10 feet between the septic tank and the loose well. The septic tank must have an 18-inch manhole and an inspection opening.

In evaluating malfunctioning existing OLDS in accordance with these regulations, the Health Department evaluates the repair of individual components as well as their impact upon public health and the environment.

4.1.3.2 Typical On-Lot Disposal System

The most common construction of septic systems within the City, due to the age of the OLDS systems, consists of a septic tank (tight well) and a seepage pit (loose well). Historically, the loose well was created by excavating the bedrock to a shallow depth and using explosives to break up the rock sufficiently to allow percolation directly into the rock strata. This procedure caused the rock to fragment, resulting in seepage paths directly into the groundwater. This method of construction was prohibited in 1975 having been replaced with septic tank and tile field systems as defined by PADER regulations.

4.1.4 Septage Management

Septic systems require periodic maintenance, which includes pumping of the accumulated scum and sludge septage. Recent EPA studies indicate that septage buildup ranges from 60 to 70 gallons per capita per year in well functioning septic systems. The required frequency of septic tank pumping ranges from 3 to 5 years. If septic tanks are not maintained, septage may overflow into the subsurface absorption area resulting in the discharge of raw sewage either into the dwelling or onto the ground surface and into the waters of the commonwealth.

Haulers transport and discharge septic tank waste into the PWD sewer system or treatment plants for disposal. Septage is anaerobic and presents problems at water pollution control plants (WPCPs) if handled in substantial quantities; however, this is not a significant concern for PWD, since the City's WPCPs are so large. The Philadelphia Health Department is responsible for responding to complaints, investigating and issuing orders for correction of malfunctioning OLDS. Septage Management is enforced by PWD and the Department of Licenses and Inspections.

4.1.5 Sewer Extensions

PWD has no established plans for extending the sewer service into Areas A through G because of the prohibitive costs. In the past, at Health Department request, the PWD has designed and extended sewers on Alton Street, Stratford Drive, Mechanicsville Road and Pennypack Street, where unsanitary conditions created by malfunctioning OLDS could not be corrected by other means. The Capital Improvement Plan for the next five years provides a limited budget for extension of the collection system. There is a potential for extensions into one or two streets in areas that have on-lot systems, but this would be on an as-needed basis and under special circumstances. Dearnley Park, in the Roxborough section, is one area for potential expansion. However, there have been few reported occurrences of malfunctions, and extension of the sewer system there is unlikely in the near future. Another area of dense OLDS is Chestnut Hill, but residents in that section are not likely to petition the City for sewer service. Many of the properties there are large, and either have ample space for replacement sewage systems or have on-lot systems that are operating satisfactorily and are acceptable to the owners. In most cases, the cost factor is prohibitive and would often require pumping stations or ejectors. The PWD is currently in the process of designing a collector system for the 9600 block of Banes and Barnes Streets and 1700 block of Fulmer Street, to eliminate the improper discharge of sewage from numerous homes into the street.

The installation of sewers in any new developments in these areas would be assumed by the developer.

4.2 WASTEWATER COLLECTION SYSTEM

The origins of the City of Philadelphia wastewater collection system date back to colonial times when drains, often hollowed trees, were installed to alleviate stormwater runoff, drain wetlands, and lower the groundwater to accommodate growth in the young city. The system soon became to be utilized to carry domestic waste, relieving the obnoxious conditions caused by stockpiling human and animal waste, which was the standard practice at the time. With the installation of water closets in City homes, house connections were made to the drains and larger extensions were added to accommodate the continually increasing demand to transport wastewater to the Schuylkill and Delaware Rivers. By 1854, there were 38 miles of sewers in service to meet the needs of the City. These drains/sewers were a convenient and inexpensive method of disposing of waste; however, they only transferred the associated nuisance and pollution problems from the residences and streets to the City's waterways.

The practice of relying on one system of sewers to convey both storm and wastewater in the 1800s and early 1900s has evolved into the modern combined sewer system that currently still services 60% of the sewered areas of the City. The remaining portion of the City has separate sewers for storm and wastewater, which is more typical of recent development. The combined sewer system relies on interceptor conduits sized to convey the wastewater flows to the treatment plants and regulator chambers that divert heavier stormwater flows from trunk sewers directly into adjacent surface waters. Conceptually, the system allows for the collection of all dry weather

wastewater flows and the first flush of stormwater runoff to the water pollution control plants for treatment. The wet weather flow, which is discharged directly into the adjacent surface waters with the stormwater runoff, would be diluted, presumably mitigating the effect on the water quality of the receiving waters.

Today, the total sewer system of the City is comprised of 2,955 miles of sewers and storm drains with more than 730 miles installed since the 1950s. A complete and comprehensive evaluation of almost 3,000 miles of sewers is beyond the scope of this report; however, an adequate understanding and evaluation of the collection system is essential to meeting the goals of this planning document and the Philadelphia wastewater collection and treatment system. The discussion and evaluation of the collection system included in this report will concentrate on the collection system's interceptors, pumping stations, and combined sewer operation and maintenance.

Interceptors are defined herein as larger sewer lines that do not normally have laterals connected to individual customers; rather their purpose is to convey large amounts of flow from remote areas to the water pollution control plants. Furthermore, the interceptors can be for either combined or separate systems. The construction and proliferation of the interceptor sewer system is a result of the City's efforts to protect its own water supply. As early as 1883, the City began construction of an intercepting sewer along the east bank of the Schuylkill River from below the Fairmount Dam to Manayunk, some six and a half miles in length. This interceptor transported wastewater from smaller sewers in Germantown, Chestnut Hill, Manayunk and Roxborough to downstream of the Fairmount Water Works, which supplied 50% of the City's potable water at the time. The frequency of having the City's water supply contaminated by its own sewage was greatly reduced by diverting the localized wastewater around the Water Works. By the turn of the century, with increasing population and industrial facilities, demand rose for a solution to the degradation of the Schuylkill and Delaware Rivers, which were plagued by offensive odors and a continued threat to public health. This situation resulted in the development of a long-term plan for wastewater treatment in 1912, the construction of the Northeast Sewage Treatment Works in 1923, and eventually the evolution of the three primary water pollution control plants in the early 1950s. The utilization of these large regional plants prompted the extension of the major intercepting sewers to collect wastewater from remote areas. As such, it is not surprising that the periods of major interceptor construction coincide with the construction of treatment plants in the early 1920s and 1950s.

4.2.1 Overview

The City's wastewater collection system includes the following components:

Separate Sanitary Sewer Collectors	585 miles
Separate Storm Sewer	620 miles
Combined Sewer Collectors	1,595 miles
Interceptors	135 miles
Outfalls	20 miles
TOTAL	**2,955 miles**
Wastewater Pumping Stations	12
Storm Water Pumping Stations	5
Metering Chambers	30
Manholes	84,590
Inlets	75,000
Regulator Chambers	175
Tide Gate Chambers	89
Diversion Chambers	23

These facilities serve a total population of approximately 2,286,000 spread over 230,600 acres, including approximately 1,586,000 people within the City and 700,000 in the outlying municipalities.

