

2013 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

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List of Acronyms

| | |
|-------|---|
| BC | Berks Conservancy |
| BCCD | Berks County Conservation District |
| BMP | Best Management Practice |
| CAC | Citizens Advisory Council |
| CSO | Combined Sewer Overflow |
| DRBC | Delaware River Basin Commission |
| EPA | United States Environmental Protection Agency |
| EWS | Early Warning System |
| FWWIC | Fairmount Water Works Interpretive Center |
| 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 Dataset |
| NPDES | National Pollutant Discharge Elimination System |
| NRCS | Natural Resource Conservation Service |
| PADEP | Pennsylvania Department of Environmental Protection |
| PDE | Partnership for the Delaware Estuary |
| PWD | Philadelphia Water Department |
| SAN | Schuylkill Action Network |
| SAS | Schuylkill Action Students |
| SRHA | Schuylkill River Heritage Area |
| SRRF | Schuylkill River Restoration Fund |
| SWA | Source Water Assessment |
| SWPP | Source Water Protection Plan |
| WCP | Watershed Control Plan |
| WTP | Water Treatment Plant |
| WWTP | Wastewater Treatment Plant |
| USDA | United States Department of Agriculture |

Section 1 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 (PADEP), 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 are being achieved through previously established and ongoing efforts of the PWD's Source Water Protection Program and through WCP actions aimed to specifically reduce levels of *Cryptosporidium* in the Schuylkill River watershed, Philadelphia's drinking water source. The following report documents PWD's progress towards WCP initiatives during 2013, the first year of the 5-year plan.

Section 2 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 immuno-compromised 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. 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 2-4. 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. Baxter and Belmont achieved Bin 1 status with average oocyst concentrations less than 0.075 per liter. However, Queen Lane 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 is required. PWD has 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 PADEP in April 2011 and received approval in December 2012. A timeline of critical LT2 events is shown in Table 1.

Table 1: LT2 WCP Timeline

| Action | Due Date |
|---|---|
| Notification to State | April 2010 |
| WCP Submitted to State | April 2011 |
| State Approval of WCP | December 2012 |
| Presentation of Annual Report Due to State | *NLT December 2013 (reoccurring annually through Dec 2017) |
| Annual Report Due to State | January 2014 (reoccurring annually through Jan 2018) |
| Sampling Plan for 2nd Round of Monitoring Due | *NLT January 2015 |
| Second Round of <i>Cryptosporidium</i> Sampling Started | *NLT April 2015 |
| Sanitary Survey Due to State | December 2015 |
| Bin Classification and Supporting Data from 2nd Round of Monitoring Due | *NLT October 2017 |

*NLT - No later than

Section 3 2013 Progress towards Source Water Protection Program Initiatives

After recognizing the need for a watershed wide effort to improve and promote the health of the Schuylkill River watershed, PWD, EPA, PADEP, Delaware River Basin Commission (DRBC), and Partnership for the Delaware Estuary (PDE) formed the Schuylkill Action Network (SAN) in 2003. The SAN is comprised workgroups to address a number of watershed issues: acid mine drainage, agricultural runoff, stormwater runoff, pathogens and compliance, land protection, and education and outreach. PWD participates in many projects led by these workgroups, but because the Schuylkill River watershed is a diverse watershed affected by a range of pollution sources, PWD looks to the expertise of SAN partners to achieve certain watershed protection goals and WCP objectives. To further support this effort, PWD continues to contribute funding to the administration of SAN through a contract with PDE to support the SAN coordinator position and SAN workgroup leadership.

In the WCP, 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. In the WCP, PWD identifies four categories of source water protection initiatives: mitigation of *Cryptosporidium* in wastewater treatment plant (WWTP) effluent, agricultural runoff, animal vectors, and education and outreach. This section discusses the progress PWD has made towards each of the ongoing and proposed initiatives by category.

3.1 Wastewater Discharge/Compliance

Effluent from WWTPs upstream of the PWD Queen Lane intake is a source of *Cryptosporidium* in the watershed (PWD, 2002; PWD, 2011). Although approximately 2% of the Schuylkill River watershed is in Philadelphia, PWD plays a leadership and supporting role in multiple initiatives outside of the City of Philadelphia presented below in Table 2, reproduced from the WCP. These initiatives aim to reduce the risk of *Cryptosporidium* contamination from treated WWTP effluent and minimize the occurrence of raw sewage discharge. Summaries of progress made towards each ongoing and proposed initiative are detailed in Table 2 and Table 3.

