2021 Annual Status Report

Long Term 2 Enhanced Surface Water Treatment Rule
Watershed Control Program Plan

Queen Lane Drinking Water Treatment Plant
Schuylkill River, Philadelphia, PA

Prepared by the Philadelphia Water Department

December 2021

This report was produced for the Pennsylvania Department of Environmental Protection in accordance with the Environmental Protection Agency National Primary Drinking Water Regulations: Long Term 2 Enhanced Surface Water Treatment Rule.

Table of Contents

List of Tables

List of Figures

List of Acronyms

AEU	Animal Equivalent Unit
APHIS	Animal and Plant Health Inspection Service
BCCD	Berks County Conservation District
BCWSA	Berks County Water and Sewer Association
BMP	Best Management Practice
CAC	Citizens Advisory Council
CAFO	Concentrated Animal Feeding Operation
CDC	Community Design Collaborative
CNMP	Comprehensive Nutrient Management Plan
CSO	Combined Sewer Overflow
CREP	Conservation Reserve Enhancement Program
DRBC	Delaware River Basin Commission
DRWI	Delaware River Watershed Initiative
EPA	United States Environmental Protection Agency
EWS	Early Warning System (Delaware Valley)
FWWIC	Fairmount Water Works Interpretive Center
GCCW	*Green City, Clean Waters*
LTCPU	Long Term Control Plan Update
LT2	Long Term 2 Enhanced Surface Water Treatment Rule
MS4	Municipal Separate Storm Sewer System
NLCD	National Land Cover Database
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
PA DEP	Pennsylvania Department of Environmental Protection
PDE	Partnership for the Delaware Estuary
PEC	Pennsylvania Environmental Council
PHS	Pennsylvania Horticultural Society
PWD	Philadelphia Water Department
SAN	Schuylkill Action Network
SAS	Schuylkill Action Students
SRDC	Schuylkill River Development Corporation
SRG NHA	Schuylkill River Greenways National Heritage Area
SRRF	Schuylkill River Restoration Fund
SWA	Source Water Assessment
SWPP	Source Water Protection Plan
WCP	Watershed Control Plan
WSS	Watershed Sanitary Survey
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant
USDA	United States Department of Agriculture

1.0 Executive Summary

In 2021, the Philadelphia Water Department (PWD) continued to implement its Watershed Control Plan (WCP) for the Queen Lane intake in the Schuylkill River Watershed in compliance with the Long Term 2 Enhanced Surfaced Water Treatment Rule (LT2). The plan reduces *Cryptosporidium* loadings in the Schuylkill River watershed from priority sources such as wastewater effluent, agriculture, animal vectors, and urban stormwater runoff. Source water protection initiatives as well as structural control measures were identified and implemented as part of the WCP to achieve a target *Cryptosporidium* load reduction. Additionally, PWD received approval in Summer 2021 of its Watershed Control Plan Update in that expands *Cryptosporidium* control strategies into the Delaware River Watershed and strives to improve collaborative foundations among stakeholders and create education and outreach programs.

PWD utilizes two key mechanisms to support WCP implementation; the Schuylkill Action Network (SAN), a watershed-wide collaborative consisting of stakeholders from public, private, and non-profit sectors and the Schuylkill River Restoration Fund (SRRF), a public-private partnership created to fund the implementation of on-the-ground environmental restoration projects in the Schuylkill River watershed. PWD supports facilitation of the Schuylkill Action Network in the amount of $155,000 annually. PWD also contributes approximately $100,000 annually to the SRRF to fund projects that best align with PWD planning priorities.

Mitigation actions in response to the COVID-19 pandemic impacted several PWD programs and initiatives. For many of the activities described in this plan, it may translate to brief interruptions in work, while other programs and initiatives may have been postponed or transformed to align with recommended health and safety protocols. Progress towards the WCP objectives is summarized below by priority sources along with highlights from the inception of the WCP.

Priority Source: Wastewater Effluent

The UV installation projects upstream of the PWD Queen Lane intake, at Upper Gwynedd Wastewater Treatment Plant (WWTP) and Fleetwood WWTP, are fully operational and effective at inactivating *Cryptosporidium* oocysts and reducing the public health risk. In 2018, PWD completed its first triennial update to the Schuylkill Watershed Sanitary Survey (WSS), a comprehensive report detailing the status of wastewater treatment technologies and sewage system planning efforts throughout the Schuylkill River watershed. PWD continues to track developments in the watershed related to Act 537 sewage facility planning through the Schuylkill Action Network (SAN) Pathogen and Point Source Workgroup and updates the WSS accordingly. The 2021 update to the WSS will be submitted to the PA DEP in January 2022. Additionally, PWD engages wastewater utilities through its continued participation in the SAN Pathogen and Point Source workgroup and as the owner of the Early Warning System for the lower Delaware River watershed.

In 2021, the SAN Pathogen and Point Source Workgroup strengthened communication between and provided educational resources to wastewater and drinking water utilities to improve source water protection efforts. The group facilitated data and information sharing to document wastewater

treatment technologies and improvements and investigated evolving source water issues – including unregulated contaminants.

Priority Source: Agriculture

During the first five years of the WCP, PWD met its goal of supporting the construction of 10 manure storage basins or vegetated buffers at 10 separate agricultural operations in the watershed through its participation and annual contribution to the Schuylkill River Restoration Fund (SRRF). Although this goal has been achieved, PWD still aims to support agricultural best management practice installation through annual contributions to the SRRF and participation on the grant advisory committee.

In 2021, $80,000 from PWD's annual contribution funded two large watershed protection projects on agricultural properties in the Schuylkill River watershed. These priority projects were selected for the implementation of agricultural best management practices to support WCP *Cryptosporidium* control objectives.

The Bolton Farm property, a dairy farm in the Saucony Creek Watershed in Berks County, received a $75,000 SRRF grant matched by several partner organizations to construct a 6-month capacity liquid manure storage basin and other agricultural best management practices (BMPs). PWD directed $40,000 to Berks Nature for the Bolton Farm project while Exelon contributed the remaining SRRF award. The suite of agricultural BMPs at Bolton Farm are anticipated for completion in 2022.

PWD also directed $40,000 towards the SRRF grant awarded to Berks Nature for the Miller Farm project in the Manatawny Creek Watershed. The Miller Farm's project suite includes the installation of a liquid manure storage basin, dry manure storage, a concrete heavy use area, exclusionary fencing and stormwater controls. The total SRRF award for the Bolton farm project was $95,000, with Exelon contributing the remaining funding.

Additionally, one of PWD's selected recipients for a 2019 SRRF grant of $50,000, Northwestern Stables, completed their stormwater management and paddock stabilization project in 2020. This project reduces sediment, nutrient, and pathogen runoff to the Wissahickon Creek, a tributary to the Schuylkill River just upstream of the Queen Lane intake. In 2021, Northwestern Stables, along with the Schuylkill River Greenways and Schuylkill Action Network partners, hosted the annual Schuylkill River Restoration Fund Grant Announcements and Project Showcase.

PWD continues to be an active participant in the SAN Agricultural Workgroup to coordinate efforts among watershed partners with similar environmental protection objectives. Through the SAN, education and outreach materials are developed and additional stakeholders are engaged to promote the implementation of agricultural best management practices and nutrient management plans throughout the watershed. In the last year SAN partners continued to help develop and implement Comprehensive Nutrient Management Plans (CNMP) for agricultural properties across the Schuylkill River watershed.

Priority Source: Animal Vectors

At PWD facilities and Fairmount Park properties, Canada geese—known mechanical vectors of *Cryptosporidium*—were removed and nests and eggs treated through a partnership with the US Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS). Wildlife management activities were also conducted on several PWD properties including Philadelphia's three drinking water treatment plants.

COVID-related administrative delays caused an interruption in services in mid-2020. In the second half of 2020, more than 4,500 geese were dispersed or removed from Philadelphia public parks while more than 7,100 geese were dispersed or removed in the first half of 2021 totaling more than 11,700 geese during FY21. In FY21 4,867 geese were dispersed or removed from Peter's Island and Pleasant Hill Park, both locations near Philadelphia drinking water intakes.

Priority Source: Urban Stormwater

Stormwater best management practices (BMPs) were not directly included in the scope of the WCP. Stormwater projects are already implemented through a variety of other programs, including stormwater ordinances and MS4 permits. Stormwater management practices are implemented throughout the City of Philadelphia as part of PWD's *Green City, Clean Waters* (GCCW) program, a 25-year plan to reduce stormwater pollution through the installation of green infrastructure. Additionally, the Rain Check program informs Philadelphia residents about the benefits of green stormwater infrastructure and how to select the best options for their property. In FY2021, a total of 9 workshops were held with 718 participants. As a result of the FY2021 program, a variety of stormwater management tools were installed on residential properties, including 34 installations of permeable pavers to allow for better infiltration of stormwater, 101 downspout planters, 14 rain garden plantings, and 285 rain barrels.

Through the SAN, a number of riparian buffer plantings and education and outreach events have occurred throughout the watershed. The SAN Stormwater and Education & Outreach Workgroups have engaged students in managing stormwater on school campuses to benefit MS4 communities through the Schuylkill Action Students (SAS) program. In 2020 and 2021, the COVID-19 pandemic restricted the number of in-person education and outreach events that could be held. PWD plans to continue its participation in the SAN Stormwater Workgroup into the future years of the WCP.

Estimated Cryptosporidium Reductions from WCP Projects

The WCP was developed with the objective of reducing the *Cryptosporidium* load to the Queen Lane intake on the Schuylkill River by 2.7% or an estimated range of 2.1E+11 to 3.8E+13 oocysts per year. Estimations indicate that the target reduction was met in the first five years of WCP implementation, but with a large degree of uncertainty regarding a precise reduction amount due to the nature of estimation methods. Target reduction estimates serve as a preliminary step in developing a quantitative assessment of Schuylkill River watershed *Cryptosporidium* loading reduction, and uncertainties in the

method emphasize the need for further research and method refinement. Moreover, the estimated reductions from agricultural best management practices are cumulative, meaning as more projects are implemented the load will be further reduced. Further calculation and summation of load reductions would be misleading as it would imply that the watershed load of an ongoing WCP would meet or surpass a total watershed load of zero. For these reasons, project load reductions past year five are not calculated in the Annual Status Reports.

The Future of the WCP

The second round of LT2 compliance sampling ended in March 2017. Each PWD intake on the Schuylkill and Delaware Rivers was sampled bimonthly for a period of 2 years. *Cryptosporidium* results from the Queen Lane Water Treatment Plant achieved an average result less than the 'Bin 1' threshold value of 0.075 oocysts per liter; however, the Queen Lane Water Treatment Plant remains classified as 'Bin 2' due to sampling results obtained from the first round of LT2 monitoring. The Queen Lane Water Treatment Plant will continue to achieve individual and combined filter effluent performance requirements as approved by PA DEP to maintain compliance with the first round of LT2 sampling. The resulting round of monitoring placed the Baxter Water Treatment plant on the Delaware River in Bin 2. The same microbial toolbox options selected for Queen Lane were selected for Baxter to ensure that PWD maintains compliance with the LT2 regulation. PWD will continue ongoing initiatives outlined in the WCP through its existing Source Water Protection Program framework. PWD submitted a WCP Update to PA DEP in October 2020 that expands WCP efforts into targeted areas of the Delaware River watershed. The updated plan was approved in June 2021. Future WCP Annual Status Reports will include progress updates relevant to the expanded scope of work.

2.0 Introduction

In April 2011, the Philadelphia Water Department (PWD) completed a Watershed Control Plan (WCP), and after receiving approval from the Pennsylvania Department of Environmental Protection (PA DEP) the WCP went into effect December 2012. The WCP presents a comprehensive source water protection approach to reducing levels of infectious *Cryptosporidium* in finished drinking water (US EPA, 2006). The elements of the WCP were achieved through previously established and ongoing efforts of the PWD Source Water Protection Program and through WCP actions aimed to specifically reduce levels of *Cryptosporidium* in the Schuylkill River watershed, a PWD drinking water source. A proposed Watershed Control Plan Update, expanding the geographic scope into priority areas of the Delaware River Watershed, was submitted in October 2020 and approved in June 2021.

The following report documents PWD completion of WCP initiatives during 2021, despite the continuance of a global pandemic limiting in-person meetings and public engagement. The existing framework of the plan and its underlying initiatives will continue to be maintained and developed to further reduce sources of pathogens, nutrients, and sediment into area waters.

3.0 Background

The US Environmental Protection Agency (EPA) published the first source water quality-based drinking water regulation on January 5, 2006. The Long Term 2 Enhanced Surface Water Treatment Rule (LT2), a series of amendments to the Safe Drinking Water Act, serves to protect the public from waterborne illness caused by *Cryptosporidium* and other microbial pathogens in drinking water. In the United States, *Cryptosporidium* has been the cause of several outbreaks of Cryptosporidiosis, a gastrointestinal disease particularly dangerous for immunocompromised individuals. The LT2 requires public drinking water systems with surface water sources, or groundwater sources influenced by surface water, to monitor monthly for *Cryptosporidium* at each supply intake for two years. The observed *Cryptosporidium* concentrations categorize each intake into one of four 'Bins.' Public water systems placed in Bin 1 indicate the lowest concentrations of *Cryptosporidium* and require no additional treatment. Public water systems placed in Bins 2, 3 and 4 require 4-log, 5-log and 5.5-log removals, respectively. A log removal represents a reduction in pathogen concentration during treatment by calculating the logarithm of the ratio of the influent and effluent concentrations; for example, 1-log removal represents 90% reduction, 2-log represents 99%, 3-log represents 99.9%, and so on. Public water systems using conventional treatment processes, coagulation, flocculation, sedimentation, filtration, are assumed to achieve a 3-log removal. Therefore, additional 1-log, 2-log or 2.5-log treatment credit(s) is required of a conventional treatment facility if placed in Bins 2 through 4. The EPA provides a "microbial toolbox" describing options to earn additional treatment credits including source water protection and management programs, pre-filtration processes, treatment performance programs, additional filtration components and inactivation technologies.

PWD *Cryptosporidium* monitoring data categorized each of Philadelphia's three drinking water treatment plants (WTPs) into Bins. During the first round of LT2 compliance sampling, Baxter

and Belmont achieved Bin 1 status with average oocyst concentrations less than 0.075 per liter. However, Queen Lane data resulted in an average oocyst concentration of 0.076 per liter, falling into Bin 2. Since Queen Lane uses conventional treatment processes and automatically receives a 3-log removal credit, an additional 1-log removal credit was required. PWD selected to use the combined filter effluent for 0.5-log credits, the individual filter effluent for 0.5-log credits, and the development and implementation of a WCP for 0.5-log back up credits. PWD submitted a WCP to the PA DEP in April 2011 and received approval in December 2012.

From April 2015 through March 2017, LT2 Round 2 monitoring occurred. Results from this sampling period classified the Queen Lane WTP as Bin 1. However, the ongoing initiatives outlined in the plan as well as annual status reporting and triennial Watershed Sanitary Survey updates are being continued to maintain the 0.5-log backup treatment credit. PWD results from Round 2 sampling reclassified the Baxter Water Treatment Plant on the Delaware River as a Bin 2 facility. PWD treatment is selecting the same IFE and CFE filter performance options as selected for the Queen Lane WTP for an additional 1-log treatment credit. Additionally, this document expands ongoing WCP for the Queen Lane intake to include priority areas influencing the Baxter intake to achieve a 0.5-log backup credit to ensure Baxter's compliance with LT2 regulation. In October 2020, PWD submitted a Watershed Control Plan Update to protect both the Baxter and Queen Lane intakes which was subsequently approved in the June 2021. A timeline of critical LT2 events is shown in Table 3-1 along with links to annual status reports detailing progress towards WCP goals.

Table 3-1: LT2 WCP Timeline

Action	Reporting	Due Date
Letter of intent to submit WCP (Queen Lane)		April 2010
WCP submitted to State	LT2 Watershed Control Plan for the Queen Lane Intake	April 2011/Approved December 2012
Annual Status Report Submitted to State	2013 Annual Status Report	January 2014/Approved May 2014
Annual Status Report Submitted to State	2014 Annual Status Report	January 2015/Approved February 2015
Second round of *Cryptosporidium* monitoring		April 2015 to March 2017
First triennial Watershed Sanitary Survey Submitted	Watershed Sanitary Survey	December 2015
Annual Status Report Submitted to State	2015 Annual Status Report	January 2016
Annual Status Report Submitted to State	2016 Annual Status Report	January 2017
Round 2 Bin Classification		October 2017
Annual Status Report Submitted to State	2017 Annual Status Report	January 2018
First Update to the Watershed Sanitary Survey Submitted	2018 Watershed Sanitary Survey	January 2018
Letter of intent to submit WCP (Baxter)		October 2018
Annual Status Report Submitted to State	2018 Annual Status Report	January 2019
Annual Status Report Submitted to State	2019 Annual Status Report	January 2020
WCP Update Submitted to State	LT2 Watershed Control Plan Update for Baxter and Queen Lane Intakes	October 2020/Approved June 2020
Annual Status Report Submitted to State	2020 Annual Status Report	January 2021
Approval of WCP Update by State		June 2021
Second Update to the Watershed Sanitary Survey	2021 Watershed Sanitary Survey	January 2022
Annual Status Report Submitted to State	2021 Annual Status Report	January 2022

Note: Shading indicates milestones that have been completed at the time of the report's preparation.