Due to the well established maintenance program utilized by the PWD, the general condition of the collector system is good. As mentioned above, the collection system provides service to virtually the entire City and ten surrounding municipalities/authorities for a total service area of 230,600 acres as itemized in Table 4.2.1 Service Area Summary.

The collection system provides this service through a vast network of sewers, storm drains, and interceptors made up of a variety of materials. A breakdown by material is shown in Table 4.2.2. The range of sizes within the collection system varies from 8" to 20' x 20' box culverts.

4.2.2 Interceptors

Local service is provided to each customer via house connections to a branch sewer, which in turn drains to a larger trunk sewer and finally to an interceptor. The 135 miles of interceptors collect the wastewater flow from about 2,200 miles of combined and separate sanitary sewers. Therefore, the interceptor system is of primary interest in evaluating the adequacy of the Philadelphia collection system due to its role in conveyance of wastewater flows to the WPCPs. The other element of the collection system that must be considered are regulators, which control the dry weather flow to the WPCPs and the overflow of stormwater during significant rain events. The regulators are located at critical points along the combined sewer system and can be utilized to take advantage of the potential storage within the trunk sewers to help control wet weather overflow.

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TABLE 4.2.1

SERVICE AREA SUMMARY

Tributary Area	Northeast (acres)	Southeast (acres)	Southwest (acres)	Interceptor	Design Flow (cfs)
Philadelphia	42,500	13,200	27,200		
Suburban					
Bucks County	45,000	-------	-------	Neshaminy Force Main/ Upper Delaware	40.0
Abington	4,500	-------	-------	Pennypack Creek	9.3
Lower Moreland	900	-------	-------	Pennypack Creek	5.4
Bensalem	4,400	-------	-------	Poquessing Creek	11.7
Lower Southampton	7,700	-------	-------	Poquessing Creek	5.4
Cheltenham	8,300	-------	-------	Tacony-Frankford Creek	21.2
Springfield	-------	300	4,500	Cresheim Valley Bridge/	1.9
				Upper Wissahickon (Low Level)	4.2
Lower Merion	-------	-------	12,100	Southwest (Main Gravity)	18.8
Upper Darby	-------	-------	7,800	Cobbs Creek	35.0
DELCORA	-------	-------	52,200	Force Main to SWWPCP	155.0
Total Suburban	70,800	300	76,600		
Total	113,000	13,500	103,800		
Total Area Served	230,600				

*Short-term

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TABLE 4.2.2

BREAKDOWN BY CONSTRUCTION MATERIALS

Separate System

Material	Sanitary (miles)	Storm Water (Branch) (miles)	Storm Water (Main) (miles)
Cast Iron		0.67	
Vitrified Clay	2.86	28.36	
Reinforced Concrete	577.17	148.50	26.39
Brick	0.81	102.05	11.09
Corrugated Metal	1.98	0.99	0.38
R.C. Box	----	----	28.58
Total	582.82	550.57	66.44
Total Separate System			1,199.83

Combined System

Material	Branch Sewer (miles)	Main Sewer (miles)	Relief Sewer (miles)	Outfalls (miles)
Cast Iron	2.84			0.21
Vitrified Clay	51.70			
Reinforced Concrete	240.73	37.84	8.82	4.61
Brick	1,004.05	104.70		6.74
Wooden				0.30
R.C. Box		42.88	2.09	8.04
Total	1,399.32	185.42	10.91	66.44
Total Miles Combined Sewer				1,615.55

TABLE 4.2.2 (Continued)

Intercepting Sewers

Material	Branch (miles)	Main (miles)
Cast Iron	7.30	0.51
Vitrified Clay	40.50	
Reinforced Concrete	25.25	18.77
Brick	11.03	10.61
R.C. Box	----	20.20
Total	84.08	50.09
Total Miles of InterceptingSewers		134.17
Total of Miles of Sewers		**2,949.55**

Note: Branch sewers <4.0 feet in diameter
Main sewers ≥ 4.0 feet in diameter

Table 4.2.3, Primary Interceptor Summary, provides some pertinent details on the main interceptors within the Philadelphia collection system. Some smaller branches are not included in this summary, which accounts for the difference between the total lengths as presented in Tables 4.2.2 and 4.2.3. Figure 4.2-1 shows the location of the interceptors included in the Primary Interceptor Summary, and Figure 4.2-2 delineates the drainage area within the City for each interceptor in question.

The PWD maintains an inventory of the interceptor system utilizing a computer model to provide a comparison of the interceptor capacity to the estimated design flow for each reach of interceptor pipe. The intended design of the interceptor system is to provide the capacity to convey 110% of the dry weather wastewater design flow. This criteria has been established to ensure the elimination of dry weather overflows via combined sewer regulator chambers to the adjacent surface waters and to provide capacity to transport the first flush of stormwater runoff to the WPCPs for treatment. The computer model output identifies which sections of interceptors have a theoretical capacity above the established criteria (110% dry weather) design flow. The program computes the full flow design capacity for each section of pipe based on Manning's Formula. For pipes that are 27" or less in diameter, the criteria design flow is based on the pipe flowing half full; for pipes 30" or greater in diameter, the criteria design flow is based on the pipe flowing two thirds full. By basing the criteria design flow on a portion of the full flow design capacity, a conservative evaluation of the capacity of the interceptors is achieved.

The design flow for each interceptor, for purposes of the PWD evaluation, is calculated by multiplying the area draining to each section of interceptor by a design flow per acre based on the estimated population density for that area. The design flows per acre are presented in Table 4.2.4 for convenience of review. Furthermore, these design flows are based on a wastewater production of 120 gallons per person and include an additional 2,000 gallons per day per acre of infiltration. In order to account for the commercial and industrial customers in the drainage basin and to ensure a conservative estimated capacity, the design population densities are estimated higher than the actual population densities derived from the 1990 census as can be seen in Table 4.2.3, Primary Interceptor Summary. A conservative evaluation is evident by comparing the design and census population densities. The design population densities are on average 450% higher than the actual densities reported in the 1990 census.

It is prudent to consider the interceptor capacities on a conservative basis since the evaluation and design criteria of the interceptor system are based on theoretical values for capacity and flows. As stated before, by establishing the criteria design flows as a fraction of the full flow design capacities and by assigning higher population densities to each drainage basin, PWD's reported capacity of the interceptor system appear to be conservative. However, the computer model which inventories the interceptors and provides the theoretical design capacity does indicate that some sections of the interceptors within Philadelphia are below the established criteria described above. Due to the conservative nature of the computer model and design criteria and the fact that the capacities and design flows are based on theoretical values, the model is not conclusive as to the adequacy of the existing interceptors. Potential capacity problems should be considered when PWD determines that an interceptor requires further evaluation or when other conditions warrant replacement or repair of the interceptor. These sections of interceptors should receive additional attention by the PWD staff when planning future improvements.