Table 2: Ongoing Wastewater Discharge/Compliance SWPP Initiatives

| Project Location | Project Overview |
|----------------------------|---|
| Philadelphia | <p>3.1.1 Philadelphia's Act 537 Plan Continue to regularly review and update Philadelphia's Act 537 Plan. The plan was last updated on February 27th, 2009.</p> |
| | <p>3.1.2 Combined Sewer Overflow (CSO) and Municipal Separate Storm Sewer System (MS4) National Pollutant Elimination System (NPDES) Permit Annual Report Continue to implement the initiatives outlined in the annual Combined Sewer Management and Stormwater Management Plans in order to fulfill the City's Stormwater and CSO permits. Ongoing initiatives include monitoring as part of the Defective Lateral Detection and Abatement Program and completion of the Main and Shurs Elimination project.</p> |
| | <p>3.1.3 Early Warning System Continue to maximize usage for the Early Warning System while maintaining the system's ongoing operations and maintenance needs.</p> |
| Schuylkill River Watershed | <p>3.1.4 Provide Project Support for the Lehigh <i>Cryptosporidium</i> Study Continue to support Lehigh's <i>Cryptosporidium</i> source tracking study by providing support in terms of sampling, elution, and project management and oversight.</p> |
| | <p>3.1.5 SAN Pathogens/Compliance Workgroup Continue to support efforts of the SAN Pathogens/Compliance Workgroup. The strategies for the 2013 SAN Pathogens/Compliance Workplan are as follows: 1) Improve discharger/water supplier communication of events and use of the Delaware Valley Early Warning System and PAWARN, 2) identify priority wastewater discharges/issues in the watershed and formulate action plans to address them, 3) provide support (financial, information, expertise, collaborative problem-solving) for partners/communities to implement projects that reduce priority discharges, and 4) provide a forum for partner and agency communication and coordination around discharge issues and the formulation of creative new ideas and approaches for solving related problems.</p> |
| | <p>3.1.6 Abate Wildcat Sewers Continue to support SAN in its efforts to identify and abate wildcat sewers throughout the Schuylkill River watershed.</p> |

Table 3: Proposed Wastewater Discharge/Compliance SWPP Initiatives

| Project Location | Project Overview |
|----------------------------|--|
| Phila- delphia | <p>3.1.7 PWD Schuylkill River Watershed 10-Year Review</p> <p>Develop a Source Water Assessment (SWA) update for the Schuylkill River by revisiting priorities established in the 2002 assessment and updating water quality analyses with recent data.</p> |
| Schuylkill River Watershed | <p>3.1.8 Support <i>Cryptosporidium</i> Monitoring at Major WWTPs and Inclusion in NPDES Permits</p> <p>Support/help develop an effluent monitoring plan for <i>Cryptosporidium</i> at major WWTPs in the Schuylkill River watershed. In conjunction with this effort, should <i>Cryptosporidium</i> monitoring be considered for incorporation into NPDES permits, PWD will support such an effort. However, in regard to <i>Cryptosporidium</i> monitoring, it is very important to PWD that the EPA promulgate an analytical method that takes into account critical factors such as recovery rates and sample variability. Track the progress of these initiatives by continuing to attend SAN Pathogens/Compliance workgroup meetings.</p> <p>3.1.9 Track Wastewater Related Changes in the Watershed</p> <p>Through continued participation in the SAN Pathogens/Compliance workgroup, help ensure that high-priority areas requiring regulatory enforcement action are identified and addressed. Areas of concern may be identified using the following measures to track wastewater related changes in the watershed.</p> <ul style="list-style-type: none"> o Assist the workgroup in identifying high-priority municipalities in need of updated Act 537 Plans in the Schuylkill River watershed. Municipalities with outdated plans located in Zones A and B of the area of influence are especially relevant. o Assist the workgroup at continuing to align sewage facilities planning, or Act 537, enforcement with the wasteload management reports filed under Chapter 94. o In addition to the above two measures, track WWTP upgrades, new facilities and community sewer improvement projects (such as the sewerage of new areas) by reviewing Part II Permits. o Track projects funded under government loan programs, such as PennVest. <p>3.1.10 Wet Weather and High Flow Management Education for WWTP Operators</p> <p>Coordinate with SAN to provide wet weather and high flow management education to WWTP operators in a workshop format. Include overview of information that should be included in I & I abatement and high-flow maintenance plans.</p> <p>3.1.11 Research on WWTP Effluent and <i>Cryptosporidium</i> in Surface Waters</p> <p>Support future research initiatives surrounding the impact of WWTP effluent on <i>Cryptosporidium</i> surface water concentrations by partnering with research organizations and/or academic institutions</p> |