4.0 Watershed Control Program Updates

As outlined in the Watershed Control Plan Update, the *Cryptosporidium* control strategies within PWD's Watershed Control Plan include the following broader categories:

- ***UV Inactivation at PWD Drinking Water Treatment Plants*** – Includes the planning, design, and construction of treatment upgrades to enhance drinking water treatment abilities
- ***Watershed Protection Initiatives*** – Consists of various research, coordination, and on-the-ground projects to address priority sources of *Cryptosporidium*
- ***Education and Outreach*** – Includes tasks to support the goal of raising awareness of source water protection issues
- ***Stakeholder Engagement and Partnership Building*** – Outlines tasks associated with the feasibility evaluation of a Delaware River Watershed Collaborative and/or funding mechanism

The sections that follow provide further detail on the progress made in each control strategy.

4.2 Capital Improvements at Philadelphia's Water Treatment Plants

Since the development of the Watershed Control Plan, the Philadelphia Water Department has developed a comprehensive Drinking Water Master Plan that reviews existing drinking water treatment, pumping, distribution, and supply infrastructure in the context of anticipated regulatory and environmental drivers. The objective of the plan is to develop a strategic, long-term capital improvement plan that anticipates the capacity, treatment, and resiliency needs of the future.

The 2020 Watershed Control Plan Update includes an overview of these updates and commits to annual reporting on the status of UV disinfection installation at Philadelphia's three drinking water treatment plants as an effective inactivation mechanism of *Cryptosporidium*.

Table 4-1 displays the planning, design, and construction timelines as described in the approved 2020 WCP Update. Planning for installation of UV treatment systems and other upgrades at Belmont and Baxter water treatment plants started in 2019. The design phase of the project is anticipated to start in 2022 for both the Belmont and Baxter plants. Planning for the installation of UV treatment and other treatment upgrades at the Queen Lane intake commenced in 2021.

Table 4-1: Planned Implementation Schedule – UV Inactivation Installation at PWD DWTPs

Control Strategy: UV Inactivation at PWD Water Treatment Plants						
Planned Capital Project	**Planning**		**Design**		**Construction**	
	Start	End	Start	End	Start	End
Installation of UV treatment system at Baxter WTP on Delaware River*	2019	2022	2022	2026	2026	2031
Installation of UV treatment system at Belmont WTP on Schuylkill River*	2019	2022	2022	2026	2030	2034
Installation of UV treatment system at Queen Lane WTP on Schuylkill River*	2021	2026	2026	2031	2035	2042

**and other treatment process upgrades*

4.4 Watershed Protection Program Initiatives

The Philadelphia Water Department has a robust Watershed Protection Program that includes source water protection, climate change adaptation planning, and water quality modeling focus areas. The Watershed Protection Program uses a multi-barrier approach that includes emergency preparedness systems, public and private communication networks, computer modeling systems, laboratories, regional and national partnerships, and the development and implementation of formal plans to achieve watershed protection goals.

In the Watershed Control Plan Update, PWD outlines ongoing and proposed initiatives from the Schuylkill River watershed Source Water Protection Plan (SWPP) that are relevant to the control of *Cryptosporidium* upstream of the Queen Lane intake as well as programs and initiatives in the Delaware River watershed to protect the Baxter intake. This section discusses the contribution PWD has made toward each of the ongoing and proposed initiatives by each priority source category during 2021.

4.4.1 Wastewater Discharge/Compliance

Effluent from WWTPs upstream of the Queen Lane intake is a source of *Cryptosporidium* in the watershed (PWD, 2002; PWD, 2011). Table 4-2 outlines planned watershed protection projects and tasks aimed to support the goal of pathogen reduction for the priority source of wastewater discharges. Table 4-2 also includes initiatives for the Delaware River Watershed proposed in the Watershed Control Plan Update submitted in October 2020. Progress towards each initiative is detailed in the sections that follow.

Table 4-2: Planned Implementation Schedule – Watershed Protection Control Strategies to Address Wastewater Discharges

Control Strategy: Watershed Protection			
Priority Source - Wastewater Discharger Compliance			
Initiatives	**Target Watershed**	**Target Completion Date**	**Report Section**
Collaborate on *Cryptosporidium* source tracking studies	Various	Ongoing	4.4.1.1
Continue to regularly review and update Philadelphia's Act 537 Plan	Lower Delaware River	Ongoing	4.4.1.2
Implement initiatives outlined in the annual Combined Sewer Management and Stormwater Management report	Lower Delaware and tidal Schuylkill River Watersheds	Ongoing	4.4.1.3
Maximize usage for the Delaware Valley Early Warning System while maintaining the system's ongoing O&M needs	Lower Delaware and Schuylkill River Watersheds	Ongoing	4.4.1.4
Continue to support efforts identified in the SAN Pathogens/Compliance Workgroup's Annual Workplans	Schuylkill River	Ongoing	4.4.1.5
Re-delineate source water protection zones in the Delaware River Watershed using advanced hydrodynamic tidal modeling and update priority dischargers accordingly	Delaware River	2023	4.4.1.6
Update discharger information from Source Water Assessments to reassess vulnerability from upstream dischargers	Schuylkill and Delaware Rivers	Ongoing	4.4.1.7
Track installation of wastewater treatment upgrades and improvements upstream of Philadelphia's intakes	Schuylkill and Delaware Rivers	Ongoing	4.4.1.8; 4.4.1.9
Work with professional organizations and industry groups e.g., NACWA, WaterRF, et al., to support related research and advocacy efforts	Various	Ongoing	1.1.1.1
Continue to strengthen relationships with upstream wastewater dischargers	Delaware River	Ongoing	4.4.1.11

4.4.1.1 Cryptosporidium Monitoring and Source Tracking Studies

PWD worked with Lehigh University for more than a decade to support ongoing research on *Cryptosporidium* in Philadelphia source water. The collaboration between PWD and Lehigh University consisted of developing sampling programs to better understand the occurrence,

sources and vectors of *Cryptosporidium* in the Schuylkill River watershed. Sampling programs were designed to answer research questions and improve and expand methods for field sample collection and laboratory analysis of *Cryptosporidium*. PWD contributed field sample collection support, project management and oversight. PWD regularly communicated with project partners at Lehigh to create solutions for issues encountered in the field and lab, incorporate improvements, and expand the project. An article detailing some of the outcomes of research collaboration, "Biofilm Sampling for Detection of *Cryptosporidium* Oocysts in a Southeastern Pennsylvania Watershed" was published in November 2020 in *Applied and Environmental Microbiology*[1]. Due to budgetary limitations resulting from the City of Philadelphia's COVID-19 pandemic response and mitigation efforts, the research collaboration with Lehigh University is paused for the foreseeable future.

4.4.1.2 Philadelphia's Act 537 Plan

Act 537 is the Pennsylvania Sewage Facilities Act. The program addresses existing sewage disposal needs and future disposal needs through proper planning, permitting and design of sewage facilities. The Philadelphia Act 537 Plan was last updated in 2009.

4.4.1.3 Combined Sewer Overflow (CSO) and Municipal Separate Storm Sewer System (MS4) National Pollutant Elimination System (NPDES) Permit Annual Report

Each year, PWD submits a report to PA DEP summarizing activities and programs pertaining to the management of stormwater in combined and separate sewers in accordance with the CSO and MS4 NPDES permits. A major component of PWD CSO NPDES permit requirements is the implementation of the Long-Term Control Plan Update (LTCPU), also called the *Green City, Clean Waters* program. *Green City, Clean Waters* is a 25-year program that includes a green stormwater infrastructure-based approach to reduce pollutants discharged by the combined sewer system. The most recent fiscal year annual report is available on http://water.phila.gov/reporting/.

4.4.1.4 Early Warning System

The Delaware Valley Early Warning System (EWS) is designed to improve the safety of the drinking water supply by providing real time water quality monitoring results and event notification to regional users. Features include a notification system, a time of travel model, the Spill Model Analysis Tool, real-time water quality data and a central website where users can access event information, analysis tools, and data. The EWS user base consists of more than 450 registered users from 55 organizations.

---

[1] Jellison K, Cannistraci D, Fortunato J, McLeod C. 2020. Biofilm sampling for detection of *Cryptosporidium* oocysts in a southeastern Pennsylvania watershed. Appl Environ Microbiol 86: https://doi.org/10.1128/AEM.01399-20.

In 2020, PWD implemented significant updates to the EWS user interface. Notable updates include full mobile device (smartphone) functionality for the EWS website and improved mapping and notification features. These updates were presented to EWS users through a series of regional workshops that were adapted to a virtual platform to align with COVID-19 pandemic public health and safety recommendations. The EWS continues to serve as an invaluable communication tool and was especially useful to communicate flooding related events during hurricane Ida in August 2021.

4.4.1.5 SAN Pathogens and Point Source Workgroup

The purpose of the SAN Pathogens and Point Source Workgroup is to facilitate and strengthen communication and coordination among regulatory agencies, downstream water users, and basin stakeholders regarding Clean Water Act and Safe Drinking Water Act goals. A new round of strategic planning for the SAN's next 5 years commenced in 2019 and was finalized in late 2020. PWD regularly attends quarterly SAN Pathogens and Point Source Workgroup meetings and serves as a workgroup co-chair. A quarterly e-newsletter was established in 2019 to improve information sharing among stakeholders. In 2020, in-person meetings were switched to a virtual platform to mitigate COVID-19 pandemic risks while continuing workgroup coordination. Virtual meetings continued throughout 2021. The group continues to be key mechanism for information exchange among stakeholders on emerging contaminant research, upcoming regulation, and wastewater treatment advancements.

4.4.1.6 Source Water Protection Zones

In the Watershed Control Plan Update PWD plans to re-delineate the source water protection zones previously established for the Schuylkill and Delaware Rivers in the Source Water Assessments. Since originally delineated, PWD's hydrodynamic modeling capabilities have advanced and can provide better time of travel estimates to inform zone delineation. This proposed project to better define priority protection areas for the Queen Lane and Baxter intake is planned for 2023.

4.4.1.7 Priority Discharger List

In preparation of the 2020 Watershed Control Plan Update, the 2002 priority *Cryptosporidium* point source list was updated to account for changes in treatment technologies. The updated Schuylkill River Watershed priority *Cryptosporidium* discharger list is shown in Table 4-3.

Table 4-3: Priority Dischargers of *Cryptosporidium* in the Schuylkill River Watershed *(Updated from 2002 SWA)*

Source ID	Source Name	Subwatershed	Zone	Time of Travel	Relative Impact (%)	Priority
781	Montgomery County Sewer Authority	Perkiomen Creek	Floodplain	10.5	0.009	Highest - A
465	Whitemarsh Twp Sew Auth	Schuylkill River	Zone A	3.5	0.009	Highest - A
666	Norristown Municipal Waste Authority	Schuylkill River	Floodplain	5.5	0.009	Highest - A
795	Abington Twp WWTP	Sandy Run	Zone A	11.3	0.009	Highest - A
664	E. Norriton/Plymouth/ Whitpain Joint Sewer Auth	Schuylkill River	Floodplain	5.5	0.009	Highest - A
2503	Berks Montgomery Municipal Authority	Swamp Creek	Floodplain	23.1	0.009	Highest - A
2491	Reading City	Schuylkill River	Zone B	29.5	0.009	Highest - A
464	Conshohocken STP	Schuylkill River	Zone A	3.5	0.009	Highest - A
2470	Birdsboro Borough Municipal Authority	Schuylkill River	Floodplain	24.8	0.009	Highest - A
2455	Pottstown Borough	Schuylkill River	Zone B	19.5	0.009	Highest - A
2509	Wyomissing Valley JMA	Wyomissing Creek	Zone B	31	0.009	Highest – A
665	Upper Merion Municipal Utility Authority	Trout Creek	Zone A	8	0.009	Highest – A
535	Upper Merion Twp Authority - Matsunk WPCC	Schuylkill River	Zone B	5	0.009	Highest – A
2574	Hamburg Municipal Authority	Schuylkill River	Zone B	41.8	0.009	Highest – A
2453	Upper Gwynedd-Towamencin Municipal Authority	Towamencin Creek	Zone B	16.5	0.009	Highest – A
792	Phoenixville Borough STP	Schuylkill River	Zone B	11.5	0.009	Highest – A

2521	Pennridge Wastewater Treatment Authority	East Branch Perkiomen	Floodplain	25.4	0.009	Highest – A
1614	Limerick Twp Municipal Authority	Schuylkill River	Floodplain	15	0.009	Highest – A
2474	Exeter Twp WWTP	Schuylkill River	Floodplain	25.7	0.009	Highest – A
780	Valley Forge Sewer Authority	Schuylkill River	Zone B	10	0.009	Highest – A
2485	Borough of Souderton	Skippack Creek	Zone B	18.5	0.009	Moderately High - B
2510	Antietam Valley Municipal Authority	Antietam Creek	Zone B	28.6	0.009	Moderately High - B
2516	Spring Twp Municipal Authority	Cacoosing Creek	Zone B	35.3	0.009	Moderately High - B
2473	Lower Frederick Township Treatment Plant	Perkiomen Creek	Floodplain	16.6	0.001	Moderately High - B
2723	Sinking Spring Borough Municipal Authority	Cacoosing Creek	Floodplain	36	0.009	Moderately High - B
2747	Leesport Borough Authority	Schuylkill River	Floodplain	37.1	0.001	Moderately High - B
2460	Schwenksville Borough Authority	Perkiomen Creek	Floodplain	16.1	0.001	Moderately High - B
2677	Spring City Borough Sewage Plant	Schuylkill River	Floodplain	14.5	0.001	Moderately High - B
622	Bridgeport Borough	Schuylkill River	Floodplain	5.5	0.001	Moderately High - B
2454	North Coventry Municipal Authority STP	Schuylkill River	Floodplain	19.5	0.001	Moderately High - B
2536	Oley Township Municipal Authority	Manatawny Creek	Floodplain	29.8	0.001	Moderately High - B
2556	Maidencreek Township Authority	Willow Creek	Zone B	37.6	0.001	Moderately High - B
2639	Lower Salford Twp Authority	West Branch Skippack Creek	Floodplain	16.5	0.001	Moderately High - B
2631	Telford Borough Authority	Indian Creek	Zone B	23.6	0.001	Moderately High - B

4.4.1.8 Watershed Wastewater Treatment Upgrades and Improvements

Several originally prioritized NPDES dischargers have either undergone, or are approved to undergo, upgrades and improvements to their treatment facilities. A detailed list containing update and improvement information is presented below in Table 4-4, for the Schuylkill River Watershed.

Table 4-4: Planned upgrades and Improvements to the Schuylkill River Source Water Assessment's Priority Dischargers of *Cryptosporidium*

Facility	Owner	Subwatershed	Priority	System Improvements
Conshohocken Borough STP	Borough of Conshohocken	Schuylkill River	Highest - A	• Improvements to plant, pump stations and collection system outlined in 5-year capital improvement plan • In 2018 awarded CFA grant of $341,559 to help rehabilitate the Regional Sanitary Sewer Interceptor • Replacement of rotating biological contractor units 1-9 planned for FY2023; belt filter press replacement planned for FY2026
Lower Perkiomen Valley Regional Sewer Authority	Montgomery County Sewer Authority	Perkiomen Creek	Highest - A	• The Perkiomen Middle Interceptor project is the final phase of the Regional Act 537 Plan approved by PA DEP in 2004 • Includes the installation of ~17,300 ft of sanitary sewer main
Fritz Island Wastewater Treatment Plant	City of Reading	Schuylkill River	Highest - A	• The Reading Wastewater Treatment plant is working with an engineering firm on a $100 million upgrade project needed to accommodate capacities determined in an Act 537 special study and the City's Consent Decree with the Department of Justice
Sinking Spring Borough STP	Municipal Authority of the Borough of Sinking Spring	Cacoosing Creek	Moderately High - B	• $1.7M PA Infrastructure Investment Authority loan to replace 2,950 ft of sanitary sewer line and eliminate raw sewage discharges into Cacoosing Creek
Upper Gwynedd Township Wastewater Treatment Facility	Upper Gwynedd Twp	Wissahickon Creek	Highest - A	• Currently implementing Wastewater Improvement Program • WIP will expand the sewer infrastructure to allow UGT the ability to divert the wastewater currently being sent to the Towamencin Municipal Authority back to Upper Gwynedd Township's Wastewater Treatment Plant – reducing SSOs and allowing rate payer money to be invested in the township.
TMA Wastewater Treatment Facility	Towamencin Municipal Authority	Towamencin Creek	Highest - A	• Awarded $200,000 in CFA funding in March 2019 for a Biosolids Process Transformation and Optimization Planning Study, leading to the adoption of a sustainable biosolids treatment, handling and disposal process within 5 yrs
Whitemarsh WPCC	Whitemarsh Township Authority	Schuylkill River	Highest – A	• In 2018 awarded CFA grant of $323,000 to assist with the rehabilitation of the wastewater treatment plant

Note: This is not an exhaustive list of all planned facility upgrades in the area of interest

4.4.1.9 Wildcat Sewer Abatement

Wildcat sewers discharge sewage directly into creeks and streams without any treatment at a wastewater treatment facility. These systems discharge pathogens into the Schuylkill River watershed and can be a source of *Cryptosporidium.* PWD supports the SAN in efforts to identify and abate wildcat sewers through participation in the SAN Pathogens and Point Source Workgroup. In 2015, PWD completed a Watershed Sanitary Survey (WSS), required under LT2 to maintain the WCP credit. As part of the WSS, PWD compiled available information from the PENNVEST database, news sources, community announcements, and personal communication with a contracted engineering firm on projects addressing wildcat sewers in the Schuylkill River watershed. The wildcat sewer project update serves as a working document and is included in the latest update to the Schuylkill River Watershed Sanitary Survey as well as on the SAN Workgroup Hub as a standalone worksheet. The updated document is included below in Table 4-5.