TABLE 4.2.3
PRIMARY INTERCEPTOR SUMMARY

System	Plant	Length (feet)	Sewered Area (acres)	Number of Combined Regulators	Criteria at Outlet Section			Design PPA*	1990 Census PPA*
					Full Capacity (cfs)	Capacity Rated (cfs)	Design Flow		
Upper Delaware	NE	37,755	5,253.3	12	516.1	404.6	377.3	>120.0	20.52
Pennypack Creek -1	NE	37,169	8,299.5	5	228.9	165.7	104.1	38.9	14.99
Wooden Bridge Run -2	NE	19,120	1,246.0		31.8	24.9	18.3	33.7	N/A
Poquessing Creek -1	NE	53,909	3,617.0		112.1	87.8	90.4	68.2	9.46
Byberry Creek -2	NE	32,057	2,123.2		68.9	54.0	34.8	63.3	9.46
Walton's Run -3	NE	16,997	1,731.0		31.8	24.9	18.3	34.7	N/A
Lower Frankford (Low Level) -1 (includes Southwest Branch)	NE	7,882	3,006.0	6	82.4	64.6	52.2	68.2	20.52
Upper Frankford	NE	12,684	1,375.2	10	49.1	38.5	34.5	106.1	20.52
Tacony - Frankford Creek (High Level)	NE	17,813	10,265.5	14	262.6	205.9	181.2	59.5	31.17
Somerset (Low Level)	NE	11,141	1,935.0	9	95.0	74.4	49.7	108.8	19.51
Lower Delaware	SE	26,234	5,997.2	33	356.8	279.7	159.1	97.0	28.03
Upper Wissahickon (High Level) -1	SE	34,302	744.6		251.6	197.3	17.7	99.6	11.57
Cresheim Valley Bridge -2	SE	14,000	850.0		35.8	24.3	6.2	7.9	
Monoshone Branch -2	SE	4,000	965.3		39.0	30.6	6.8	17.8	
Oregon Avenue -1	SE	6,402	1,497.1		83.8	65.7	20.4	49.7	19.86
Southwest (Main Gravity)	SW	19,455	5,472.1	10	521.3	370.5	438.7	>120.0	24.76
Central Schuykill (East Side) -1	SW	38,035	3,322.1	18	205.1	145.6	143.5	>120.0	28.03
Upper Schuykill (Low Level) -2	SW	16,795	2,519.0		44.9	35.2	35.4	51.9	10.78
Upper Wissahickon (Low Level) -2	SW	38,452	3,468.0		107.8	84.5	29.5	18.9	10.78
Central Schuykill (West Side) -1	SW	11,810	1,408.0	9	89.0	69.8	41.9	>120.0	24.76
Lower Schuykill (East Side) -1	SW	14,340	2,063.0	9	100.7	79.0	45.5	91.6	19.86
Cobbs Creek -1	SW	28,194	2,469.0	23	147.9	115.9	103.8	120.0	24.76
Indian Creek -2	SW	4,285	622.0	13	56.3	44.2	24.6	>120.0	24.76
Lower Schuykill (West Side)	SW	19,241	1,383.7	4	68.9	54.0	6.9	7.7	11.36
Island Avenue - 80th Street	SW	22,175	1,860.0		106.3	75.6	35.0	75.3	11.36
Total Length in feet		544,247	73,493.8	175					
Total Length in miles/square miles		103.08	114.8						

*People Per Acre
N/A - not applicable
Note: Negative numbers beside interceptors denote number of indentation for that interceptor
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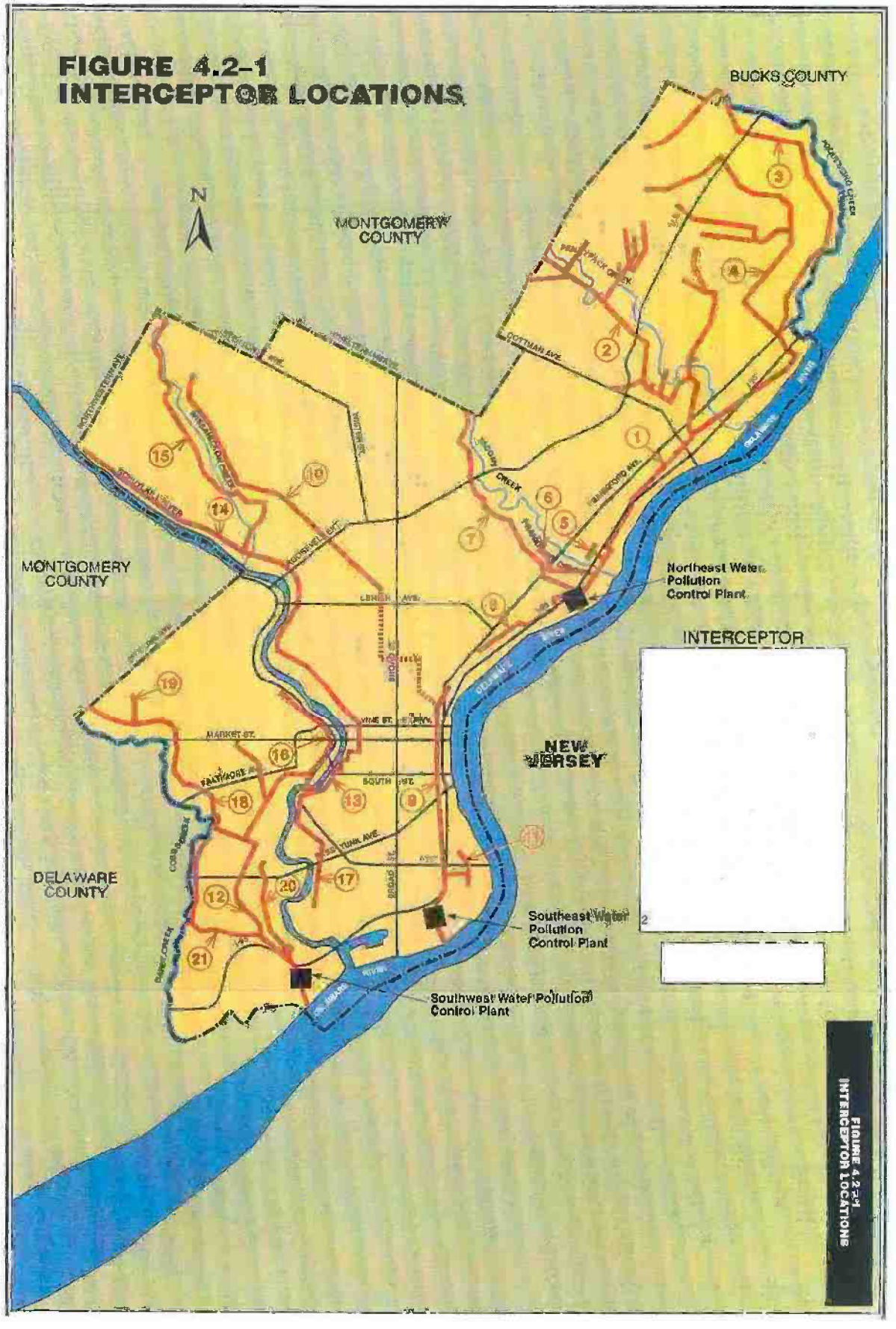
FIGURE 4.2-1
INTERCEPTOR LOCATIONS
BUCKS COUNTY
N
MONTGOMERY COUNTY
MONTGOMERY COUNTY
DELAWARE COUNTY
NEW JERSEY
Northeast Water Pollution Control Plant
Southeast Water Pollution Control Plant
Southwest Water Pollution Control Plant
INTERCEPTOR
FIGURE 4.2-1
INTERCEPTOR LOCATIONS