3.1.1 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. Philadelphia's Act 537 Plan was last updated in 2009.

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

Each year, PWD summarizes its activities and programs pertaining to the maintenance of stormwater in combined and separate sewers in accordance with Philadelphia's CSO and MS4 NPDES permits. A major component of Philadelphia's CSO NPDES permit requirements is the implementation of the Long Term Control Plan Update (LTCPU), *Green City, Clean Waters*. *Green City, Clean Waters* is a 25-year plan with a green stormwater infrastructure-based approach to reduce pollutants discharged by the combined sewer system. The 2013 fiscal year report is available to the public on phillywatersheds.org.

3.1.3 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. The system features include a notification system, a time of travel model, the Spill Model Analysis tool, real-time flow water quality data and a central website where users can access event information, analysis tools and data. In 2013, several improvements were made to the system. Using a \$295,000 grant awarded to PWD by the Maritime Exchange for the Delaware River and Bay, major upgrades to EWS mapping and modeling capabilities were made in 2013. EWS ArcGIS information technology application improvements, completed and launched in early 2013, include extensively re-built webpages which allow EWS users to identify a spill location with a high degree of accuracy. The map upgrades also display a more broad geographical area and enhance the display of a river contamination event on the website. The grant also funded the development of a Tidal Spill Trajectory Tool, with which the EWS is capable of predicting a contaminant spill path, as well as contaminant plume arrival times at tidal intakes in the lower Delaware River. The new Tidal Spill Trajectory Tool is currently in testing and is expected to be fully available to EWS users in early 2014.

Additionally in 2013 and 2014, the EWS server is being relocated from a temporary hosting facility near Lancaster, Pennsylvania to a facility within the City of Philadelphia. The relocation increases EWS technical support staff access to the server in the event of a system outage, which ultimately improves the system's reliability.

PWD continues to expand the user base and offered a training workshop to water suppliers through the SAN Pathogen/Compliance group in March 2013.

3.1.4 Provide Project Support for the Lehigh Cryptosporidium Study

Through the Lehigh University *Cryptosporidium* project, PWD and Lehigh University collaborate to develop sampling programs to better understand the occurrence, sources and vectors of *Cryptosporidium* in the Schuylkill River watershed. Sampling programs are also designed to answer research questions and improve and expand methods for field sample collection and laboratory analysis of *Cryptosporidium*. In past studies, PWD has provided sampling, project management and oversight. Beginning in July 2013, PWD staff members have been collecting samples twice per month in Philadelphia. PWD regularly communicates with project partners at Lehigh to solve problems encountered in the field and lab, incorporate improvements and expand the project.

3.1.5 SAN Pathogens/Compliance Workgroup

The strategic goal of the SAN Pathogens/Compliance Workgroup is to improve NPDES compliance, reduce discharges from unsewered communities and prevent drinking water outbreaks. The SAN Pathogens/Compliance Workgroup has four strategies to address this goal: improve discharger and water supplier communication of events and use of EWS, identify priority wastewater discharges and issues in the watershed and formulate action plans to address them, provide support for partners and communities to implement projects that reduce priority discharges, and provide a forum for partner and agency communication and coordination around discharge issues and the formulation of creative new ideas and approaches for solving related problems. PWD regularly attends quarterly SAN Pathogens/Compliance Workgroup meetings. The minutes for the meetings in 2013 are included in Appendix A.