4.4.1.9.1 River Road Properties

River Road in northwest Philadelphia runs along the Schuylkill River directly upstream of two PWD treatment plant intakes. Sitting at a low elevation, the stretch of residential road is prone to flooding during rain events. Both the city and PA DEP had been concerned about the on-lot septic systems of many River Road residential properties sitting in the Schuylkill River's floodplain, but the existing septic systems could not be replaced as they did not meet current regulations. PWD began the design for sewer installation and hosted public meetings in 2007, permits and approval for the project were obtained from PA DEP in 2008 and 2009, and the road's residents agreed to move forward following more public meetings in 2017.

The approximately mile-long new sanitary sewer provides service for 42 properties along River Road from Port Royal Avenue to County Line Road. A sewage pumping station was constructed on the river side and sewage collected from the sewer is pumped to the nearby Nixon Street sewer. Construction began in early 2019 and was completed during 2021.

Table 4-5: Progress towards Wildcat Sewer Abatement and Public Sewer Connections in the Schuylkill River Watershed

Discharger	Municipality	County	Stream	Update	Sources
Blythe Township	Blythe Township	Schuylkill	Silver Creek and Schuylkill River	The municipalities of Middleport Borough, New Philadelphia Borough, Blythe Township and Schuylkill Township joined together to form the Schuylkill Valley Sewer Authority (SVSA) and completed an Act 537 plan. A new sewage treatment plant with the capacity to treat 550,000 gallons per day and over 30 miles of sewage pipe was constructed using SVSA funds and an over $18 million combined loan and grant package from PENNVEST. The new wastewater treatment plant began discharging treated effluent in June 2006. As of 2009, 1432 customers were connected to the SVSA WWTP, and 69 were not connected. Of those customers not connected, most were abandoned properties, buildings being foreclosed on or were being pursed legally to force connection.	Chris McCoach, Alfred Benesch & Company, personal communication, April 7, 2015; PENNVEST. www.pennvest.pa.gov
Village of Cumbola	Blythe Township	Schuylkill	Schuylkill River		
Middleport Borough	Middleport Borough	Schuylkill	Schuylkill River		
New Philadelphia	New Philadelphia Borough	Schuylkill	Silver Creek and Schuylkill River		
Schuylkill Township	Schuylkill Township	Schuylkill	Schuylkill River & tributaries		
Village of Brockton	Schuylkill Township	Schuylkill	Schuylkill River		
Village of Delano	Delano Township	Schuylkill	Pine Creek	Delano has public sewer. In 2007, Delano Township received a nearly $3 million grant and loan package from PENNVEST to construct three miles of sewer lines and a pump station to convey sewage to Northeast Schuylkill Joint Municipal Authority, which was previously being discharged to Delano Creek, a branch of Pine Creek.	Chris McCoach, Alfred Benesch & Company, personal communication, April 7, 2015; "Governor Rendell Announces $61 Million Investment to Help Protect Pennsylvania's Waterways, Public Health; Promote Community Revitalization Efforts." April 17, 2007. PRNewswire. www.prnewswire.com
Minersville	Minersville Borough	Schuylkill	West Branch Schuylkill River	Minersville has public sewer. Minersville Sewer Authority received over $4 million loan from PENNVEST to construct almost two miles of sewer and stormwater lines and replace about one mile of water mains to eliminate a continuous discharge of untreated wastewater to the West Branch Schuylkill River.	Chris McCoach, Alfred Benesch & Company, personal communication, April 7, 2015; "Governor Rendell Announces Funding to Protect Pennsylvania's Waterways, Public Health; Promote Community Revitalization Efforts." Jul 18, 2006. PRNewswire. www.prnewswire.com

Village of Llewellyn	Branch Township	Schuylkill	West Creek and West Branch Schuylkill River	The Village of Llewellyn has public sewer. Branch-Cass Regional Sewer Authority received an over $16 million loan and grant package from PENNVEST to construct over 28 miles of sewage collection lines and a 450,000 gallons per day wastewater treatment plan to serve portions of Branch, Cass and New Castle Townships and mitigate wildcat sewers and malfunctioning on-lot systems discharging untreated sewage into local streams. In 2010, Branch-Cass Regional Sewer Authority was acquired by the Schuylkill County Municipal Authority (SCMA).	Chris McCoach, Alfred Benesch & Company, personal communication, April 7, 2015; "PA Gov. Schweiker Administration Announces $94 Million in Loans and Grants for Clean-Water Projects." Nov 14, 2001. PRNewswire. www.prnewswire.com; Schuylkill County Municipal Authority. www.scmawater.com
Deer Lake Municipal Authority (acquired by Schuylkill County Municipal Authority in 2008)	Deer Lake Borough	Schuylkill	Pine Creek	In 2011, Schuylkill County Municipal Authority (SCMA) received grant and loan funding from PENNVEST to expand its Deer Lake wastewater treatment plant and construct several miles of sewerage collection lines. The project would eliminate several small, inadequate wastewater treatment plants and discharges from wildcat sewers and malfunctioning on on-lot septic systems to local streams. Expansion and construction began in 2013. The wastewater treatment plant was completed and operational in September 2014. SCMA was awarded the Governor's Award for Environmental Excellence from PA DEP in 2015 for completion of the project.	Chris McCoach, Alfred Benesch & Company, personal communication, April 7, 2015; "Pennsylvania Governor Corbett Announces $99 Million Investment in Water Infrastructure Projects in 20 Counties." Jul 20, 2011. PRNewswire. www.prnewswire.com; Schuylkill County Municipal Authority. www.scmawater.com
New Ringgold Municipal Authority	New Ringgold Borough	Schuylkill	Little Schuylkill and Koenig Creek	In 2001, the Borough of New Ringgold received a loan from PENNVEST to design sewage collection lines and a WWTP to eliminate malfunctioning on-lot septic systems contaminating local drinking water wells, Koenig Creek and the Little Lehigh. The Borough of New Ringgold received over $1.4 million in loans and grants in 2004 and over $2.6 million in loans and grants in 2005 from PENNVEST to install approximately 3 miles of sewage collection lines to eliminate the use of malfunctioning on-lot septic systems that are contaminating a local stream and drinking water wells. The WWTP was completed in 2006.	"PA Gov. Schweiker Administration Announce $94 Million in Loans and Grants for Clean-Water Projects." Nov 14, 2002. PRNewswire, www.prnewswire.com; "PENNVEST Initiates Brownfield Program, Approves $97 Million for Water Projects," Mar 24, 2004. PRNewswire. www.prnewswire.com; "PENNVEST Approves $100 Million for Water Projects." Mar 23, 2005 PRNewswire. www.prnewswire.com; "2014 Chapter 94 Annual Report Borough of New Ringgold Sewage Treatment Plant." 2014. *Chapter 94 Municipal Wasteload Management Report.*

West Hamburg	Tilden Township	Berks	Schuylkill River	In 2008, Tilden Township received a $5.3 million loan from PENNVEST to construct nearly six miles of sewage collection and transmission lines, three pump stations and other facilities to eliminate the use of wildcat sewers and malfunctioning on-lot septic systems discharging untreated and inadequately treated sewage into areas draining to the Schuylkill River.	"Governor Rendell Announces $72 Million in Water Infrastructure Investments." Apr 14, 2008. PRNewswire. www.prnewswire.com
Virginville	Richmond Township	Berks	Maiden Creek, Saucony Creek	Richmond Township received a $1.6 million loan in 2008 and over $1.7 million in loans and grants in 2001 to construct a new WWTP, pump station, and sewage collection lines to serve 247 homes in the township, where malfunctioning on-lot septic systems are contaminating local wells. The Richmond-Virginville WWTP was completed in 2013.	"Governor Rendell Announces $66 Million Investment in PA's Water Infrastructure," Oct 27, 2008, PRNewswire, www.prnewswire.com; "Governor Corbett Announces $84 Million Investment in Water Infrastructure Projects in 14 Counties," Oct 26, 2011, PRNewswire, www.prnewswire.com; Steckbeck Engineering and Surveying, Inc., *Facebook.* www.facebook.com
Strausstown	Strausstown Borough	Berks	Tributaries to Blue Marsh Reservoir	In 2002, Strausstown Borough received a loan from PENNVEST to design a sewage collection and treatment facility to serve Strausstown Borough and portions of Upper Tulpehocken Township, where wildcat sewers and malfunctioning on-lot septic systems are contaminating almost half of the local drinking water wells. In 2007, Strausstown Borough received $3.65 million in loans and grants from PENNVEST to construct the wastewater collection and treatment system to serve both the Borough of Strausstown, as well as Upper Tulpehocken Township. The construction of approximately 3 miles of sewage collection lines and a 65,000-gallon per day wastewater treatment plant was completed in November 2009.	"Pennsylvania Gov. Schweiker Administration Announces $95.5 Million in Loans and Grants for Clean Water Projects." Mar 20, 2002. PRNewswire. www.prnewswire.com; "Governor Rendell Announces $69 Million in Clean, Safe Water Infrastructure Investments." Oct 23, 2008. PRNewswire. www.prnewswire.com; "Borough of Strausstown, Berks County, Sewage Treatment Plan, Municipal Wasteload Management." 2012. *Annual Report for 2012 DEP Rules and Regulations, Chapter 94.*

Lenhartsville	Lenhartsville Borough	Berks	Furnace Creek, Maiden Creek	Lenhartsville Borough received over $1.3 million in 2002 and over $1.6 million in 2004 in loans and grants from PENNVEST to construct a new sewage treatment plant and collection system to eliminate the use of on-lot septic systems contaminating drinking water wells and local streams, including Furnace Creek and Maiden Creek. The new sewage treatment plant went online in July 2005.	"Pennsylvania Governor Schweiker Announces $3 Billion Milestone for Funding of Clean Water Projects in Pennsylvania." Nov 20, 2002. PRNewswire. www.prnewswire.com; "PENNVEST Initiates Brownfields Program, Approves $97 Million for Water Projects." Mar 24, 2004. PRNewswire. www.prnewswire.com; PENNVEST. www.pennvest.pa.gov; "Borough of Lenhartsville Wastewater Treatment and Conveyance Facilities." 2012. *Title 25 Chapter 94 Municipal Wasteload Management Annual Report.*
Sassamansville	Douglass Township	Montgomery	Schlegel Run and Middle Creek	In 1999, 20 houses were cited by the Montgomery County Health Department for failing sewage systems. In 2007, Berks-Montgomery Municipal Authority completed a $2.3 million project constructing a pump station and sewerage lines to serve a community of Sassamansville, which is located in Douglass and New Hanover Townships.	"Douglass (Mont.) Oks Sassamansville Sewer Project." The Mercury News; Berks-Montgomery Municipal Authority Sewer Revenue Bonds. Apr 20, 2015. McElwee & Quinn Financial Printing. www.mcelweequinn.com.
Village of Branchdale	Reilly Township	Schuylkill	Muddy Branch	The Village of Branchdale has wildcat sewers and failing on-lots. Alfred Benesch has worked on an Act 537 Plan for them, but it is not affordable.	Chris McCoach, Alfred Benesch & Company, personal communication, April 7, 2015
Tamaqua	Tamaqua Borough	Schuylkill	Wabash Creek	Tamaqua Borough hired Alfred Benesch and Company to investigate wildcat sewers in Wabash Creek. A total of 101 connections were investigated - 17 had abandoned lines to Wabash Creek and were connected to the municipal sewer system. Five properties are not connected, four of which are vacant, abandoned properties with water service shut off. The remaining property is illegally discharging into Wabash Creek and has been issued several Notice of Violation Tickets and is being processed through the court system.	(Rob Jones, Tamaqua Public Works, personal communication, May 22, 2015)
South Tamaqua	West Penn Township	Schuylkill	Little Schuylkill	Act 537 planning in Walker and West Penn Townships is ongoing. The existence of wildcat sewers and malfunctioning on-lot disposal systems has been confirmed. In 2016, West Penn and Walker Townships continued to work with Rettew Associates and PA DEP on Act 537 planning and creating a financially feasible plan to address 30 residences in five areas in need of	"Wildcat Sewers Exist in West Penn Township." Times News, LLC. Apr 5, 2013. http://www.tnonline.com/2013/apr/05/wildcat-sewers-exist-west-penn-township; "WestPenn-Walker Twp. Sewage Plan Advances." Times News, LLC. Mar 6, 2016.

				sewage disposal. Possible solutions include five community on-lot sewage disposals or new or repaired individual on-lot sewage disposals. In March 2017, Walker Township's Board adopted a resolution to advance its revised Act 537 plan to the state. In June 2017, the revised sewage facilities plan was submitted to the PA DEP. The plan includes a maintenance ordinance that requires residents to have their on-lot septic systems pumped and inspected every three years. The 30 residences would either repair or replace their current system. Township officials met with DEP in December 2017 and adopted resolutions for their revised Act 537 sewage facility plan. The townships continue to await the completion of an administratively complete plan.	http://www.tnonline.com/2016/mar/05/west-penn-walker-twp-sewage-plan-advances "Walker Twp. submits sewage facility plan to DEP" Times News, LLC. Jun 3, 2017. https://www.tnonline.com/2017/jun/03/walker-twp-submits-sewage-facility-plan-dep "W. Penn, Walker to meet with DEP over previously submitted." Times News, LLC. Nov. 9, 2017. https://www.tnonline.com/w-penn-walker-meet-dep-over-previously-submitted "West Penn hears update on sewage facility plan." Times News, LLC. Feb. 21, 2018. https://www.tnonline.com/west-penn-hears-update-sewage-facility-plan
River Road Properties	Philadelphia	Philadelphia	Schuylkill	Construction to connect residents of Upper Roxborough along Nixon Street and River Road to the public sewer system commenced in October 2019 and was completed in 2021.	Weilbacher, M. "Natural Selections: Joanne Dahme – water is in her blood" Montgomery News. Nov. 28, 2018. http://www.montgomerynews.com/roxreview/opinion/natural-selections-joanne-dahme-water-is-in-her-blood/article_17d5fbbe-f262-11e8-9b89-9f0a3a92d9bb.html?fbclid=IwAR1urpwdEjXprIRONJTrbq_Obg5WjrlxAXl_hNd3E3fqv5pMnIrXk9Nd_JY
Albany	Albany Township	Berks	Maiden Creek	Unknown	
Port Indian	West Norriton	Montgomery	Schuylkill River, main stem	Unknown	
Geigertown	Geigertown	Berks	Hay Creek	Installation of a new sewer system and pumping station which connects 115 residents from failed, antiquated, and non-existent septic systems to an existing system 6 miles away in Birdsboro, PA. Residents will have until June 2020 to connect to the $6 million project.	https://www.dailylocal.com/news/union-township-couple-pushes-to-get-geigertown-sewer-project-back/article_0043a620-ff2e-11e9-9685-df45bfbca347.html

4.4.1.10 Collaboration with Industry Organizations

PWD has a long-standing partnership with professional/industry organizations. In the 2020 Watershed Control Plan Update, PWD proposes leveraging these partnerships to conduct research and advocacy efforts to further LT2 compliance goals. One of these potential partnership mechanisms includes participation in American Water Works Association's Source Water Technical Advisory Workgroup, which PWD's Source Water Program officially joined in Fall 2021. Additionally, PWD's Source Water staff have met with Water Research Foundation representatives throughout 2021 to better understand and define research priorities for the near-term.

4.4.1.11 Watershed Wastewater Treatment Partnerships

4.4.1.11.1 Wissahickon Clean Water Partnership

In summer 2016, The City of Philadelphia joined 13 Wissahickon Creek watershed municipalities and four wastewater treatment plant operators to form a Wissahickon Clean Water Partnership (WCWP). The WCWP seeks to collaboratively develop an alternative TMDL for nutrients that would better address aquatic life impairments in the Wissahickon Watershed. The municipal participants represent over 98% of the watershed area, which provides a powerful stakeholder group that is uniquely positioned to develop a coordinated plan to improve water quality in the watershed. The project was funded in part by The William Penn Foundation through the Pennsylvania Environmental Council. Technical work was performed by Temple University. PWD is also a key participant in the effort providing technical support and important historical water quality information about the Wissahickon Creek.

With encouragement from PA DEP and EPA, the WCWP is preparing a comprehensive Water Quality Improvement Plan for this highly visible, urbanized watershed that will include a long-term program to achieve significant water quality improvements through an adaptive management process. Specified projects and/or treatment upgrades may reduce pathogens in addition to nutrients as well as establishing a partnership framework for future collaborative efforts.

4.4.1.11.2 DO Partnership

The Philadelphia Water Department has developed a Dissolved Oxygen (DO) Partnership with other large regional municipal utilities to share strategic utility planning and technology evaluations in response to potential changes in water quality criteria that could impact acceptable levels of DO in local waterways. Dissolved oxygen, or DO, is influenced by several factors, including ammonia-containing sewage discharges and the presence of excess nutrients in rivers and streams. To continue progress in reducing nutrient discharges and improving DO levels, many of the dischargers have participated in the development of an early action matrix that outlines the early steps to prepare for or better understand the needs for the potential implementation of advanced technologies and operational adjustments. Understanding infrastructure capabilities, limitations, and affordability will be critical to further reducing pollutants in the Delaware Estuary in the future. The DO Partnership continued to meet quarterly throughout 2021. The Partnership has established a foundation for communication and data sharing amongst the municipal dischargers, with future possibilities to leverage the Partnership as a vehicle to collectively address additional wastewater permitting-related concerns.