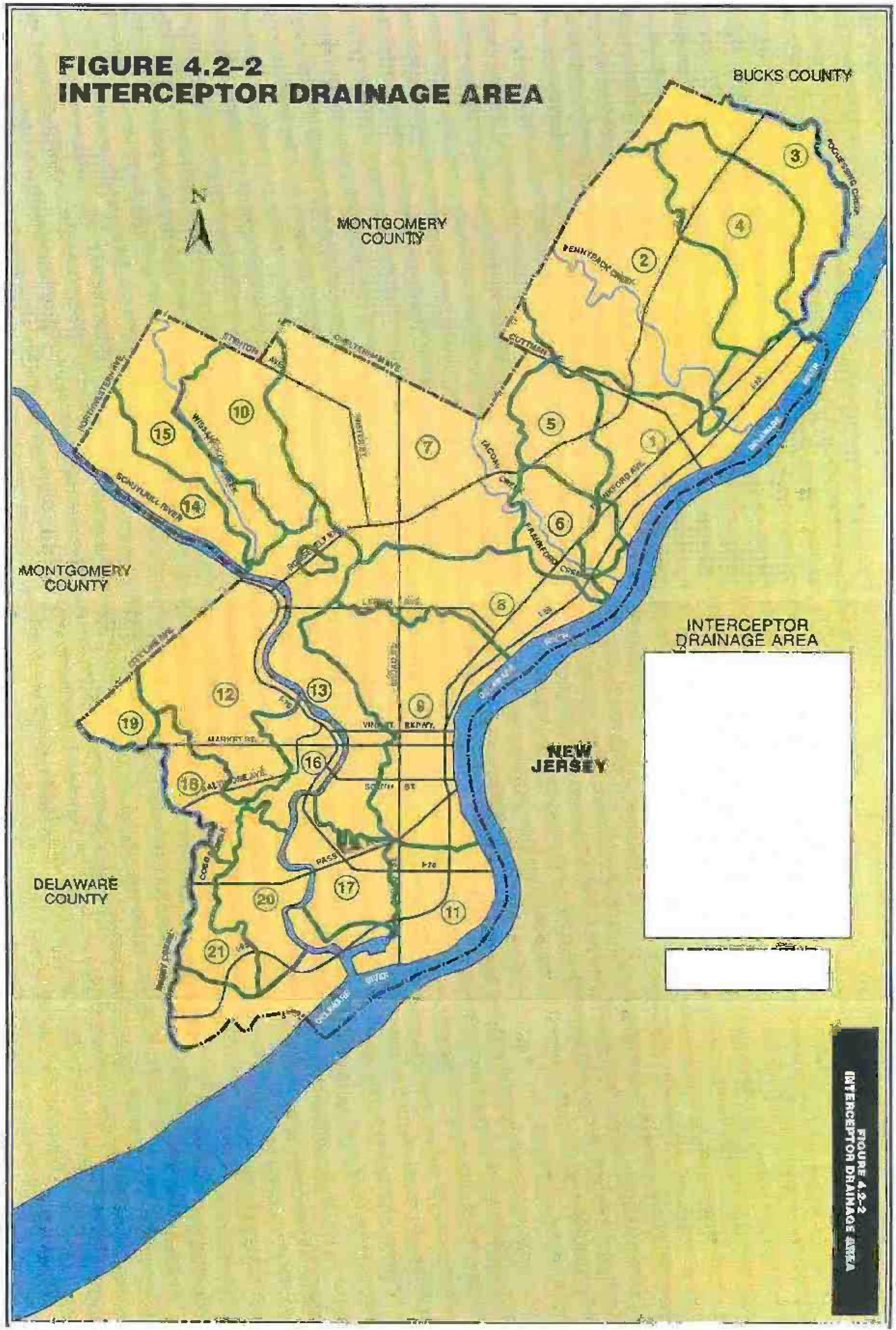
FIGURE 4.2–2
INTERCEPTOR DRAINAGE AREA
BUCKS COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
DELAWARE COUNTY
NEW JERSEY
INTERCEPTOR DRAINAGE AREA
N
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
FIGURE 4.2-2
INTERCEPTOR DRAINAGE AREA

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TABLE 4.2.4

DESIGN OF INTERCEPTING SEWERS

Type of Development	Persons per acre	Infiltration	Daily Max Total gals. per acre	Daily Max cfs per acre
Park	0	2,000	2,000	0.0031
Residential	10	2,000	3,200	0.0050
Residential	20	2,000	4,400	0.0068
Residential	40	2,000	6,800	0.0106
Residential	60	2,000	9,200	0.0143
Residential	90	2,000	12,800	0.0198
Residential	120	2,000	16,400	0.0254
Commercial	90	2,000	12,800	0.0198
Commercial	120	2,000	16,400	0.0254
Industrial	67*	2,000	10,000	0.0155
Industrial	83*	2,000	12,000	0.0186
Industrial	150*	2,000	20,000	0.0310
Industrial	233*	2,000	30,000	0.0465
Center City		2,000	64,000	0.0990

*Flow based on 120 gallons per capita per day.

A full listing of each segment of the interceptors is available, in the form of a computer printout, identifying the capacity, reserve capacity and shortfall where relevant. Appendix F includes a list of interceptor sewers that may be under capacity according to the design criteria. There is a lack of metered data for the interceptors that could be used to verify the theoretical design flow and capacities presented in the interceptor computer model. If questions of adequate reserve capacity for dry weather flows arise, it may be prudent to install meters in the interceptors with potential problems to confirm their flows and reserve capacity.

Table 4.2.1, Service Area of PWD Collector System also identifies which interceptors flow from each outlying municipality/authority drains. The flow from each outlying municipality/authority passes through one of 30 different meter chambers before being discharged into the Philadelphia interceptors or (WPCPs). Wastewater flow is measured at 19 of these chambers. Billing information derived from the remaining 11 chambers is based on historic standardized flow data. While the meters record the flow, separate equipment collects samples to determine BOD and suspended solids loadings from the respective municipalities in order to compile the data for billing purposes and to ensure their compliance with their respective intermunicipal agreements. Remote sensing flow meters, data loggers, and modems feed the data directly from the metering stations to the HP1000 computer at the Collector System Headquarters, which eliminates the need to manually collect data. The name and location of each meter chamber is presented in Table 4.2.5. The location of each meter station is shown in Figure 4.2-3.