3.1.6 Abate Wildcat Sewers

Wildcat sewers are sewer systems that discharge sewage directly into creeks and streams without any treatment at a waste water treatment facility. These systems discharge pathogens into the Schuylkill River watershed and can be a source of *Cryptosporidium*. PWD continues to support the SAN in efforts to identify and abate wildcat sewers through participation in the SAN Pathogens/Compliance Workgroup.

3.1.7 PWD Schuylkill River Watershed 10-Year Review

During the past year, PWD has begun a review of the 2002 Schuylkill Watershed Source Water Assessment (SWA) and SWPP. This new report focuses on the objectives defined in the SWPP and highlights program achievements towards these objectives. The 10-Year Review describes PWD Source Water Protection Program capabilities and responses to unplanned source water events. Water quality data from PWD's drinking water treatment intakes on the Schuylkill River from the last decade are included and observed for changing trends. Additionally, Schuylkill River watershed water quality data provided by additional water utilities and other

sources is used to observe spatial trends in pH, temperature, TDS and iron and manganese. The 10-Year Review is expected to be completed in 2014.

3.1.8 Support *Cryptosporidium* Monitoring at Major WWTPs and Inclusion in NPDES Permits

PWD regularly attends the quarterly SAN Pathogens/Compliance Workgroup meetings. Through this involvement, PWD supports the development of monitoring for *Cryptosporidium* at major WWTPs. Although such efforts are still in the planning phase, PWD remains an active participant of the workgroup and related activities.

3.1.9 Track Wastewater Related Changes in the Watershed

Through the SAN Pathogens/Compliance Workgroup, PWD and the PADEP Southeast Regional Office have initiated a data compilation effort, which will ideally be expanded to other PADEP regional offices in the future. The information being compiled from Chapter 94 annual reports, Act 537 plans and Part II permits will serve primarily as a SAN planning tool and will assist PWD in tracking wastewater related changes in the Schuylkill River watershed. The information collected relevant to a downstream water utility includes upstream WWTP discharge flow rates, permit limitations and treatment technologies. The process for compiling and regularly updating the data is in the early planning stages. A map of WWTPs in the Schuylkill River watershed is included in Appendix B. The map will be updated with data from this compilation effort in the future.

3.1.10 Wet Weather and High Flow Management Education for WWTP Operators

Providing a wet weather and high flow management workshop to WWTP operators and potentially reducing wastewater overflows in the Schuylkill River watershed during wet weather has been a long-term goal of the SAN Pathogen/Compliance Workgroup. In 2013 a consulting firm with expertise on wet weather discharge management agreed to assist in putting on the workshop, expected in spring 2014.

3.1.11 Research on WWTP Effluent and *Cryptosporidium* in Surface Waters

In collaboration with Lehigh University, PWD in past years has funded and conducted research investigating the impact of WWTP effluent on *Cryptosporidium* in the Wissahickon Creek watershed, a tributary to the Schuylkill River directly upstream of the PWD Queen Lane intake. Beginning in July 2013, Lehigh University and PWD began *Cryptosporidium* sampling twice per month at the Schuylkill River, near the Queen Lane intake, and in the Monoshone Creek, a tributary to the Wissahickon Creek. Through participation in this research project with Lehigh University, the PWD Source Water Program aims to collect information on viability and species of oocysts detected at the Queen Lane intake. Additionally, this project researches what, if any, *Cryptosporidium* from the Monoshone Creek are present in the Wissahickon Creek.

In conjunction with this monitoring, Lehigh University is also developing a more cost effective alternative to the EPA sampling method that requires filtering a 10 liter volume of water for one *Cryptosporidium* sample. Lehigh University's new method collects *Cryptosporidium* oocysts from biofilms grown in situ on glass microscope slides. Lehigh University is also determining the viability of detected *Cryptosporidium* and identifying the species most frequently responsible for human infection.

3.2 Agricultural Land Use and Runoff

Animal manure-laden runoff from agricultural land is a source of *Cryptosporidium* and pathogens in the Schuylkill River watershed (PWD, 2002; PWD, 2011). Much of PWD's efforts to address agricultural runoff occur upstream of the PWD intakes because the agricultural land within the City of Philadelphia 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). Table 4 and Table 5 outline the ongoing and proposed SWPP initiatives that aim to reduce the impact of agricultural activities on water quality in the Schuylkill River watershed. This section explains the progress made in 2013 towards each initiative listed.