4.4.2 Agricultural Land Use and Runoff

Stormwater runoff containing manure from agricultural land is a source of *Cryptosporidium* and pathogens in the Schuylkill River watershed (PWD, 2002; PWD, 2011). PWD efforts to address agricultural runoff occur upstream of Philadelphia because the agricultural land within the city and upstream of the intakes is minimal and best management practices (BMPs) have previously been installed at Northwestern Stables, Belmont Stables, Courtesy Stables, Monastery Stables and W.B. Saul High School (PWD, 2011). In the *Watershed Control Plan Update* (2020), opportunities to address agricultural sources of runoff in the lower Delaware River watershed are also identified.

Table 4-6: Planned Implementation Schedule – Watershed Protection Control Strategies to Address Agricultural Runoff

Control Strategy: Watershed Protection			
Priority Source – Agricultural Runoff			
Initiatives	**Target Watershed(s)**	**Target Completion Date**	**Report Section**
Coordinate with watershed partners to develop Comprehensive Nutrient Management Plans for WB Saul High School, Fox Chase Farm, and Manatawna Farm.	Wissahickon and Pennypack Creeks, Schuylkill River	2021	4.4.2.1
Work with USDA/NRCS, PA Dept of Agriculture and the Philadelphia School District to implement best management practices at WB Saul High School.	Wissahickon Creek	2025	4.4.2.1
Work with USDA/NRCS, PA Dept of Agriculture and the Philadelphia School District to implement best management practices at Fox Chase Farm	Pennypack Creek	2025	4.4.2.1
Work with Northwestern, Courtesy Stables, and Monastery Stables to implement conservation planning practices	Wissahickon and Pennypack Creeks	2021/2022	4.4.2.1
Develop maintenance plans or MOUs for PWD's in-city agricultural BMPs	Wissahickon and Pennypack Creeks	2024	4.4.2.1
Reassess land use in the Schuylkill River Watershed with each update of the National Land Cover Database	Schuylkill River	Ongoing	4.4.2.2.1
Reassess land use in the priority Delaware River Watershed sub-basins with the 2016 National Land Cover Database (NLCD)	Delaware River	2021	4.4.2.2.2
Actively participate in the SAN Agricultural Workgroup and support initiatives outlined in the Annual Workplans	Schuylkill River	Ongoing	4.4.2.3

Identify priority projects and available funding sources; work with SAN partners to best utilize Farm Bill funds; Promote drinking water protection in existing funding programs	Schuylkill and Delaware Rivers	Ongoing	4.4.2.6
Assess status of CAFO NPDES permits in the delineated Area of Influence	Schuylkill River	Ongoing	4.4.2.3
Participate in nutrient management trainings and conferences to further develop expertise and enhance liaison role to Philadelphia's agricultural properties	Wissahickon and Pennypack Watersheds	Ongoing	4.4.2.5

4.4.2.1 Philadelphia In-City Agricultural Best Management Practices

4.4.2.1.1 W.B. Saul High School

In 2016, Saul High School created a 501(c)(3) as a mechanism to acquire funding for projects identified in their school master plan. PWD began collaborating with Saul and other stakeholders in 2018 to facilitate the implementation of BMPs to reduce sediment, pathogen, and nutrient loading in the Schuylkill watershed. Construction of BMPs at Saul began in 2019, when the construction of a swale and culvert diverting runoff from the adjacent Henry Avenue was completed. The diversion system connects to a highway inlet at the top of the Saul High School access drive and conveys diverted flow below pastureland adjacent to the Wissahickon Valley Park.

PWD continues to coordinate internally to determine resources available to support projects to manage stormwater and protect source water on the Saul Agricultural High School campus given shifting priorities dictated by the COVID-19 response. Planned BMPs still to be implemented include the construction of a new concrete heavy use area, manure transfer system, and roofed barn area.

4.4.2.1.2 Fox Chase Farm

In the Watershed Control Plan Update submitted in October 2020, Fox Chase Farm is identified as a potential project opportunity in the Pennypack Creek watershed of the Upper Delaware Estuary sub-basin. Project implementation is proposed for 2025.

4.4.2.1.3 Philadelphia Stables

There are several horse stables located throughout the City of Philadelphia. These locations provide opportunities for best management and conservation practices. Water quality benefits include sediment and erosion control, nutrient management and pathogen controls. Figure 4-1 shows the locations of horse stables on public land along the Schuylkill River (2), Wissahickon Creek (3), and Pennypack Creek (1).

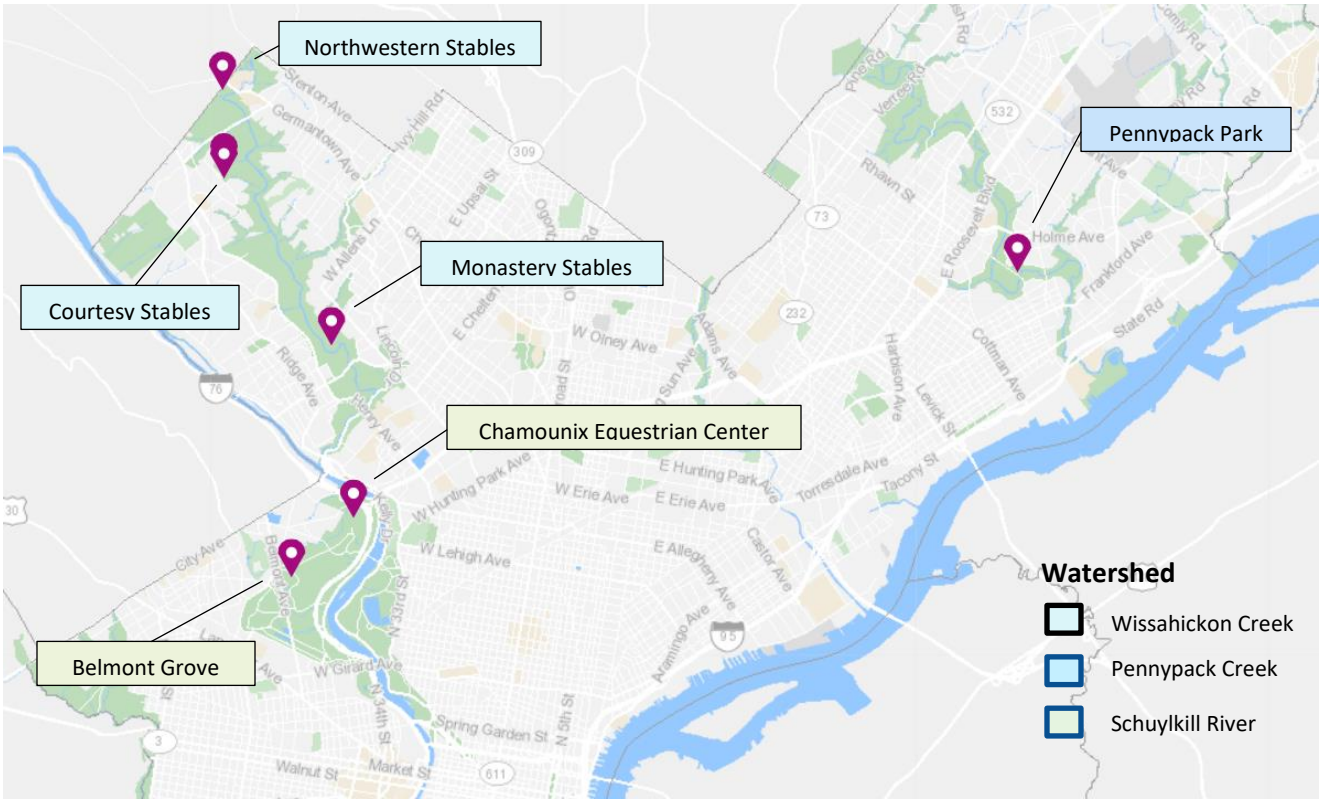


Figure 4-1: Horse Stables in Philadelphia *(Adapted from Philadelphia Parks and Recreation 2020)*

Northwestern Stables

In 2019, PWD contributed $50,000 through the SRRF toward stormwater management projects at Northwestern Stables. The property on which the non-profit stables sit drains into a small tributary of the nearby Wissahickon Creek, which then discharges into the Schuylkill River upstream of the Queen Lane intake. Following recommendations from the NRCS, Northwestern Stables implemented various BMPs including diverting street runoff through a newly constructed trench drain and 200 ft of outlet pipe; roof gutter installation, downspout connection repairs, and underground pipe installation to manage 22,000 ft^2 of impervious roof area; planting 12,000 ft^2 of vegetated buffers; and grading and stabilization of ~41,000 ft^2 of paddock area. In 2020, construction of the stormwater management and paddock stabilization project at Northwestern Stables was completed. Before and after photos of the three main heavy use areas are shown in Figure 4-2. In 2021, Northwestern Stables was the host of the Schuylkill River Restoration Fund grant announcements and project showcase event. Attendees were able to speak to the landowners as well as NRCS staff to get a better understanding of the planning and design considerations.

Pre-Construction Heavy Use Area 1

Post Construction Heavy Use Area 1

Pre-Construction Heavy Use Area 2

Post Construction Heavy Use Area 2

Pre-Construction Heavy Use Area 3

Post Construction Heavy Use Area 3

Figure 4-2: Pre and Post Construction Photos from Northwestern Stables Stormwater Management and Paddock Stabilization Project

4.4.2.2 Land Use Assessments

4.4.2.2.1 Schuylkill River Watershed

In November 2019, the United States Geological Survey released the latest iteration of the National Land Cover Database (NLCD). The land use categories are broken out in Table 4-7. Definitions of the land cover classifications are available from the Multi-Resolution Land Characteristics Consortium. The 2016 dataset is mapped for the Schuylkill River Watershed in Figure 4-3. A total of 27.6% of the Schuylkill River Watershed land cover is attributed to agricultural uses e.g., pasture/hay and cultivated crops. More information on the National Land Cover Database project can be found on the Multi-Resolution Land Characteristics Consortium website at https://www.mrlc.gov/data.

Table 4-7: Land Cover Classification Areas in the Schuylkill River Watershed (NLCD 2016)

Schuylkill River Watershed Land Cover (NLCD 2016)				
Land Cover Class	**Land Use Classification**	**Code**	**2016 Area (acres)**	**% of Total Area**
Water	Open Water	11	11,462.4	0.9%
Water	Perennial Ice/Snow	12	-	0.0%
Developed	Developed-Open Space	21	162,860.8	13.3%
Developed	Developed-Low Intensity	22	89,164.8	7.3%
Developed	Developed-Medium Intensity	23	48,377.6	4.0%
Developed	Developed-High Intensity	24	23,321.6	1.9%
Barren	Barren Land	31	7,200.0	0.6%
Forest	Deciduous Forest	41	401,888.0	32.9%
Forest	Evergreen Forest	42	4,896.0	0.4%
Forest	Mixed Forest	43	100,915.2	8.3%
Shrubland	Shrub/Scrub	52	14,035.2	1.1%
Herbaceous	Grassland/Herbaceous	71	5,056.0	0.4%
Planted/Cultivated	Pasture/Hay	81	164,211.2	13.4%
Planted/Cultivated	Cultivated Crops	82	173,996.8	14.2%
Wetlands	Woody Wetlands	90	14,112.0	1.2%
Wetlands	Herbaceous Wetlands	95	1,011.2	0.1%
		Total	1,222,509	100.0%

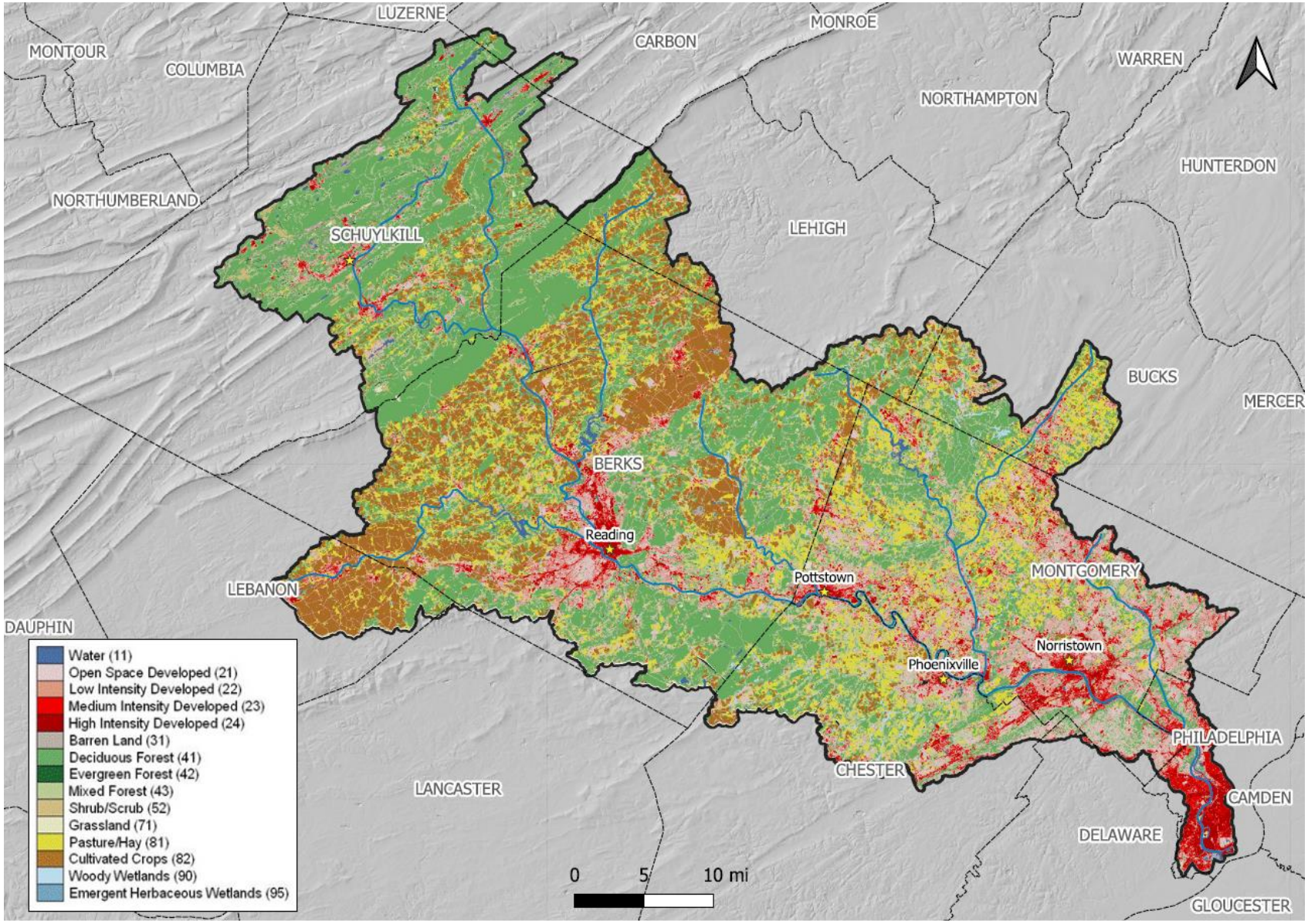


Figure 4-3: Land Use in Schuylkill River Watershed (NLCD 2016)

4.4.2.2.2 Delaware River Watershed

A land use analysis of priority sub-basins of the Delaware River Watershed using the 2016 NLCD was completed in 2021 and detailed in the sections that follow.

The sub-basins of the Delaware River Watershed within the Baxter Water Treatment Plant's Area of Influence (AOI) are delineated in the *PWD Watershed Control Plan Update*. The Baxter intake AOI covers a total of 2,887 square miles and includes the Lehigh Valley sub-basin and the Pennsylvania side of the Upper Central, Lower Central, and Upper Estuary sub-basins comprising 47%, 28%, 9%, and 15% of the land area in the AOI, respectively. The largest land cover type in the Baxter AOI is deciduous forest, which comprises 42% of the land cover in the Baxter AOI. Table 4-8 and Figure 4-4 show the NLCD 2016 land use data for the Baxter Water Treatment Plant area of influence. In the sections that follow, the 2016 National Land Cover Database data is presented for each priority sub-basin. More information on the National Land Cover Database project can be found on the Multi-Resolution Land Characteristics Consortium website at https://www.mrlc.gov/data.