At two points within the interceptor system, a diversion chamber has the capability to allow wastewater to be redirected from one water pollution control plant service area to another. These two diversion chambers are located as follows:

- The diversion chamber at Snyder Avenue and South 16th Street allows overflow from the Southeast service area to flow to the Southwest service area via the Passyunk Relief Sewer in the event of surcharging in the sewer in Snyder Avenue.

- The diversion chamber at 24th Street and Indiana Avenue directs dry weather flow to the Southeast service area while allowing the relief of wet weather flow to the Northeast service area in periods of high flow.

These facilities are essentially fixed and not considered a part of normal operations; however, they do have the potential to be adjusted by the addition of stop logs and, thereby, partially divert flow.

4.2.3 Pumping Stations

The Philadelphia wastewater collection system includes 12 sanitary pumping stations and 5 stormwater pumping stations. A package wastewater treatment plant at Fort Mifflin has two influent pumps and two effluent pumps and is the responsibility of the Department of Recreation. The stormwater pumping stations are included in this discussion since they are under the auspices of the PWD and are an integral part of the PWD system. Since they are drainage facilities, they will not be included in the evaluation section of this report. A summary of the pumping stations

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TABLE 4.2.5

METER CHAMBER LOCATIONS

Township	Meter Chamber	Plant
Lower Moreland	Byberry & Philmont	NE
Southampton	Trevose & Delvin	NE
Neshaminy	Neshaminy Pump Station	NE
Bensalem	Kay & Poquessing	NE
	Townsend & Poquessing	NE
	Dunks & Poquessing	NE
	Gravel & Poquessing	NE
	Knights & Frankford	NE
	Grant & James	NE
Abington	Fillmore & Shelmire	NE
	Shady Lane & Pennypack	NE
	Pine Road & Pennypack	NE
Cheltenham	Adams & Crescentville	NE
	Laurel & Tacony	NE
Springfield	Woodbrook & Stenton	SE
	Mermaid & Stenton	SE
	Winston & Stenton	SE
Springfield	Northwest & Stenton	SW
	Erdenheim & Stenton	SW
	Northwest & Thomas	SW
Lower Merion	Presidential & City Line Avenue	SW
	Conshohocken & City Line Avenue	SW
	51st & City Line Avenue	SW
	59th & City Line Avenue	SW
	63rd & City Line Avenue	SW
	66th & City Line Avenue	SW
	73rd & City Line Avenue	SW
Upper Darby	60th & Cobbs Creek N	SW
	60th & Cobbs Creek S	SW
	DELCORA	SW

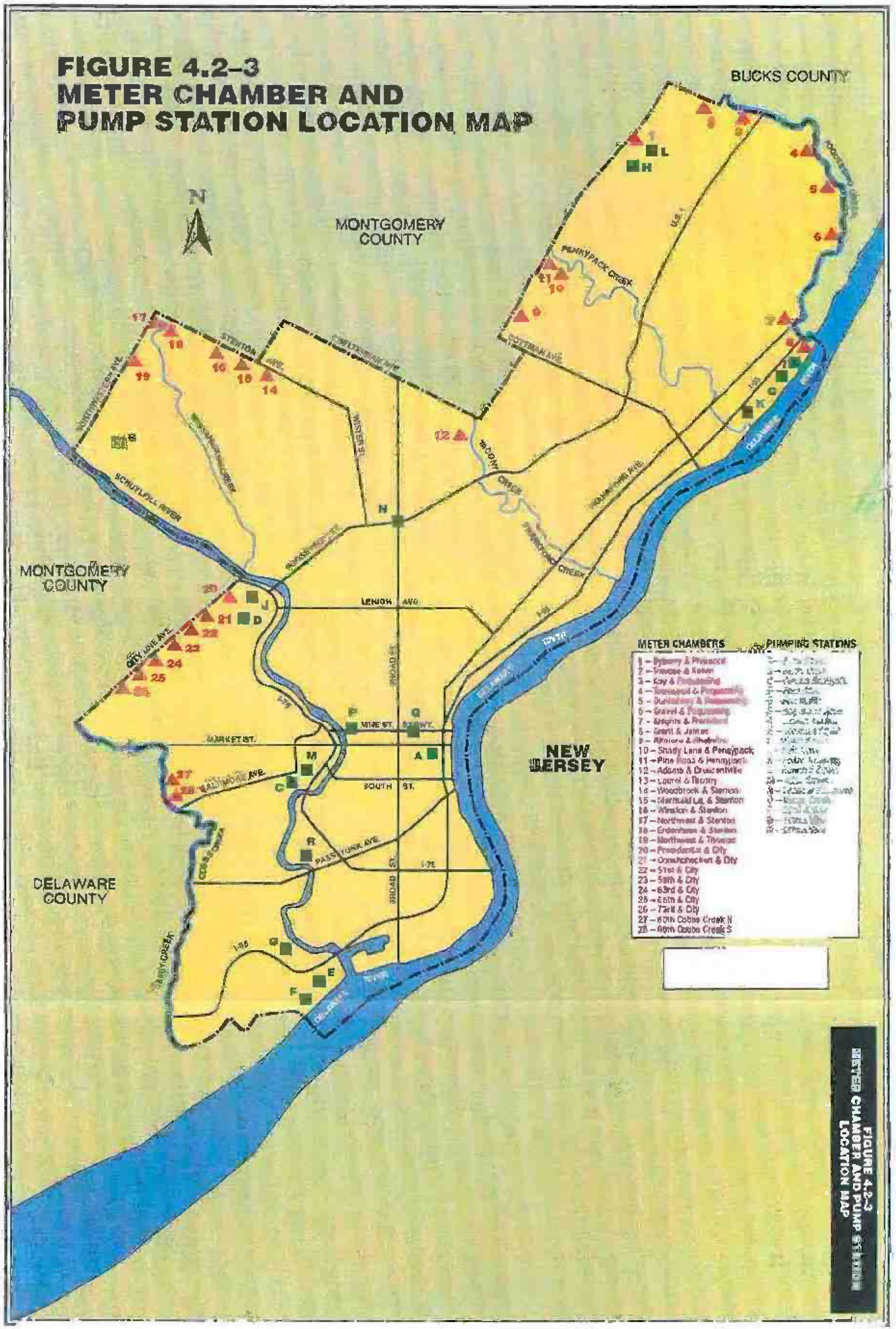

FIGURE 4.2-3
METER CHAMBER AND
PUMP STATION LOCATION MAP
BUCKS COUNTY
MONTGOMERY
COUNTY
MONTGOMERY
COUNTY
DELAWARE
COUNTY
NEW
JERSEY
PENNYPACK CREEK
COTTMAN AVE.
STENTON AVE.
SCHUYLKILL RIVER
LEHIGH AVE.
MARKET ST.
SOUTH ST.
PASSYUNK AVE.
BROAD ST.
VINE ST.
I-95
I-76
RIVER
METER CHAMBERS
PUMPING STATIONS
8 – Grant & James
10 – Shady Lane & Pennypack
12 – Adams & Crescentville
13 – Laurel & Tacony
20 – Presidential & City
22 – 51st & City
23 – 59th & City
24 – 63rd & City
25 – 66th & City
26 – 72nd & City
27 – 60th Cobbs Creek N
28 – 60th Cobbs Creek S
1 2 3 4 5 6 7 8 9 10 11 12 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
A C D E F G H J K L M N O P Q R
FIGURE 4.2-3
METER CHAMBER AND PUMP STATION
LOCATION MAP