Table 4-8: Land Cover Classification Areas in the Baxter Area of Influence (NLCD 2016)

Baxter Water Treatment Plant Area of Influence Land Cover (NLCD 2016)				
Land Cover Class	**Land Use Classification**	**Code**	**2016 Area (acres)**	**% of Total Area**
Water	Open Water	11	33,463	1.81%
Water	Perennial Ice/Snow	12	-	-
Developed	Developed-Open Space	21	232,178	12.57%
Developed	Developed-Low Intensity	22	127,709	6.91%
Developed	Developed-Medium Intensity	23	72,857	3.94%
Developed	Developed-High Intensity	24	36,088	1.95%
Barren	Barren Land	31	9,019	0.49%
Forest	Deciduous Forest	41	775,128	41.96%
Forest	Evergreen Forest	42	31,985	1.73%
Forest	Mixed Forest	43	141,915	7.68%
Shrubland	Shrub/Scrub	52	12,938	0.70%
Herbaceous	Grassland/Herbaceous	71	9,611	0.52%
Planted/Cultivated	Pasture/Hay	81	146,035	7.91%
Planted/Cultivated	Cultivated Crops	82	136,535	7.39%
Wetlands	Woody Wetlands	90	78,591	4.25%
Wetlands	Herbaceous Wetlands	95	3,315	0.18%
		Total	1,847,367	100.00%

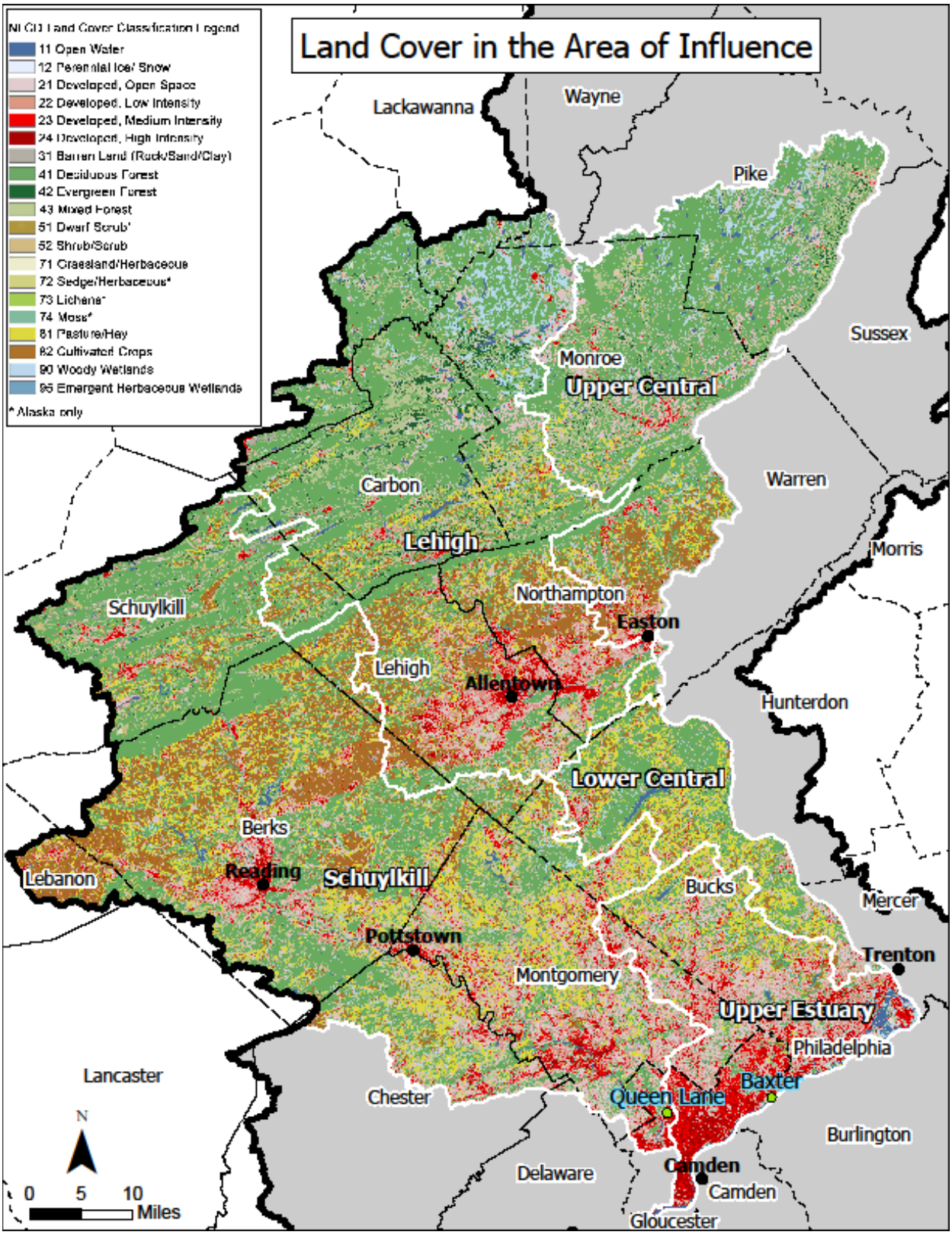
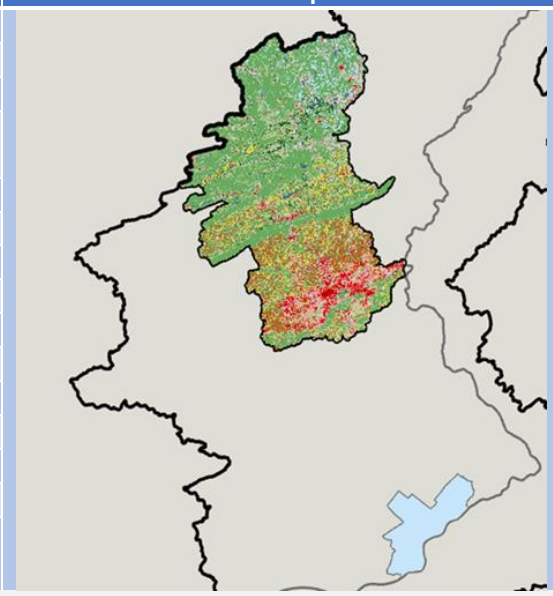


Figure 4-4: Map of Land Use in the Expanded Area of Influence in the *PWD Watershed Control Plan Update* (2020), (NLCD 2016)

4.4.2.2.2.1 Lehigh Valley Sub-basin

The Lehigh Valley sub-basin of the Delaware River Watershed is within the Baxter Water Treatment Plant's Area of Influence. It encompasses a total of 1,362 square miles and comprises the northern most boundary of the Baxter Area of Influence. The top land uses consist of deciduous forest (596 mi^2, 44%), developed open space (138 mi^2, 10%), mixed forest (137 mi^2, 10%), and cultivated crops (133 mi^2, 10%), see Table 4-9 and Figure 4-5.

Table 4-9: Land Use Classification for the Lehigh Valley Sub-Basin within the Area of Influence (NLCD 2016)

Code	Land Use Classification	Coverage (mi^2)	Lehigh Valley Sub-Basin in Relation to Philadelphia
11	Open Water	18.4	
21	Developed, Open Space	138.4	
22	Developed, Low Intensity	77.8	
23	Developed, Medium Intensity	37.2	
24	Developed, High Intensity	14.7	
31	Barren Land	9.1	
41	Deciduous Forest	596.0	
42	Evergreen Forest	37.3	
43	Mixed Forest	136.9	
52	Shrub/Scrub	8.1	
71	Herbaceuous	7.5	
81	Hay/Pasture	87.3	
82	Cultivated Crops	133.1	
90	Woody Wetlands	57.9	
95	Emergent Herbaceuous Wetlands	2.4	
	Total	***1362.2***	

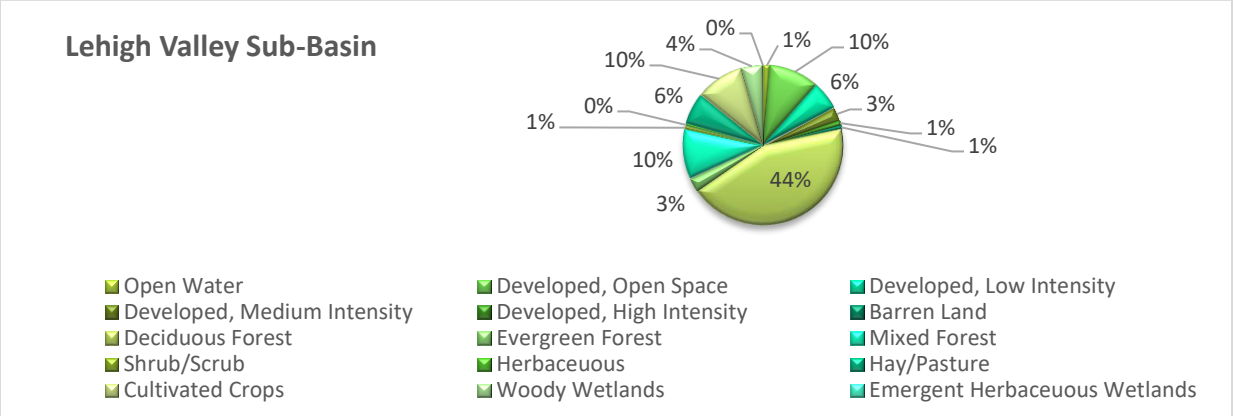


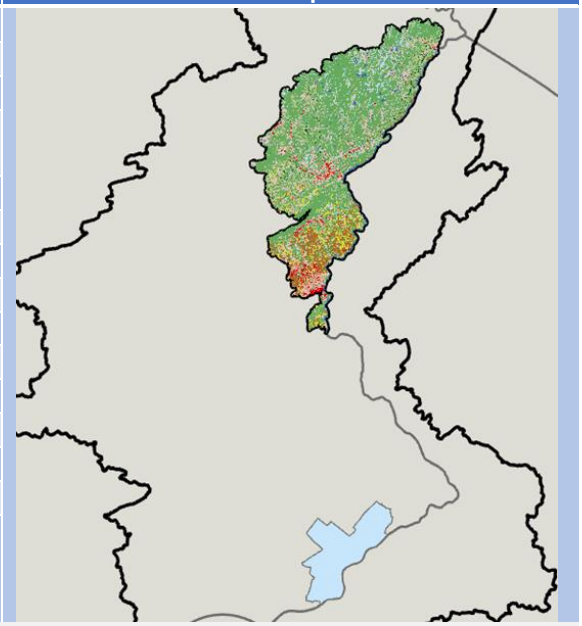
Figure 4-5: Land Use Breakdown in the Lehigh Valley Sub-basin within the Baxter WTP Area of Influence

4.4.2.2.2.2 Upper Central Sub-basin

The Upper Central sub-basin of the Delaware River Watershed is within the Baxter Water Treatment Plant's Area of Influence as defined in the *PWD Watershed Control Plan Update (2020).* Limited to the Pennsylvania side of the Delaware River watershed, it encompasses a total of 808 square miles and comprises the northeastern boundary of the Baxter Area of Influence. The top land uses consist of

deciduous forest (436.5 mi^2, 54%), developed open space (90.7 mi^2, 11%), mixed forest (67.9 mi^2, 8%), cultivated crops (49.8 mi^2, 6%), and wood wetlands (43.7 mi^2, 6%), see Table 4-10 and Figure 4-6.

Table 4-10: Land Use Classification for the Upper Central Sub-Basin within the Area of Influence (NLCD 2016)

Code	Land Use Classification	Coverage (mi^2)	Upper Central Sub-Basin in Relation to Philadelphia
11	Open Water	12.6	
21	Developed, Open Space	90.7	
22	Developed, Low Intensity	27.4	
23	Developed, Medium Intensity	10.9	
24	Developed, High Intensity	4.2	
31	Barren Land	2.2	
41	Deciduous Forest	436.5	
42	Evergreen Forest	11.2	
43	Mixed Forest	67.9	
52	Shrub/Scrub	8.6	
71	Herbaceuous	4.1	
81	Hay/Pasture	36.8	
82	Cultivated Crops	49.8	
90	Woody Wetlands	43.7	
95	Emergent Herbaceuous Wetlands	1.5	
	Total	***807.9***	

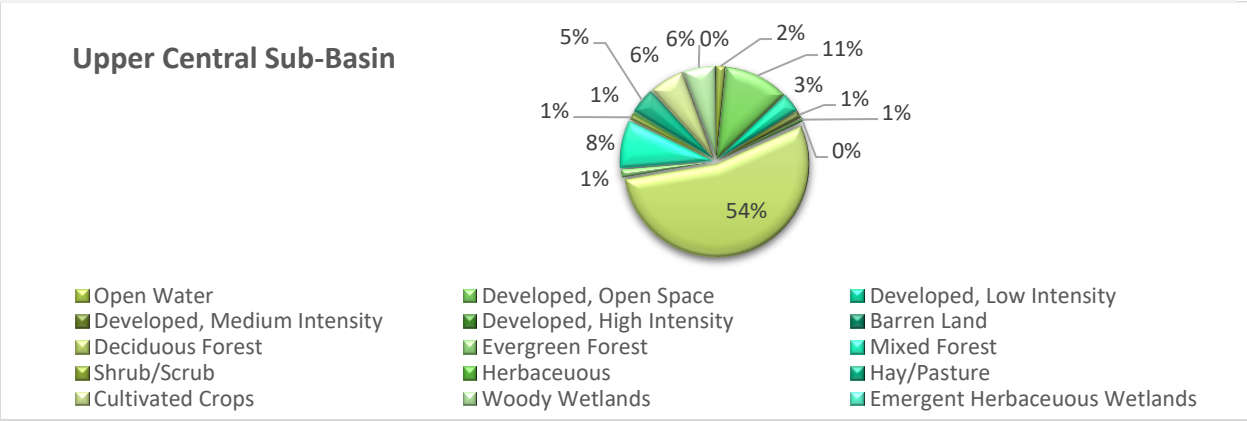
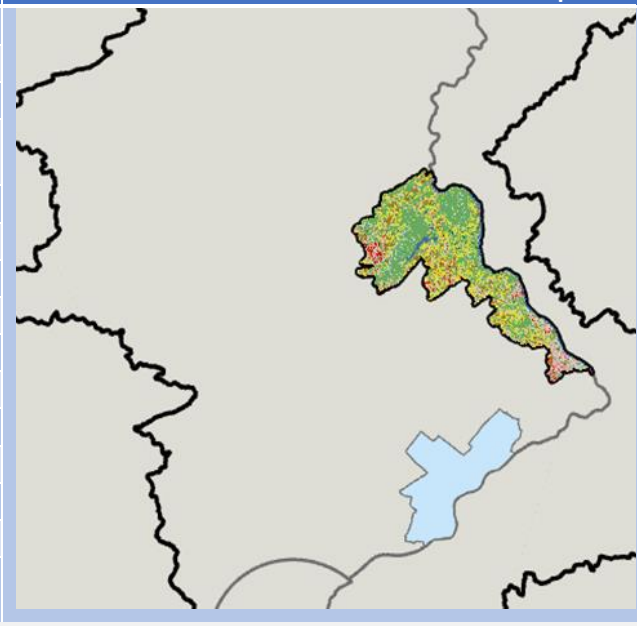


Figure 4-6: Land Use Breakdown in the Upper Central Sub-basin within the Baxter WTP Area of Influence (NLCD 2016)

4.4.2.2.2.3 Lower Central Sub-basin

The Lower Central sub-basin of the Delaware River Watershed is within the Baxter Water Treatment Plant's Area of Influence as defined in the *PWD Watershed Control Plan Update.* Limited to the Pennsylvania side of the Delaware River watershed, it encompasses a total of 274 square miles and comprises part of the eastern boundary of the Baxter Area of Influence. The top three land uses consist of deciduous forest (116.1 mi^2, 42%), hay/pasture (64.7 mi^2, 24%) and developed open space (30.3 mi^2, 11%), see Table 4-11 and Figure 4-7.

Table 4-11: Land Use Classification for the Lower Central Sub-Basin within the Baxter WTP Area of Influence (NLCD 2016)

Code	Land Use Classification	Coverage (mi^2)	Lower Central Sub-Basin in Relation to Philadelphia
11	Open Water	5.9	
21	Developed, Open Space	30.3	
22	Developed, Low Intensity	11.2	
23	Developed, Medium Intensity	3.7	
24	Developed, High Intensity	0.9	
31	Barren Land	0.4	
41	Deciduous Forest	116.1	
42	Evergreen Forest	1.3	
43	Mixed Forest	9.8	
52	Shrub/Scrub	1.8	
71	Herbaceuous	0.9	
81	Hay/Pasture	64.7	
82	Cultivated Crops	19.3	
90	Woody Wetlands	7.4	
95	Emergent Herbaceuous Wetlands	0.2	
	Total	***273.9***	

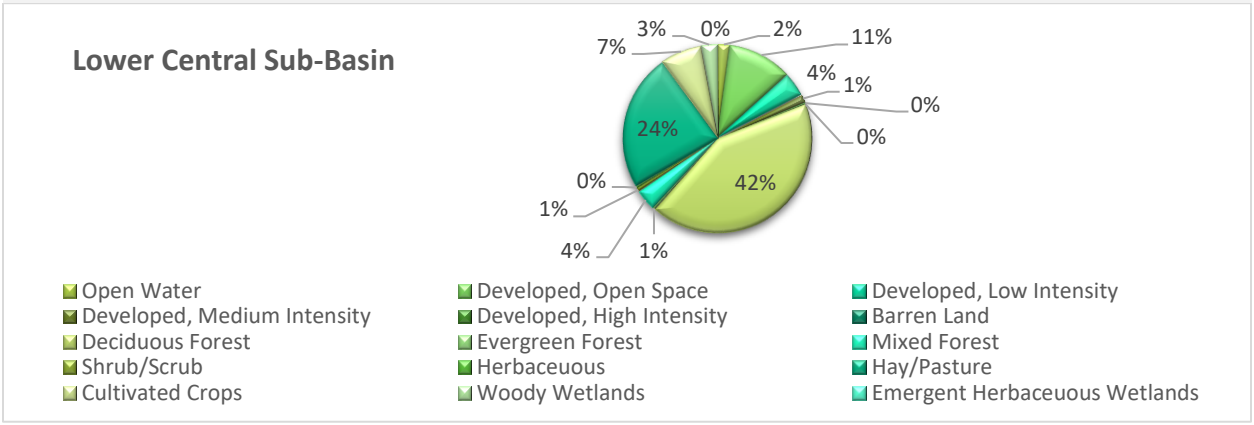
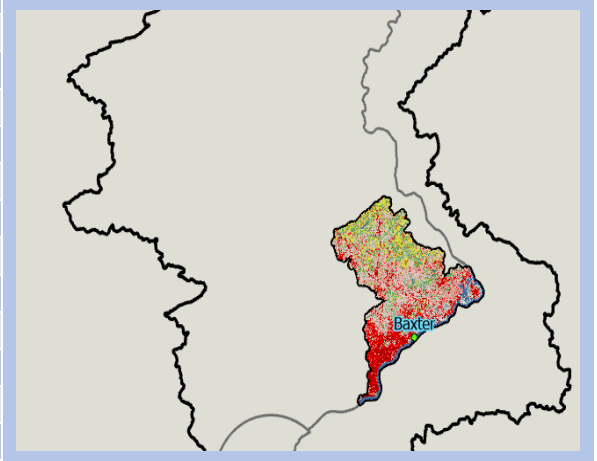


Figure 4-7: Land Use Breakdown in the Lower Central Sub-basin within the Baxter WTP Area of Influence (NLCD 2016)

4.4.2.2.2.4 Upper Estuary Sub-basin

The Upper Estuary sub-basin of the Delaware River Watershed is within the Baxter Water Treatment Plant's Area of Influence as defined in the *PWD Watershed Control Plan Update.* Limited to the Pennsylvania side of the Delaware River watershed, it encompasses a total of 442.5 square miles and comprises the southeastern boundary of the Baxter Area of Influence. The top two land uses consist of developed open space (103 mi^2, 23%) and developed low intensity (83 mi^2, 19%); both deciduous forest (62.4 mi^2) and developed medium intensity (62 mi^2) compromise 14% of the area's land use (Table 4-12, Figure 4-8).

Table 4-12: Land Use Classification for the Upper Estuary Sub-Basin within the Baxter WTP Area of Influence (NLCD 2016)

Code	Land Use Classification	Coverage (mi^2)	Upper Estuary Sub-Basin in Relation to Philadelphia
11	Open Water	15.4	
21	Developed, Open Space	103.3	
22	Developed, Low Intensity	83.2	
23	Developed, Medium Intensity	62.0	
24	Developed, High Intensity	36.6	
31	Barren Land	2.5	
41	Deciduous Forest	62.4	
42	Evergreen Forest	0.3	
43	Mixed Forest	7.1	
52	Shrub/Scrub	1.7	
71	Herbaceuous	2.6	
81	Hay/Pasture	39.4	
82	Cultivated Crops	11.1	
90	Woody Wetlands	13.8	
95	Emergent Herbaceuous Wetlands	1.1	
	Total	***442.5***	

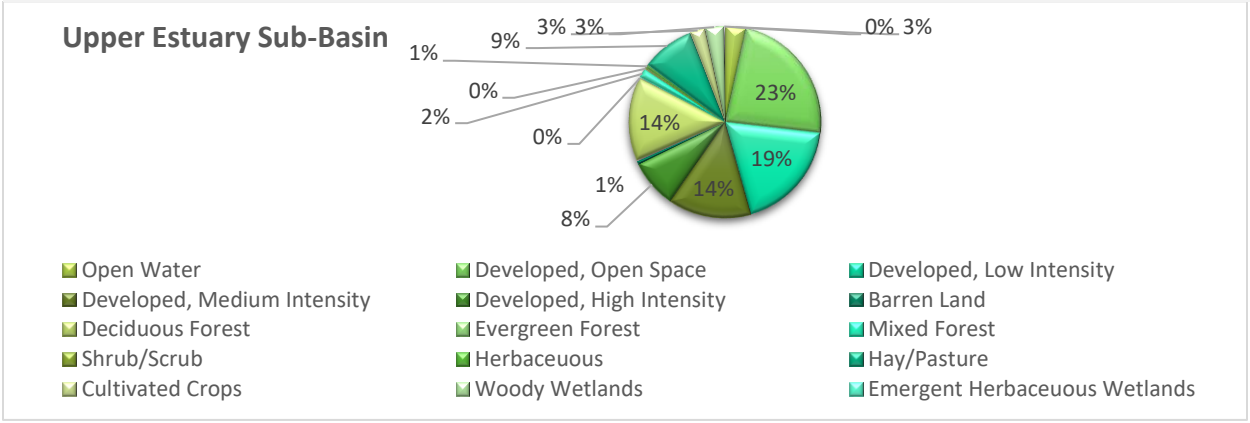


Figure 4-8: Land Use Breakdown in the Upper Estuary Sub-basin within the Baxter WTP Area of Influence (NLCD 2016)

4.4.2.3 SAN Agriculture Workgroup

PWD contributions to the Schuylkill River Restoration Fund (SRRF) and involvement in the SAN Agriculture Workgroup are the main vehicles for identifying and implementing agricultural best management projects in Philadelphia's source watersheds. Through the SAN Agriculture Workgroup, PWD is kept informed about the progress of recent SRRF grant recipients and potential future high priority agricultural BMP projects. The workgroup also develops education and outreach materials including *A Farmer's Guide for Healthy Communities* (available on the SAN website at www.Schuylkillwaters.org) and engages fellow stakeholders to promote the implementation of agricultural best management practices and the development of Comprehensive Nutrient Management

Plans throughout the watershed. A new round of strategic planning for the SAN's next 5 years commenced in 2019 and was finalized in late 2020.

In 2021, PWD regularly attended workgroup meetings which were switched to a virtual platform to align with COVID-19 pandemic restrictions.

4.4.2.4 CAFO Identification in the Area of Influence

Concentrated animal feeding operations (CAFOs) are agricultural operations where animals are confined in small land areas. CAFOs have the potential to contribute *Cryptosporidium* contaminated runoff to the Schuylkill River watershed. In 2019, PWD received updated CAFO data from PA DEP including number of animal equivalent units and primary animal for each operation. As of October 2019, a total of 36 CAFOs exist in the Schuylkill River watershed representing more than 25,200 animal equivalent units (AEUs, 1 AEU = 1,000 lbs. of animal weight). These totals mark only a slight increase from 2018 data, during which 32 CAFOs representing more than 22,700 AEUs existed in the Schuylkill River watershed. A map depicting 2019 data is shown in Figure 4-9. Due to a lack of significant changes from year to year, this dataset will be updated every 5-years. Beginning in 2022, following the first full implementation year of the approved Watershed Control Plan Update, CAFOs identification within the Baxter intake's area of influence will be included.

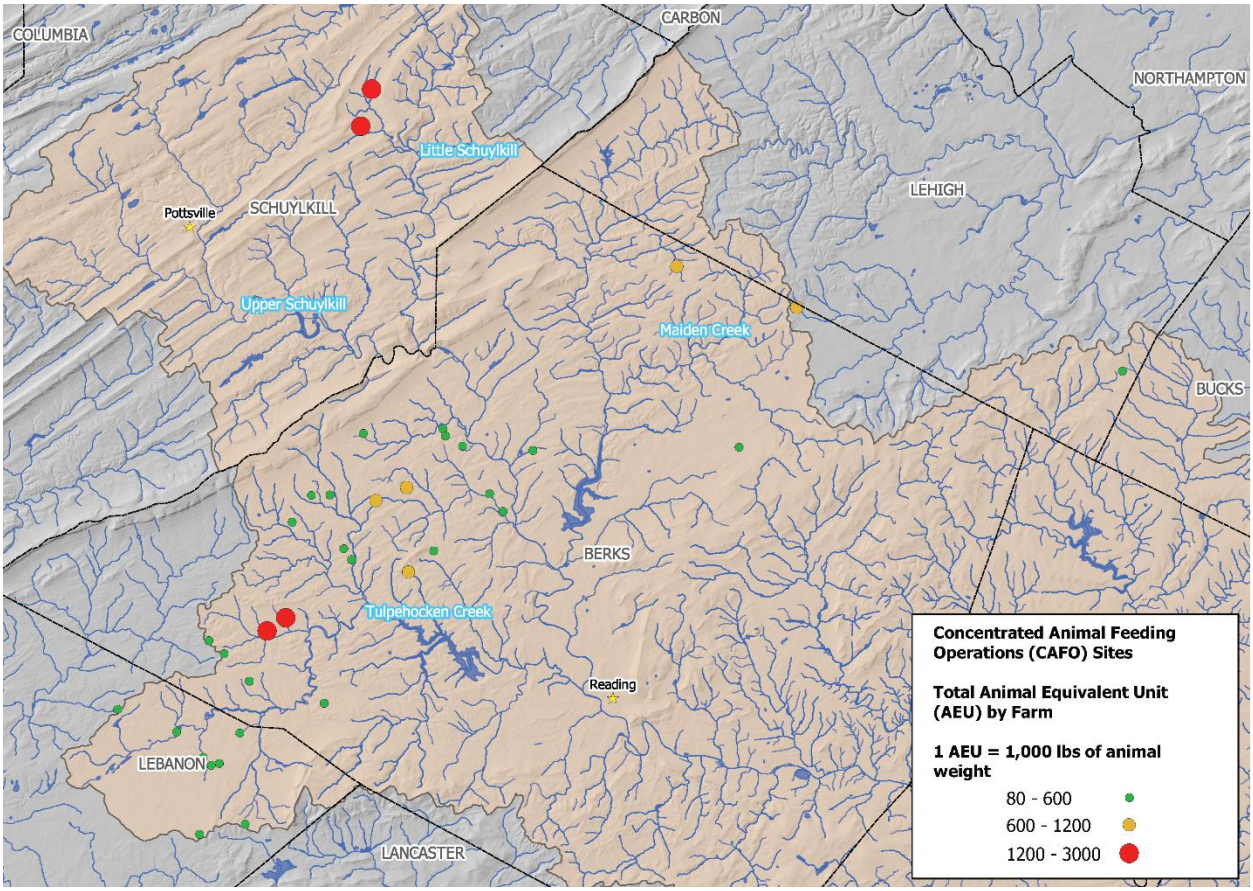


Figure 4-9: Concentrated Animal Feeding Operations in the Schuylkill River Watershed by Total Animal Equivalent Units (AEUs) (PA DEP 2019)

4.4.2.5 Nutrient Management Trainings

In 2021, PWD continued to utilize virtual platforms for continuing education and professional development on nutrient management. Opportunities for in-person trainings and conferences were limited due to public health and safety restrictions resulting from the COVID-19 pandemic. In June and July 2021, Source Water Protection Staff attended the USACE's Learning Exchange harmful algal bloom webinar series, *Comprehensive Strategies to Protect Drinking Water from Harmful Algal Blooms,* to better understand the interconnections between pathogen control, nutrient management, and water supply impacts.

4.4.2.6 Schuylkill River Restoration Fund Grants for Agricultural BMP Projects

In the WCP, PWD outlines several actions to reduce *Cryptosporidium* in the Schuylkill River watershed from agricultural runoff. These include the installation of agricultural BMPs, including manure storage basins and vegetated buffers, on select farms in the Schuylkill River watershed. PWD contributions to the Schuylkill River Restoration Fund (SRRF) and involvement in the SAN Agriculture Workgroup are the main vehicles for identifying and implementing projects.

In 2006, Exelon, SAN, and the Schuylkill River Greenways National Heritage Area (SRG NHA) established the Exelon Restoration Fund, now named the SRRF. The SRRF provides grants to support projects that improve and protect water quality throughout the Schuylkill River watershed. Initially, Exelon provided all the funding to fulfill a requirement in their DRBC docket for the Wadesville Mine Demonstration Project. Beginning in 2009, PWD became the second annual contributor to the SRRF. Partnership for the Delaware Estuary (PDE) became a member and contributor in 2010 and Aqua PA followed in 2012. Additionally, MOM's Organic Market contributed to the SRRF in 2014 through 2016, and Coca-Cola contributed in 2015. In 2021, Pennsylvania American Water Company signed on to contribute annual funds to the SRRF. Members of the SAN serve as technical experts in the grant selection process to support the review of project applications for their benefit to the Schuylkill River watershed. SRG NHA oversees the SRRF and distributes grant money.

PWD now contributes approximately $100,000 to the SRRF each year. Priority projects are selected for the implementation of agricultural best management practices to support WCP *Cryptosporidium* control objectives. To meet the WCP objectives specified for the first five years of plan implementation, PWD supported the construction of either manure storage basins or vegetated buffers at 10 separate agricultural operations in the watershed through its participation in the SRRF.

Recognizing the water quality benefits of reducing pathogens, nutrients, and sediment, PWD continues to support the implementation of conservation practices on agricultural properties. SRRF projects that have received PWD grant funding in the past five years are listed in Table 4-13.

Table 4-13: Additional Schuylkill River Restoration Fund Agriculture Projects

Farm	Subwatershed	Award Year	BMP Work Completed or In Progress
Bolton Farm	Saucony Creek	2021	Liquid manure storage basin, two manure transfer systems, a reception pit, a concrete heavy use area, and 650 linear feet of stream bank fencing
Miller Farm	Manatawny Creek	2021	Liquid manure storage basin, a dry manure storage, a reception pit, two manure transfer systems, a concrete heavy use area, stormwater controls, 400 linear feet of paddock fencing, 310 linear feet of stream bank fencing, and a designated stream crossing
Kunkel Farm	Manor Creek	2020	Dry manure storage, roofed heavy use area, and barnyard stormwater controls
Grube Farm	Irish Creek	2020	Liquid manure storage basin, manure transfer system, dry manure storage, concrete heavy use area, livestock exclusion fencing, barnyard controls, and rain gutters
Love Farm	Hay Creek	2019	Dry manure storage basin, rain gutters and lined outlets, water pipeline to pasture, and animal stream crossing
Northwestern Stables	Wissahickon	2019	Stabilization of 41,000 square foot heavy use paddocks, 12,000 square feet of vegetated buffers and rain gardens, underground pipe system to collect and divert flow from paddocks, and improvements to existing roof drainage
A. Burkholder Farm	Saucony Creek	2018	Dry roofed manure storage area, water pipeline to pasture, animal stream crossing, and rain gutters and other barnyard controls
Brown Farm	Maiden Creek	2018	Manure storage basin, stream bank and wetland exclusion fencing, water supply well establishment, automatic drinker installation, and rain gutter improvements
Youse Farm	Manatawny Creek	2017	Manure storage basin, rain gutters and lined outlets, and other barnyard controls
Maidenford Farm	Irish Creek	2017	350 feet of streambank restoration and planting of vegetation, protection of 1.4 acres of forested riparian buffer and 1.3 acres of marginal pastureland wildlife habitat buffer, and 700 feet of livestock exclusion fencing
Zettlemoyer Farms	Upper Maiden Creek	2016	Two manure storage areas, rain gutters and other barnyard controls, establishment and planting of a riparian buffer with stream fencing, and implementation of rotational grazing

Projects Funded to Reduce Non-Point Source Pollution from Agricultural Lands

In 2021, PWD partially funded two new agricultural projects in the Schuylkill River Watershed:

Bolton Farm, 2021 SRRF Grant Recipient

The Bolton Farm is a 35-acre organic dairy operation located in Richmond Township, Berks County, with 72 cows on site. In 2020, the Bolton family was awarded a USDA-NRCS Environmental Quality Incentive Program (EQIP) contract to implement agricultural conservation practices on their farm. However, USDA-NRCS EQIP requires cash match funding to implement an NRCS contract. At the time of their funding application, there was no manure storage or stormwater management systems on the farm, allowing nutrients, sediment, and pathogens to runoff into an unnamed tributary to Saucony Creek, which eventually drains into the Schuylkill River.

The full best management project suite includes the installation of a 6-month capacity liquid manure storage basin, two manure transfer systems, a reception pit, a concrete heavy use area, and 650 linear feet of stream bank fencing. PWD contributed $40,000 for roughly one half of the requested SRRF award for this project, with Exelon contributing the remaining funding. A total of $75,000 is being awarded towards this project from the SRRF.

At the time of this report, construction at the Bolton Farm had recently been completed.

Figure 4-10: Bolton Farm paved manure transfer area (left) and 6-month capacity liquid manure storage basin (right) ***Photo Credit: PWD 2021***

Miller Farm, 2021 SRRF Grant Recipient

The Miller Farm is a 225-acre dairy operation located in Oley Township, Berks County, with 65 milking cows on site. An unnamed tributary to Manatawny Creek, itself a tributary to the Schuylkill River, is located on the farm property. The Millers were awarded an NRCS EQIP contract and have a shovel-ready project design but need cash match to satisfy NRCS requirements. At the time of their SRRF application, there was no manure storage or stormwater management systems on the farm, allowing nutrients,

sediment, and pathogens to runoff into the unnamed tributary to Manatawny Creek, which itself drains into the Schuylkill River.

The Miller Farm's project suite includes the installation of a 6-month capacity liquid manure storage basin, a dry manure storage, a 7-day capacity reception pit, two manure transfer systems, a concrete heavy use area, stormwater controls, 400 linear feet of paddock fencing, 310 linear feet of stream bank fencing, and a designated stream crossing.

PWD awarded Berks Nature with $40,000 towards the Miller Farm project. Exelon contributed the balance of the SRRF award, for a total SRRF grant of $95,000. At the time of this report improvements to the Miller Farm are under construction and nearly completed. Prior to BMP implementation, manure was loaded directly onto a truck from a heavily used dairy barn. Now manure is now pumped directly from newly installed grates within the barn into a pit under the previous reception area, which itself is now paved. The grated pit is located at the reception area's low point and will pump manure to the aboveground manure storage basin.

Figure 4-11: Miller Farm paved reception area with manure storage pit and pumping system (left) and six-month liquid manure storage basin (right). ***Photo Credit: PWD 2021***

In-City Projects Funded to Reduce Non-Point Source Pollution

In 2020 and 2021, PWD partially funded two in-city stormwater management projects:

Riparian Buffer Restoration in East Falls (2021 SRRF Award)

The East Falls Development Corporation is in the process of constructing a new public river landing in East Fairmount Park along the banks of the Schuylkill River in the East Falls neighborhood of Philadelphia. The river landing project includes approximately one half-acre of native riparian vegetation planting at the site.

The River Landing site and riparian corridor immediately upstream and downstream consist of a compromised vegetative community dominated by a native but aging riparian tree canopy and an understory of invasive shrubs and vines. Extending downstream approximately 650 linear feet to the East Falls Bridge and upstream approximately 850 linear feet to PWD's Queen Lane intake, this corridor is one of the few stretches of unarmored riverbank with a naturally vegetated riparian habitat along the eastern edge of the Schuylkill River within Fairmount Park.