located within the City, including their capacities and 1991 peak flows, is included in Table 4.2.6, Pump Station Summary. A description of each individual pumping facility is provided below. As described, two of the stations have dual feed power supplies. The others are covered by a contract that provides for operation of portable generators within two hours of a power failure. Figure 4.2-3 also shows the location of each pumping station described in this report.

As can be seen in Table 4.2.6, all of the wastewater pumping stations are operating under capacity, with a range from 5 percent of capacity at the Fort Mifflin facility to 67 percent at the 42nd Street Pumping Station.

The operation and maintenance of these sites is the responsibility of the Wastewater Pumping Group, which is part of the PWD Pumping Unit.

The general condition of these pumping stations is good due to the regular maintenance on an average three times a week each receives. Additional maintenance is performed on an as-needed basis due to malfunctions or clogging. Some stations with bar screens and communicators (see individual description below) are visited by maintenance personnel on a daily basis. In 1992, $950,000 was budgeted for the maintenance of the pumping stations. Table 4.2.6 also includes the history of the most recent refurbishment of the facilities, which occurs on an average of every 25 years for the major equipment.

Appendix G, Wastewater Pumping Station Spreadsheet Information, contains additional data for each pumping station including:

- Location
- Address
- Motor data
- Pump data
- Wet well data
- Flow data
- Station information, including conduit size

BANK STREET PUMPING STATION

Located in Center City, this below grade wastewater lift station handles the sewage for the condominiums and businesses located on Bank Street between Market Street and Chestnut Street.

Two submersible sewage pumps, rated 250 gpm at 39 feet Total Dynamic Head (TDH) with 7.5 Horse Power (HP) motors, pump the wastewater to the Market Street sewer. The station capacity is 500 gpm with an average inflow of 12 gpm. The flow destination is the Southeast WPCP.

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TABLE 4.2.6
PUMPING STATION SUMMARY

	Number of Pumps	Tested Capacity (each) (g pm.)	Total Station Capacity (gpm)	Peak Flow (gpm)	Percent Max flow/ Capacity (%)	Condition
Bank Street	2	292	584	70	12	One pump rebuilt in 1988. One pump rebuilt in 1989.
Belfry Drive	2	154	308	31	10	Station built in 1979.
Central Schuylkill P.S.	2 4	26,928 29,000	169,860	82,856	49	Two new pumps in 1973. Four new pumps in 1978. Two pumps rebuilt in 1987. One pump rebuilt in 1988.
Ford Road	2	759	1,518	444	29	Station completely rehabilitated in 1981.
Fort Mifflin*	2 Inf. 2 Eff.	40	80	7	5	
Hog Island Road	2	693	1,386	450	32	Station built in 1989.
Linden Avenue	2	920	1,840	251	14	Station built in 1968.
Lockart Street	2	586	1,172	296	25	Station built in 1968. One pump rebuilt in 1986.
Milnor Street	3	357	1,071	180	17	Station built in 1968. One pump rebuilt in 1986.
Neill Drive	3	1,787	5,361	3,092	58	Station competely rehabilitated in 1981. Three pumps rebuilt in 198?.
Police Academy	2	31	62	20	33	Station built in 1973. One pump rebuilt in 1987. One pump rebuilt in 1988.
Rennard Street	2	198	396	81	15	Station built in 1979. Two pumps rebuilt in 1987.
42nd Street	3	2,463	7,389	4,925	67	Station rehabilitated in 1981. One pump rebuilt in 1988. Two pumps rebuilt in 1989.

*Operated by Department of Recreation; planned to be phased out by 1994.

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Two hundred volt, single phase, single service power to the station is supplied through the local Philadelphia Electric Company (PECO) service in the area.

There is no overflow line from the station; the first sewage back up location is in the condominium courtyard adjacent to the station. There is no bar screen for the system and, the wet well is located under the pump floor.

BELFRY DRIVE PUMPING STATION

Located in Upper Roxborough, this lift station handles the domestic wastewater for the residential development in the immediate area (approximately 75 homes).

Two sewage pumps, rated 150 gpm at 75 feet TDH with 15 HP motors, pump the wastewater to the collector located 1,100 feet east of the station on Steeple Drive. The station capacity is 300 gpm with an average inflow of 23 gpm. The flow destination from this pumping station is the Southwest WPCP.

Two hundred thirty volt, 3-phase, single service power to the station is supplied through the local PECO service in the area. PECO uses 571 S. Manatawna Street for location identification.

Overflow from the station goes to the drainage right-of-way adjacent to the station. There is no bar screen for the system. The wet well is located next to the pump room vault.

CENTRAL SCHUYLKILL PUMPING STATION

Located just west of the Schuylkill River at the 34th Street Bridge, this is the largest lift station in the City and pumps the Central Schuylkill (East Side) and Central Schuylkill (West Side) Interceptors. The Upper Schuylkill, Central Schuylkill, and the Lower Schuylkill Interceptors merge at the Central Schuylkill Siphon - South Shaft located across the river from the pumping station.

This facility has two bar screens that prevent the twin 4-foot, 2-inch siphon tubes from becoming obstructed with large debris. The Schuylkill West Side Interceptor merges with the Schuylkill East Side Interceptor just outside of the pumping station at the North Shaft.

The pumping station consists of six main pump units, four constant speed pumps rated 29,000 gpm at 50 feet TDH with 450 HP motors, and two variable speed pumps rated 27,000 gpm at 49 feet TDH with 400 HP motors. The pump station lifts the wastewater to the Southwest WPCP gravity main.

The station has a firm hydraulic capacity of 195 mgd (135,500 gpm). The average inflow is 46,000 gpm. The normal pumping scheme is to operate one constant and one variable speed pump to match the inflow. In order to prevent flooding of the wet well, the station sluice gates will close automatically when the level reaches 12 feet in the bar screen channel.

Thirteen thousand two hundred volt dual feeders supply power to the station. Only one line is in operation at a time.