The riparian improvement project includes the removal of invasive plant species and planting of native riparian species with soil amendments on this 2.5 acres of land. Public education and stewardship will be promoted through signage and programming with partner organizations like the Discovery Center and National Audubon Society. PWD contributed $13,000 towards the riparian restoration component of the project. Additionally, PWD staff provided narration on components of the interactive educational signage.

Initial construction and installation of erosion prevention controls along this new public facility was scheduled for the summer of 2021 and delayed due to impacts from hurricane Ida. The associated planting is scheduled for spring 2022 and a ribbon cutting ceremony will follow.

Smith Run Stabilization Project (2020 SRRF Award)

In 2020, PWD also awarded $35,000 through the SRRF to the Schuylkill Center for Environmental Education (SCEE) for the Smith Run stabilization project. Smith Run, located in northwest Philadelphia, is one of Philadelphia's few remaining open first-order streams and flows directly into the Schuylkill River. The stream sits on land managed by the SCEE, founded in 1965 as the nation's first urban environmental education center. Steep topography in the area creates stormwater sheet flows which have proven difficult for SCEE to manage. Heavy stormwater runoff from nearby Port Royal Avenue has caused significant erosion and gullying adjacent to Smith Run, carrying eroded soil and debris directly into the stream's headwaters.

The proposed project aims to alleviate stormwater runoff by constructing a stepped infiltration swale and reinforcing the stream's adjacent riparian forest buffer along the 300 feet of currently scoured land. The project will improve the water quality of Smith Run, as well as that of an educational pond on SCEE property and ultimately the Schuylkill River. SCEE plans to engage community volunteers during

construction of the project and to continue to do so through educational programming following the project's completion.

PWD is contributing the entirety of the SRRF award for the Smith Run Stabilization project, at an amount of $35,000. The project has been delayed as the COVID-19 pandemic response and supply chain issues have impacted both the project timeline and the total project cost. SCEE is in the process of identifying other funding sources to cover the remaining project costs. PWD Source Water Protection Staff has continued to meet with other department and city stakeholders to assess strategies to move the project forward and has also remained in touch with SCEE staff.

4.4.3 Animal Vectors

Animals in the Schuylkill River watershed serve as mechanical vectors of *Cryptosporidium*, transferring viable oocysts from original hosts. Geese are particularly effective vectors, as identified in PWD and Lehigh University source tracking studies (Jellison et al., 2009; Jellison, 2010a). The SWPP details ongoing and proposed initiatives that aim to reduce the impact of animal vectors near the PWD Queen Lane and Belmont intakes and expand implementation of animal vector control in the Schuylkill River watershed.

Table 4-14: Planned Implementation Schedule – Watershed Protection Control Strategies to Address Animal Vectors

Control Strategy: Watershed Protection			
Priority Source - Animal Vectors			
Initiatives	**Target Watershed**	**Target Completion Date**	**Report Section**
Implement goose control measures on Fairmount Park Properties, including Peter's Island	Wissahickon Creek and Lower Delaware	Ongoing	4.4.3.2
Implement waterfowl management programs at Philadelphia Water Department Facilities	Lower Schuylkill and Delaware River Watersheds	Ongoing	4.4.3.2
Continue to support source tracking research	Various	Ongoing	4.4.1.1
Support efforts to publish scientific journal article to raise awareness and contribute to the state of the science	Various	Ongoing	4.4.1.1
Redesign and install "Do-Not-Feed Geese" educational signage in priority locations	Pennypack and Wissahickon Creeks	2023	NA

4.4.3.1 Education and Outreach on Threat of Animal Vectors in the City

PWD provides education and outreach efforts concerning the management of animal vectors in the Schuylkill River watershed. In partnership with PDE, PWD hosts the Philly Water's Best Friend Spokesdog Competition where two dogs are selected to be Philly Water's Spokesdog and serve for one year as ambassadors educating dog owners on the importance of picking up pet waste. The most recent competition was held in 2019 at the Cobbs Creek Environmental Center. The Spokesdog event was cancelled in 2020 because of COVID-19 health and safety concerns. Alternatively, PWD worked with the Partnership for the Delaware Estuary to engage area animal shelters for participation in a new

educational campaign where information and pet waste disposal bags are distributed with each dog adoption. This effort to educate new pet owners on their role in controlling non-point source pollution continued throughout 2021.

4.4.3.2 Wildlife Management at Fairmount Park and PWD Properties

To address animal vectors of *Cryptosporidium*, PWD is committed to geese management through the WCP. PWD has active contracts with the United States Department of Agriculture (USDA) for geese management at Fairmount Park properties and PWD facilities. Geese management is conducted at Fairmount Park properties including Peter's Island, Pleasant Hill Park, Concourse and Centennial Park and FDR Park and Golf Course. Geese management is also conducted at PWD facilities including the Belmont WTP, Queen Lane WTP, Baxter WTP, Southeast WWTP, Southwest WWTP, Northeast WWTP, and Oak Lane Reservoir. A total annual budget of $140,000 is reserved for wildlife management initiatives throughout Fairmount Park and PWD facilities. These locations are displayed in Figure 4-12.

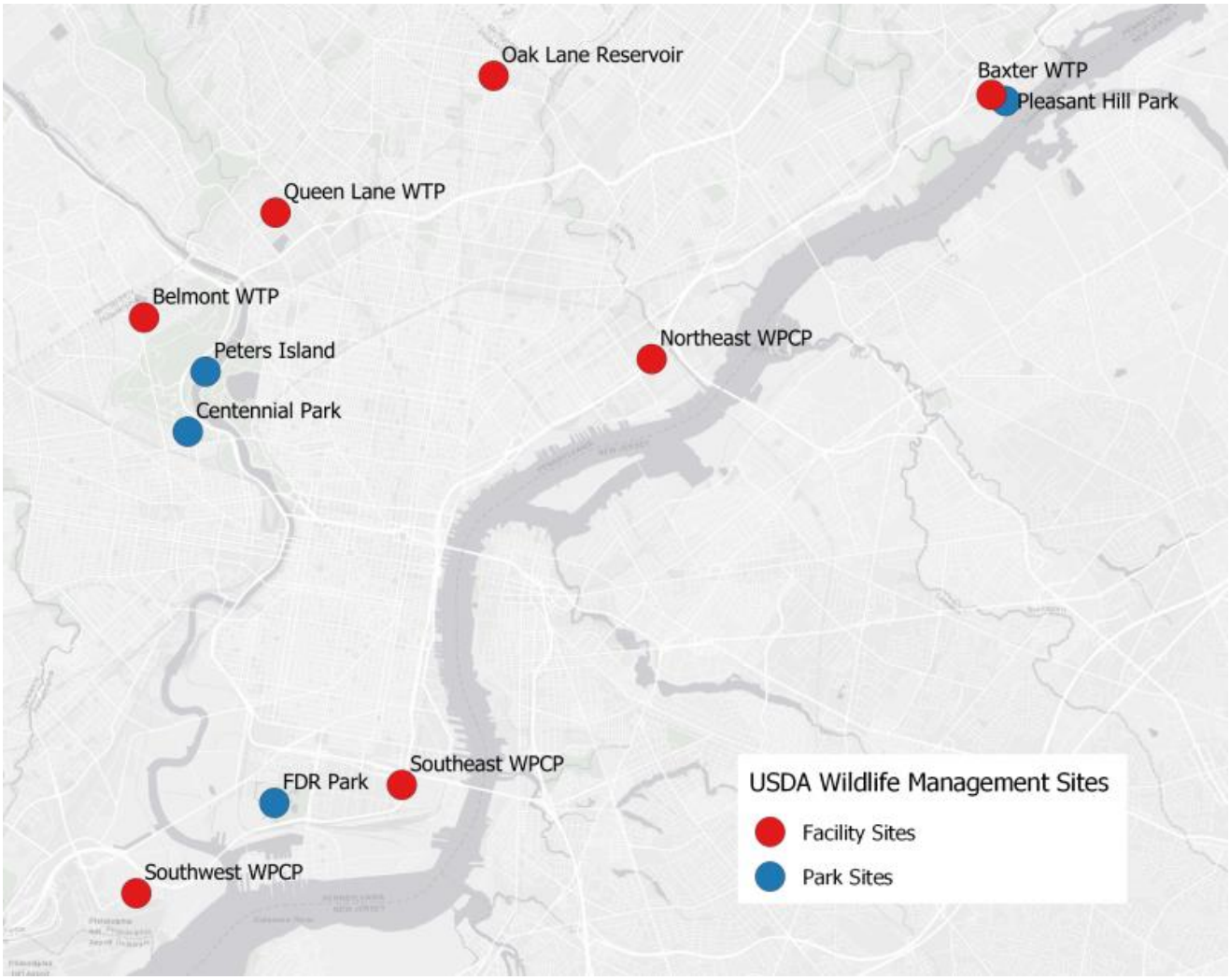


Figure 4-12: Map of USDA-APHIS Wildlife Management Sites

On Fairmount Park properties and PWD facilities, the geese are harassed and dispersed or removed from the site. Geese are dispersed using a range of harassment techniques including physical harassment, electronic harassment devices, pyrotechnics, lasers and paintball guns. At all locations, any nests and eggs are treated with 100% food grade corn oil that stops embryo development by preventing air from passing through the shell.

In the last year, goose control measures were maintained at several Fairmount Park locations, including Pleasant Hill Park, FDR Park and Golf Course, Concourse and Centennial Park, and Peter's Island under a PWD contract with the USDA-APHIS (Table 4-15). Under this contract, geese are harassed or removed from the site and eggs and nests are treated to reduce the population.

Table 4-15: Wildlife Management Data for Philadelphia Parks for FY21

	Peter's Island	Centennial Park	Pleasant Hill Park	FDR Park and Golf Course
Quarter	No. of Geese Dispersed/Removed	No. of Geese Dispersed/Removed	No. of Geese Dispersed/Removed	No. of Geese Dispersed/Removed
2020-Q3	642	0	0	0
2020-Q4	1,420	33	221	2,250
2021-Q1	1,285	194	950	4,375
2021-Q2	*220*	*2*	*129*	*0*
Subtotal	*3,567*	*229*	*1,300*	*6,625*

Also, under a PWD contract with the USDA APHIS, goose control measures were maintained at the three drinking WTPs, three WWTPs and Oak Lane Reservoir. Under this contract, geese are harassed or removed from the site and eggs and nests are treated to reduce the population. Additional measures are taken to control other wildlife populations at PWD facilities.

4.6 Education and Outreach

Education and outreach initiatives are a critical component of PWD SWPP because point and nonpoint source discharges and land management throughout the Schuylkill River watershed influence water quality at the Queen Lane and Belmont intakes. Many education and outreach initiatives are implemented through PWD watershed partnerships, which are maintained by various programs within PWD. The education and outreach control strategy aims to raise awareness of source water protection issues in Philadelphia and throughout Philadelphia's source watersheds. Table 4-16 details initiatives and planned implementation timelines for the in-city education and outreach.

Table 4-16: Planned Implementation Schedule – In-City Education and Outreach Control Strategies

Control Strategy: Education and Outreach **Goal -Continue to raise awareness of source water protection issues in Philadelphia**			
Objectives and Tasks	Target Watershed	Target Completion Date	Report Section
Continue to submit a comprehensive annual water quality report that emphasizes critical source water issues	NA/Citywide	Ongoing (Annually)	4.6.1.1
Continue to maintain the FWWIC and promote source water protection through the center's exhibits and programs	NA/Citywide	Ongoing	4.6.1.2
Continue to operate and maintain Philly RiverCast and promote the web-based recreational warning system	NA/Citywide	Ongoing (Seasonal)	4.6.1.3
Implement in-City stormwater education programs	NA/Citywide	Ongoing	4.6.1.4
Continue to implement pet waste education program in the City of Philadelphia	NA/Citywide	Ongoing	*see 4.4.3.1*

4.6.1.1 Annual Water Quality Report

PWD annually distributes source water protection information to customers in the annual Drinking Water Quality Report. The most recent report published in 2021 shares 2020 water quality data and information on the Schuylkill and Delaware River SWPPs, pharmaceuticals and *Cryptosporidium* source tracking. The report also includes sources for additional information on source water protection issues. PWD takes a proactive approach to customer education and goes beyond reporting requirements by including robust overviews of source water and watershed protection efforts.

4.6.1.2 Fairmount Water Works Interpretive Center

The Fairmount Water Works Interpretive Center (FWWIC) is a PWD educational center that presents the history of the Schuylkill River and the influence of human activities on water quality and quantity through innovative exhibits and interactive educational programs. Fairmount Water Works, PWD,

Academy of Natural Sciences and PDE have partnered to develop a Freshwater Mussel Recovery Program. Freshwater mussels filter water and improve water quality. The goal of the program is to rebuild populations of native mussels through hatchery propagation to improve water quality in the Schuylkill and Delaware River watersheds. Additional program information is available online at delawareestuary.org. The project includes the development and construction of a freshwater mussel hatchery and an aquatic field station at the FWWIC. The goal of the hatchery is to propagate new mussels to increase the population in the Delaware and Schuylkill River watersheds. Installation of the demonstration hatchery at the FWWIC was completed in 2017 and over the course of 2018 and 2019, several thousand individual mussels, consisting of five distinct species, were successfully propagated.

Following the COVID-19 pandemic, the FWWIC closed in the interest of public health protection. Additionally, Hurricane Ida caused a flooding event in early September 2021 that will require extensive cleanup and repairs of the facility. Efforts are currently underway to restore the FWWIC while being mindful of public health recommendations to minimize pandemic risks to employees and other FWWIC staff. The FWWIC's virtual programing and digital messaging are expected to continue safely educating the public on urban watershed issues during the COVID-19 pandemic.

4.6.1.3 Philly RiverCast

PWD continues to promote and maintain Philly RiverCast. The website, www.phillyrivercast.org, has received more than 1. 5 million visits since its launch in 2005. In 2020, PWD continued to assist individuals and recreational groups in interpreting RiverCast ratings. In 2019, PWD analyzed the data communicated by RiverCast as it compared to laboratory-tested data from PWD routine sampling over the past three years. This analysis showed that even more than a decade after RiverCast has been implemented, the program continues to protect public health by providing accurate characterizations of ambient bacteria river conditions.

4.6.1.4 In-City Stormwater Education and Outreach

PWD continues to help Philadelphia residents manage stormwater and beautify their homes through the Rain Check program, a collaborative effort with the Pennsylvania Horticultural Society (PHS) and the Sustainable Business Network. As part of the program, residents attend a workshop to learn about stormwater tools and how to select the most appropriate management tools for the property. Once the property owner identifies the most suitable stormwater management practices, PWD and PHS will help connect them with a contractor to assist with the installation, and Rain Check provides a portion of the project cost. In FY2021, Rain Check held a total of 9 workshops throughout Philadelphia with a total of 718 participants. These numbers are slightly lower than normal due to adaptations warranted by the ongoing COVID-19 pandemic. Stormwater controls installed are itemized in Table 4-17.

Table 4-17: Rain Check Program Progress in FY2021

Stormwater Management Practice	Total FY2020 Installations	Total FY2021 Installations	Cumulative Total (Fall 2014 - July 2021)
Permeable pavers	57	34	366
Downspout planters	66	101	737
Rain gardens	11	14	85
Rain barrels	376	285	4,094

Source: J. Waldowski, personal communication, October 19, 2021.

Table 4-18 details initiatives and planned implementation timeline for watershed-wide education and outreach programs to support the LT2 WCP goals.

Table 4-18: Planned Implementation Schedule – Watershed Education and Outreach Control Strategies

Control Strategy: Education and Outreach			
Education and Outreach Goal -Raise awareness of source water protection issues throughout Philadelphia's source watersheds			
Objectives and Tasks	Target Watershed	Target Completion Date	Report Section
Continue to participate in the SAN workgroups and support initiatives outlined in each group's workplan	Schuylkill River	Ongoing	**Error! Reference source not found.**
Continue to collaborate with the PDE on various education and outreach initiatives	Schuylkill and Lower Delaware River	Ongoing	4.6.1.6
Continue to promote the use of the Delaware Valley Early Warning System among industries, wastewater dischargers, and water suppliers	Schuylkill and Lower Delaware River	Ongoing	4.4.1.4
Work with Philadelphia and regional schools to identify opportunities to enhance conservation practice education in the curriculum	Wissahickon and Pennypack Creeks	2022	4.6.1.7

4.6.1.5 Schuylkill Action Network Collaboration

PWD maintains a $155,000 professional services contract with the Partnership for the Delaware Estuary which incorporates facilitation of the SAN, including workgroup meetings, communication, and project coordination. PWD also sits on the SAN's Planning and Executive Steering Committees, assisting in the planning of annual events and drafting strategic planning documents. PWD regularly attends quarterly SAN Pathogens and Point Source and Agriculture Workgroup meetings, and PWD personnel serve as co-chairs on each of the Pathogens and Point Source and Stormwater Workgroups.

The SAN workgroups provide a mechanism for PWD to engage and collaborate with stakeholders to address priority sources of *Cryptosporidium*, like agricultural runoff and wastewater effluent. Through the SAN Agriculture Workgroup, PWD is kept informed about the progress of recent SRRF grant recipients and potential future high priority agricultural BMP projects. Through the SAN Pathogens and Point Source Workgroup, PWD can track changes related to wastewater discharge throughout the watershed. PWD and other workgroup partners also share information about water quality, treatment technology improvements, regulatory updates, effective water management best practices, and contaminants of emerging concern (CECs).