The auxiliary equipment at the pumping station includes:

- Two sump pumps to prevent station flooding
- Two service pumps for seal water and instrument backflushing
- Two booster pumps for the hydraulic operated discharge valves
- Two bar screen trash rakes to remove inflow debris

The overflow on the collector level chart recorder is 12.5 feet. At this level, the Schuylkill East Side Interceptor may overflow into the Schuylkill River at the S-7 regulator located under the Vine Street bridge on the east side of the river.

The Central Schuylkill Pumping Station is currently slated to undergo an extensive renovation including the total replacement of all electrical systems, wet well sluice gates, bar screens, and trash rake systems. Furthermore, the station will be fully automated at the conclusion of the contract, which is expected to be executed shortly.

FORD ROAD PUMPING STATION

Located across the street from West Park Hospital, 3900 Ford Road, this below grade lift station handles wastewater from local residences and West Park Hospital.

Two vertical wastewater pumps, rated 900 gpm at 142 feet TDH with 40 HP motors, pump the wastewater to the sanitary sewer located at Ford Road and Monument Avenue. The station capacity is 1,800 gpm with an average inflow of 198 gpm. The flow destination is Southwest WPCP.

Two hundred forty volt, 3-phase, single service power to the station is supplied through the local PECO service in the area. PECO uses 3800 Ford Avenue as the location identification. The pump room utilizes explosion-proof equipment.

The wet well has a bar screen and communicator to separate solids. The overflow from the station goes into a small creek, 50 feet east of the station, that drains to the Schuylkill River north of the Falls Bridge.

HOG ISLAND ROAD PUMPING STATION

Located on the north side of Hog Island Road, 500 feet east of the Philadelphia International Airport control tower, this lift station handles the wastewater for the UPS facility and the Crash, Fire, and Rescue Station located on the airport grounds.

Two vertical sewage pumps, rated 500 gpm at 150 feet TDH with 40 HP motors, pump the wastewater 6,000 feet north to the gravity sewer in Hog Island Road. The station capacity is 700 gpm with an average inflow of 26.2 gpm. The peak flow is limited to 400 gpm because of the UPS pumping station that discharges into the station.

Four hundred eighty volt, 3-phase power is supplied by the PECO transformer located outside of the station.

The wet well has no means of separating large solids, as it has no bar screen or comminutor. The pump floor and the wet well are confined spaces.

LINDEN AVENUE PUMPING STATION

Located just north of Baxter Treatment Plant at Linden Avenue and Milnor Street, this below grade wastewater lift station handles residential sewage for the nearby community.

Two vertical sewage pumps, rated 1,400 gpm at 26 feet TDH with 15 HP motors, pump the wastewater up to the Linden Avenue sewer. The station capacity is 2,800 gpm with an average inflow of 87 gpm. The flow destination is the Northeast WPCP. The pump room and the wet well utilize explosion proof equipment.

Two hundred forty volt 3-phase power is supplied by the local PECO service in the area. PECO uses 5200 Linden Avenue for the location identification.

The wet well has a bar screen to prevent large solids from entering the pumps. The pump room and wet well utilize explosion-proof equipment.

LOCKHART STREET PUMPING STATION

Located in the Somerton section of the City, this below grade lift station handles domestic wastewater for the local community.

Two sewage pumps, rated 600 gpm at 60 feet TDH with 15 HP motors, pump the wastewater to a gravity sewer on Nandina Street a few blocks away. The station capacity is 1,200 gpm with an average inflow of 158 gpm. The flow destination is the Northeast WPCP.

Two hundred forty volt, 3-phase, single service power to the station is supplied through the local PECO service in the area.

The wet well has a bar screen and comminutor to separate the large solids. The overflow from the station goes to a creek located approximately 1,000 feet to the west of the station. The pump room and wet well utilize explosion-proof equipment.

MILNOR STREET PUMPING STATION

Located in the Torresdale section of the City, this below grade lift station handles domestic wastewater for the surrounding community.

Two sewage pumps, rated 300 gpm at 36 feet TDH with 5.0 HP motors, pump the wastewater to a gravity collector in State Road. The station capacity is 600 gpm with an average inflow of 17 gpm. The flow destination is the Northeast WPCP.

Two hundred forty volt, 3-phase, single service power to the station is supplied through the local PECO service in the area.

The wet well has a bar screen to separate large solids. The overflow from the station goes to the Delaware River just east of the station.

NEILL DRIVE PUMPING STATION

Located in Fairmount Park just west of the Presidential Apartments, this lift station handles the wastewater for the community and an area hospital.

Three sewage pumps, rated 1,800 GPM at 172 feet TDH with 125 HP motors, pump the wastewater to the collector at Ford Road and Monument Avenue. The station capacity is 3,600 gpm with an average inflow of 1,250 gpm. The flow destination is the Southwest WPCP.

Thirteen thousand two hundred volt dual feeders supply power to the station.

The wet well has a bar screen and comminutor to separate large solids. The overflow from the station goes to a creek located approximately 1,000 feet to the west of the station. The wet well utilizes explosion-proof equipment.

POLICE ACADEMY PUMPING STATION

Located on the grounds of the Police Academy, this ground level wastewater lift station is the smallest public pumping station in the City and handles the sewage for the dog kennels and police facilities other than the main building.

Two submersible sewage pumps, rated 100 gpm at 24 feet TDH with 2.0 HP motors, pump the wastewater to a gravity sewer in State Road. The station capacity is 200 gpm with an average inflow of 3.1 gpm. The flow destination is to the Northeast WPCP.

Two hundred thirty volt, single phase, single service power to the station is supplied through the local PECO service in the area.

There is no overflow line from the station. The first sewage back up location is in the dog kennels. There is no bar screen for the system, and the wet well is located under the pump motor floor.

Along with the Central Schuylkill Pumping Station, this pumping station is slated for refurbishment in 1993, including new pumps, motors, and controls. This work is to be completed in-house by PWD personnel.

RENNARD STREET PUMPING STATION

Located in the Somerton section of the City, this station handles domestic wastewater for the surrounding community.

Two sewage pumps, rated 400 gpm at 46 feet TDH with 10 HP motors, pump the wastewater to the sewer at Rennard and Greiner Road. The station capacity is 800 gpm with an average inflow of 28 gpm. The flow destination is the Northeast WPCP.

Two hundred eight volt, 3-phase, single service power to the station is supplied through the 13,200 volt transformer on the grounds.

Overflow from the station goes to the drainage right-of-way adjacent to the station. There is no bar screen for the system. The wet well is located next to the pump room vault.

42ND STREET PUMPING STATION

Located at the intersection of 42nd and 43rd Street, this below grade lift station handles the wastewater in the Mill Creek Sewer.

Two vertical sewage pumps, rated 2,000 gpm at 45 feet TDH with 40 HP motors, pump the wastewater to the gravity sewer located across the street on the railroad embankment. The station capacity is 4,000 gpm with an average inflow of 4,873 gpm. The flow destination is the Southeast WPCP.