4.6.1.6 Collaboration with Partnership for the Delaware Estuary

PWD continues to contribute financial resources toward collaboration efforts with Partnership for the Delaware Estuary (PDE) on several education and outreach initiatives. Initiatives include engaging Philadelphia residents in the prevention of stormwater pollution to the Schuylkill and Delaware Rivers and facilitating coordinated action, communication and projects for the Schuylkill Action Network (SAN).

PDE hosted what was formally known as the annual Pennsylvania Coast Day at Penn's Landing in Philadelphia, which was renamed the Delaware River Festival beginning in 2019. This celebration of the Delaware River included partners and activities across the river in Camden, NJ. The 2021 Delaware River Festival took place from September 24 through October 3. A total of 14 in-person events including kayaking and nature walks were complemented by 10 virtual events, which included career panels, animal presentations, and storybook readings. Attendance at in-person events reached an estimated 1,092 people. Estimated reach from the Delaware River Festival social media pages, including video, page, and event views was approximately 123,000; PDE social media posts relating to RiverFest had a reach of over 60,000. Additionally, PDE helps to coordinate the annual Schuylkill Scrub initiative, which takes place from March through May alongside Keep Pennsylvania Beautiful. The 2021 Schuylkill Scrub included 82 cleanup events that engaged 21,115 volunteers. In this three-month period, volunteers removed an estimated 28,965 trash bags of litter and bulk waste from the watershed, as well as 3,624 tires.

The SAN also sponsored a Sojourn Steward to participate in the Schuylkill River Sojourn. This 112-mile kayak journey was modified in 2021 to minimize public health and safety concerns resulting from the COVID-19 pandemic. From July 31 through August 4, 2021, Schuylkill River Greenways hosted the annual Schuylkill Sojourn. Instead of taking place during the first week of June, the Sojourn began on the last day of July. The Sojourn started later in the summer to allow more time for people to become vaccinated and for COVID cases to decrease, enabling more people to attend. The headwaters of the river tend to have decreased water flow and are shallower later in the summer, making it difficult to navigate by boat. For this reason, the 2021 Sojourn began further downriver at Jim Dietrich Park. Although modified to be a slightly shorter 80-mile journey, the Sojourn remained an unforgettable and adventurous experience. The SAN-sponsored 2021 Sojourn Steward, Riel Bilto, engaged sojourn participants while taking photos and posting on social media about her experience. Riel's final video documenting the journey can be found on Youtube.

Additionally, PWD, PDE, Academy of Natural Sciences, and FWWIC partnered to install a freshwater mussel hatchery demonstration project at FWWIC that was opened to the public on February 16, 2017. The FWWIC and freshwater mussel hatchery exhibits are now under repair following a flooding event in September 2021. See Section 4.6.1.2 for more detail on the FWWIC.

4.6.1.7 Educational Partnerships

The 2020 Watershed Control Plan Update commits to working with Philadelphia and regional schools to identify opportunities to enhance conservation practice education.

In FY2021, PWD engineering staff participated as a member of the Occupational Advisory Council (OAC) for Lincoln High School, a Philadelphia public school adjacent to a tributary to Pennypack Creek. PWD staff played an active role in developing curriculum for the school's Environmental Engineering career pathway; in addition, PWD developed and implemented a series of lesson plans that were presented virtually due to the Covid-19 pandemic. Approximately 100 students from 4 classes attended each presentation on Engineering Careers (March 8-9, 2021), Watershed Science (March 16-17, 2021), and Soil Moisture (May 26-27). In FY22, PWD committed to chair the OAC with the mission of advising teachers on industry-relevant and engaging curriculum, and to support a yearly work plan that includes procuring guest speakers and facilitating project-based learning.

4.7 Stakeholder Engagement and Partnerships

As described in the 2020 Watershed Control Plan Update, stakeholder engagement and partnership initiatives are intended to support the following goals:

1) Maintain and strengthen existing watershed partnerships, and
2) Develop a framework for a Delaware River Watershed Collaborative.

The first goal focuses primarily on existing Schuylkill River Watershed partnerships and reinvigorating Philadelphia's in-city watershed partnerships. The second goal is to identify and assess the gaps in collaborative efforts to protect and preserve the Lower Delaware River Watershed. Associated objectives and tasks are outlined in Table 4-19.

Table 4-19: Planned Implementation Schedule – Stakeholder Engagement and Partnership Building

Control Strategy: Stakeholder Engagement and Partnership Building			
Goal - Continue to strengthen existing partnerships			
Objectives and Tasks	Target Watershed	Target Completion Date	Report Section
Continue to support the Schuylkill River Restoration Fund to achieve implementation of priority projects	Schuylkill River	Ongoing	4.7.1.1
Champion the Schuylkill River Restoration Fund and work with SAN partners to draw in more funders	Schuylkill River	Ongoing	4.7.1.2
Promote the Schuylkill River Restoration Fund to potential applicants where appropriate	Schuylkill River	Ongoing	4.7.1.2
Remain an active participant in watershed partnerships and reinvigorate Philadelphia Watershed partnerships e.g., Friends of the Pennypack and Friends of Fox Chase Farm	Pennypack and Poquessing Creeks	Ongoing	4.7.1.3
Engage Philadelphia stables in the implementation erosion and sediment control measures	Wissahickon, Pennypack and Poquessing Creeks	Ongoing	4.4.2.1.3

4.7.1.1 Schuylkill River Restoration Fund Grant Advisory Committee

The Schuylkill River Restoration Fund (SRRF) provides grants to government agencies, non-profits, businesses and other organizations to support environmental projects that improve and protect water quality in the watershed. Contributors include Exelon, PWD, PDE, Aqua, DTE Energy, and MOM's Organic Market. The Schuylkill River Greenways National Heritage Area (SRG NHA) oversees the SRRF and distributes grant money. Grant recipients from the SRRF are selected by an advisory committee comprised of representatives from Exelon, Aqua PA, DRBC, PWD, EPA, PA DEP, SRHA, Partnership for the Delaware Estuary, and the Schuylkill Action Network (SAN).

With less than two percent of the Philadelphia source watershed located within the jurisdiction of the city, taking a partnership approach is critical for PWD. Through the SRRF, PWD can leverage funding and

support projects that protect the drinking water for Philadelphia, educate the public on the importance of source water protection, and implement on-the-ground projects that support Watershed Control Plan goals.

On May 18, 2021, the SRRF advisory committee met virtually to hear presentations from SRRF applicants and to select grant recipients. More than $362,000 was available for 2021 grants. PWD contributed $100,000 to the SRRF in 2021 and had a carryover of $20,000 from the previous year. In the 2021 SRRF grant round, PWD awarded a total of $93,000 to the following grant recipients:

- $40,000 to Berks Nature to implement agricultural best management practices at the Bolton Farm in the Saucony Creek Watershed
- $40,000 to Berks Nature to implement agricultural best management practices at the Miller Farm in the Manatawny Creek Watershed, and
- $13,000 to the East Falls Development Corporation for the restoration of 2.5 acres of riparian habitat along the Schuylkill River near the Falls Bridge in northwest Philadelphia.

After the completion of the 2021 SRRF grant recipient selection and payment of administrative fees to SRGA, PWD has a balance of $17,000 that will be available to the 2022 SRRF grant round or to other source water protection or restoration projects or education and outreach in the Schuylkill River watershed as approved by PWD. More information on the above projects is in Section 4.4.2.6.

4.7.1.2 Schuylkill River Restoration Fund Outreach and Promotion

Due to safety concerns and restrictions related to the COVID-19 pandemic, the annual Schuylkill Action Network (SAN) Bus Tour and Schuylkill River Restoration Fund (SRRF) Press Event was adapted to a virtual platform. On September 17, 2021, Schuylkill Action Network partners hosted *Celebrate the Schuylkill: SRRF Grant Announcement and SAN Project Showcase* at Northwestern Stables in Philadelphia. During this event, 30 attendees toured the suite of BMPs implemented at the stables following the funding awarded during the 2020 SRRF grant round. Representatives from Northwestern Stables guided attendees around the grounds and spoke to the history of the stables and staff from NRCS showcased improvements made to the heavy use areas and stormwater controls that were incorporated throughout the property. The 2021 SRRF grant recipients for projects that enhance the Schuylkill Watershed were also announced by Schuylkill River Greenways. Photos taken during the event are available on the Schuylkill Action Network Flickr Channel.

PWD actively works to champion the Schuylkill River Restoration Fund and work with SAN partners to draw in more funders. In recent years private water utilities were engaged on the work of the Restoration Fund. In 2021, a new private water supplier committed to providing funds for the 2022 grant round.

4.7.1.3 Other Watershed Outreach

PWD helped plan and implement the Schuylkill Action Network Annual Meeting on November 5, 2021. For the second time in the history of the SAN, this event was adapted to a virtual platform in accordance

with COVID-19 pandemic restrictions. The annual event drew the participation of 80 attendees. Discussion topics were centered on the meetings theme of *Adaptation and Resilience*.

The virtual meeting started with a presentation from Schuylkill River Greenway's Deputy Director, Tim Fenchel, on *A Unique Approach to Outfitting Along the Schuylkill River* This presentation was followed by *Green Stormwater Control Measures in the Delaware River Watershed Initiative* by Villanova Ph.D. Candidate and Graduate Research Assistant , Michael Burns. Michael Thompson, a Water Resource Engineer at the Delaware River Basin Commission, then presented *Water Withdrawal and Consumptive Use Projections Through 2060.* The virtual meeting ended with a presentation on *Climate Impacts, Risks, and Adaption* by Abby Sullivan, and Environmental Scientist from PWD.

PWD commits to remaining an active participant in watershed partnerships and plans to reinvigorate Philadelphia Watershed partnerships. In 2020, a contract was conformed with the Partnership for the Delaware Estuary to work collaboratively with PWD and other key city partners to deepen and expand current outreach programming and develop diverse educational campaigns centered on the prevention of non-point source pollution and source water protection in the Philadelphia portion of the Delaware River Watershed. PDE will also lay the groundwork for the development of stronger partnerships with watershed groups and other stakeholders in the city to increase future engagement in clean water initiatives. In 2021, PWD began working with PDE to engage potential partners through preliminary focus groups, gauging interest in the upcoming collaborative and determining shared goals in the region. At the very end of calendar year 2020, PDE was also awarded a $57,044 Growing Greener grant by PA DEP towards the establishment of a water quality collaborative for the lower Delaware River watershed.

4.7.1.4 Philadelphia Stables Partnerships

In 2020, a comprehensive stormwater improvement and paddock restoration project at Northwestern Stables was completed with the help of $50,000 in PWD funding towards the SRRF grant award. The SRRF award helped the non-profit Northwestern Stables, Inc. leverage $143,000 in additional funding and in-kind support towards the project's completion. This project was showcased during the annual Schuylkill River Restoration Fund press event on September 17, 2021. More information on the Northwestern Stables project is in Section 4.4.2.1.3.

4.8 Expectations for 2022

Although the second round of LT2 compliance sampling resulted in an average *Cryptosporidium* concentration within 'Bin 1' range, the Queen Lane intake will remain a 'Bin 2' facility based on the results from the first round of compliance sampling as mandated by PA DEP regulations. The PWD Queen Lane Water Treatment Plant will continue to employ options from the 'Microbial Toolbox' including achieving individual and combined filter effluent performance requirements to maintain in compliance with LT2 regulations. Additionally, PWD will continue ongoing initiatives outlined in the WCP through its existing Source Water Protection Program framework.

In 2022, PWD will continue to maintain programs and activities that allowed it to accomplish its LT2 goals as outlined in the Watershed Control Plan Update, approved June 2021. These include continuing to address WWTP effluent, agricultural land runoff, and animal vectors as priority sources of *Cryptosporidium*, as well as expanding education and outreach in the watershed through source water protection program initiatives. It also includes completing WCP actions that specifically reduce *Cryptosporidium* in the watershed. Specific focus will continue to be on the following:

- Continued partnership with SAN and PDE for project facilitation and collaboration
- Continued support for research surrounding *Cryptosporidium* in Philadelphia source water
- Continued funding toward SAN administration and the SAN Coordinator position
- A contribution of ~$100,000 to the SRRF for 2022 project grants
- Involvement with the SAN Pathogens and Point Source Workgroup to track wastewater discharge related changes in the watershed
- Involvement with the SAN Agriculture Workgroup to identify and contribute to agricultural BMP and CNMP implementation in the watershed
- Wildlife management at Fairmount Park properties and PWD facilities

The Watershed Control Plan efforts will be expanded into the Delaware River watershed as outlined in the 2020 WCP update. Work to coordinate and collaborate among area stakeholders will be a primary aim for the next year.

5.0 References

American Society of Agricultural Engineering. 2003. *Manure Production and Characteristics*. ASAE D384.1, St. Joseph, MI.

Carroll Engineering Corporation. 2013. *Municipal Wasteload Management North Wales Water Authority Wastewater Treatment Plant Annual Report Calendar Year 2012.*Print. Obtained through communication with PA DEP Southeast Regional Office.

Cox, Peter; Griffith, Merran; Angles, Mark; Deere, Daniel; & Ferguson, Christobel. (2005) *Concentrations of Pathogens and Indicators in Animal Feces in the Sydney Watershed*. Applied Environmental Microbiology. 71 (10):5929.

Crockett, C.S. 2007. "The Role of Wastewater Treatment in Protecting Water Supplies Against Emerging Pathogens." *Water Environment Research* 79.3: 221-32. Print.

Duzinski, Phil. 2008. *Schuylkill Action Network Pathogens Workgroup Study of Cryptosporidium Occurrence in Wastewater Treatment Plants.* Rep. Print.

Environmental Engineering & Management Associates, Inc. 2013. *Upper Gwynedd Township, Chapter 94 Municipal Wasteload Management, Annual Report 2012.* Print. Obtained through communication with PA DEP Southeast Regional Office.

Fayer, Ronald; Santin, Mónica; Trout, James M.; Greiner, Ellis. 2006. Prevalence of species and genotypes of *Cryptosporidium* found in 1–2-year-old dairy cattle in the eastern United States. Veterinary Parasitology, 135(2):105-112.

Jellison, Kristen L., Amy E. Lynch, and Joseph M. Ziemann. 2009. "Source Tracking Identifies Deer and Geese as Vectors of Human-Infectious *Cryptosporidium* Genotypes in an Urban/Suburban Watershed." *Environmental Science and Technology* 43.12: 4267-272. Print.

Jellison, Kristen. 2010a. *Detection and Genotyping of Cryptosporidium Spp. Oocysts in Water and Geese Faces in the Wissahickon Watershed: September 2008-May 2010*. Rep. Lehigh University, Department of Civil and Environmental Engineering, Bethlehem, PA. Print.

Johnson, E.; Atwill, E.R.; Filkins, M.E.; & Kalush, J. 1997. *The prevalence of shedding of Cryptosporidium and Giardia spp. Based on a Single Fecal Sample Collection from each of 91 Horses used for Backcountry Recreation*. Journal of Veterinary Diagnostic Investigation. 9.1:56-60. Print.

Fleetwood Borough. 2013. Fleetwood Borough Council Meeting Minutes. Web. www.fleetwoodboro.com/page3.html.

R.H. McCuen. 2004. *Hydrologic Analysis and Design*. Prentice Hall, Upper Saddle River, New Jersey, 07458, 3rd edition.

Philadelphia Water Department (PWD). 2002. *Belmont & Queen Lane Treatment Plant Source Water Assessment Report (PWSID #1510001)*. Publication.

Philadelphia Water Department (PWD). 2006. *The Schuylkill River Watershed Source Water Protection Plan, Belmont & Queen Lane Surface Water Intakes (PWSID#1510001)*. Publication.

Philadelphia Water Department (PWD). 2011. *Long Term 2 Enhanced Surface Water Treatment Rule Watershed Control Program Plan*. Publication.

Philadelphia Water Department (PWD). 2014. *2013 Watershed Control Plan Annual Status Report.* Publication. www.phillywatersheds.org/what_were_doing/documents_and_data/watershed_plans_reports

Philadelphia Water Department (PWD). 2015a. *2014 Watershed Control Plan Annual Status Report.* Publication. www.phillywatersheds.org/what_were_doing/documents_and_data/watershed_plans_reports

Philadelphia Water Department (PWD). 2015b. *Watershed Sanitary Survey.* Publication.

Philadelphia Water Department (PWD). 2015c. *Philadelphia's Wet Weather Management Programs Combined Sewer Management Program Annual Report and Stormwater Management Program Annual Report. Publication.* phillywatersheds.org/doc/FY15CSO_MS4AnnualReport.pdf

Pennsylvania Department of Environmental Protection (PA DEP). 2016. *2016 Draft Pennsylvania Integrated Water Quality Monitoring and Assessment Report: Clean Water Act Section 305(b) Report and 303(d) List.* http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-13014

United States Environmental Protection Agency (US EPA). 2006. *Federal Register: 40 CFR Parts 9, 141, and 142 National Primary Drinking Water Regulations: Long Term 2 Enhanced Surface Water Treatment Rule; Final Rule*. 3rd ed. Vol. 71. Print.

United States Department of Agriculture (USDA). 1993. *Cryptosporidium* is Common in Dairy Calves: National Dairy Heifer Evaluation Project. Web.

http://www.aphis.usda.gov/animal_health/nahms/dairy/U.S. Department of Agriculture (USDA). 2002. *2002 Census of Agriculture.* Publication.

World Climate. "Hamburg, Berks County, Pennsylvania USA Average Rainfall." Web. http://www.worldclimate.com/cgi-bin/data.pl?ref=N40W075+2300+363632C