Two hundred volt, 3-phase, single service power to the station is supplied through the 13,200 volt transformer on the grounds.

The wet well has a bar screen and comminutor to separate solids. Overflow from the station drains into the Schuylkill River via the 43rd Street and Woodland Regulator. The pump room and wet well utilize explosion-proof equipment.

4.2.4 Force Mains

Two force mains that convey wastewater from outlying authorities warrant consideration since ownership and maintenance responsibilities have been contracted to Philadelphia. The DELCORA Force Main and the Neshaminy Force Main each originate from pumping stations

outside of the City (and, therefore, are not the responsibility of the City) and convey wastewater to Philadelphia from DELCORA and the Bucks County Water and Sewer Authority, respectively.

DELCORA Force Main - This 66-inch force main conveys wastewater from the Darby Creek Pumping Station to the Southwest WPCP with a peak capacity of 60 cfs (cubic feet per second). This pumping station and force main were built by DELCORA as agreed in the intermunicipal agreement between DELCORA and PWD executed in 1974, and thereafter the ownership and maintenance responsibilities of the force main within the City were transferred to PWD. The force main traverses the City for approximately 12,400 feet along the following route:

- The force main crosses Darby Creek in the vicinity of the intersection of 88th Street and Lindbergh Boulevard
- Continues north in Lindbergh Boulevard to 84th Street, than east to Barthram Avenue
- North again along Bartram Avenue to parallel the 80th Street Low Level Intercepting Sewer to the Screen, Blow and Pump Building at the Southwest WPCP.

Neshaminy Force Main - The Bucks County Water and Sewer Authority is currently installing a new 42-inch force main into Philadelphia to parallel the existing 36-inch force main that currently conveys wastewater flows from Bucks County to the Northeast WPCP. This additional force main is part of a comprehensive improvement on the part of Bucks County to serve the Neshaminy watershed. The 42-inch force main is expected to be completed in 1993 and aid the existing system in conveying wastewater flow from the Totem Road Pumping Station (also upgraded) to the Upper Delaware Interceptor. The ultimate capacity of the upgraded pumping station and force main will be 40 cfs. The paths of both force mains lie within State Road from the City boundary across the Pennypack Creek to Rhawn Street for a distance of approximately 13,350 feet.

STORMWATER PUMPING STATIONS

Broad and Boulevard Storm Water Pumping Station

Located on the Roosevelt Boulevard Extension at the Broad Street underpass, this pumping station handles the road surface stormwater runoff and some groundwater infiltration.

Two submerged centrifugal pumps, rated 3000 gpm at 54 feet TDH with 60 HP motors, handle the groundwater infiltration and most storms. Two mixed flow pumps, rated 10,000 gpm at 47 feet TDH with 150 HP motors, handle the larger storm events. The 1991 calendar year average inflow was 73 gpm. When the basin level exceeds the second lag pump level, the small pumps turn off. After a 10-second delay, the large pumps come on to pump the water level down.

Four thousand-one hundred sixty volt dual feeders supply power to the station. Only one line is in operation at a time with an automatic transfer switch that closes should either of the lines lose power. The 4,160 to 460 volt transformer and switchgear are located in the electrical room next to the pumping station.

There are three bar screens located in the front of the building to prevent trash and debris from entering the wet well. The wet well is a confined space. Confined Entry Procedures must be followed before entering the wet well.

Mingo Creek Storm Water Pumping Station

Located next to the southwest WPCP and the Sludge Processing and Distribution Center, this stormwater retention basin and pumping station handle the stormwater runoff from the Philadelphia International Airport and the Eastwick section of the City.

Six mixed flow pumps, rated 56,300 gpm at 28 feet TDH with 500 HP motors, are available to handle the stormwater flow. Normally one pump is set to run or automatic. In the event of a large storm, additional pumps can be turned on by a Chatterbox remote control feature. The 1991 calendar year average inflow to this station was 4,827 gpm.

The basin elevation is maintained between 14.0 feet and 16.0 feet. In the event of a large storm, the elevation can rise to 19.0 feet before a high level alarm is activated. The flood level elevation has not been determined yet, but the water surface has been as high as 28 feet without causing flooding in the area.

The station operates on a night rider. Pump operation is limited to off peak hours (8:00 pm to 6:00 am Tuesday - Thursday and 4:00 pm Friday through 8:00 am Monday).

Thirteen thousand-two hundred volt dual feeders supply power to the station. A 13,200 to 550 volt transformer and switchgear area located in the electrical room at the station.

There are four bar screens and a trash rake located on the basin side of the building to prevent trash and debris from entering the pumps.

22nd and Vine Storm Water Pumping Station

Located on the northeast corner of 22nd Street and Vine Street at the underpass level, this pumping station handles the Vine Street Expressway underpass stormwater, from 15th Street to 24th Street.

Three mixed-flow pumps, rated 3000 gpm at 35 feet TDH with 40 HP motors, handle the stormwater flow and a steady flow of groundwater infiltration.

Thirteen thousand-two hundred volt dual feeders supply power to the station. The 13,200 to 480 volt 2-phase transformer and switchgear are located in the fenced area on PECO property. These transformers also provide power to the street lighting outside.

There are two bar screens located on the influent side of the building to prevent trash and debris from entering the pumps. Entrance to the bar screens is through the steel grating next to the entrance door and at the head of a retention basin about 120 feet east of that opening.

The bar screen chamber and retention well are confined spaces. Confined Space Entry Procedures must be followed in these areas.

10th and Vine Storm Water Pumping Station

Located on the southwest corner of 10th Street and Vine Street at the overpass level, this pumping station handles the Vine Street Expressway underpass stormwater, from 6th Street to 15th Street.

Three mixed-flow pumps, rated 3000 gpm at 36 feet TDH with 40 HP motors, handle the stormwater flow.

Thirteen thousand-two hundred-volt dual feeders supply power to the station. The 13,200 to 480 volt transformer and switchgear are located in the electrical room.

There are bar screens located on the influent side of the building to prevent trash and debris from entering the pumps. Entrance to the bar screens is through the steel grating next to the pumping station entrance.

The bar screen chamber and wet well are confined spaces. Confined Space Entry Procedures must be followed in these areas.

Operations and Maintenance of both the above 22nd and Vine and 10th and Vine Street Stormwater Pumping Station was transferred to PennDOT in May 1992.

26th and Vare Storm Water Pumping Station

Located on the southwest corner of Passyunk Avenue at Vare Avenue and 26th Street on the overpass level, this pumping station handles the 26th Street underpass stormwater runoff.

Two vertical centrifugal pumps, rated 2000 gpm at 35 feet TDH with 30 HP motors, handle the stormwater inflow. There is no groundwater infiltration.

Two hundred-thirty volt, 2-phase, dual feeders supply power to the station. The power and control for the street lighting outside is located in the building.