Table 4: Ongoing Agricultural Land Use and Runoff SWPP Initiatives

| Project Location | Project Overview |
|-------------------------------|---|
| Phila- delphia | <i>BMPs have been implemented at all agricultural sites within the City.</i> |
| Schuylkill River Watershed | 3.2.1 SAN Agriculture Workgroup |
| | Continue to be an active participant in the SAN Agricultural Workgroup and support future efforts. The strategies for the 2013 SAN Agricultural Workplan are as follows: 1) support implementation of projects that demonstrate BMPs and/or creative solutions for agriculture in priority areas (with funding, information, expertise, collaborative problems, solving, etc.), 2) provide a forum for partner and agency communication and coordination around agricultural impacts and issues and the formulation of creative new ideas and approaches for solving related problems, 3) promote agricultural BMP successes and understanding of agricultural water quality issues and solutions to target audiences in the watershed through an educational/outreach program, and 4) monitor the impacts of agricultural BMP installations on stream water quality. |

Table 5: Proposed Agricultural Land Use and Runoff SWPP Initiatives

| Project Location | Project Overview |
|------------------|--|
| Philadelphia | 3.2.2 PWD In-City Agricultural BMPs Develop a maintenance plan for PWD’s in-city agricultural BMPs, which include Northwestern Stables, Belmont Stables, Courtesy Stables, Monestary Stables and the WB Saul High School project. |
| | 3.2.3 Natural Lands Trust and Erdenheim Farm The National Lands Trust (NLT) is currently performing stream restoration on a tract of land on Erdenheim Farm, located in the Wissahickon watershed. The land is currently not being used for grazing, but may be used for this purpose in the future. PWD will consider future coordination with the NLT to install additional agricultural BMPs at the farm. |
| | 3.2.4 Land Use in the Schuylkill River Watershed As part of the SWA update process, PWD plans to re-assess land use in the Schuylkill River watershed. To complete this update, the 2001 National Land Use Database will be used, along with more current information from the 2010 Census. |

| | |
|----------------------------|--|
| Schuylkill River Watershed | <p>3.2.5 Visual Assessments for the Agriculture BMP Projects</p> <p>Coordinate with SAN to develop a maintenance and monitoring plan for the agricultural BMPs installed as a result of the parcel prioritization process. The maintenance plan may be centered on regular visual assessments to identify any problems or repair needs.</p> |
| | <p>3.2.6 Agricultural BMP Monitoring for <i>Cryptosporidium</i></p> <p>PWD will explore the possibility of partnering with academic institutions on <i>Cryptosporidium</i>-related research. Relevant research may include monitoring to assess the efficacy of different agricultural BMPs at removing pathogens from runoff. PWD will also identify priority research needs that may be fulfilled in collaboration with Lehigh University.</p> |
| | <p>3.2.7 Promotion of SAN Agriculture Projects</p> <p>Through involvement in the SAN Agriculture Workgroup, PWD will continue to work with partners and state and federal officials to identify priority projects and available funding sources. For funding programs that already exist within the watershed, such as the United States Department of Agriculture (USDA) – Natural Resource Conservation Service (NRCS) conservation programs outlined in the 2008 Farm Bill, PWD will help promote drinking water protection, and <i>Cryptosporidium</i> contamination reduction, as a high-priority water quality improvement goal that requires adequate funding.</p> |
| | <p>3.2.8 CAFO Identification in the Watershed</p> <p>Through the SAN Agriculture Workgroup, PWD will work with partners to identify CAFOs located in the Schuylkill River watershed and assess the status of their NPDES permits.</p> |
| | <p>3.2.9 Schuylkill River Restoration Fund Grants for Agriculture BMP Projects</p> <p>Starting in 2012, PWD has committed SRRF dollars to be directed toward priority agricultural BMPs addressing pathogen-contaminated stormwater runoff from livestock operations. These projects will be selected on an annual basis through the established project selection processes. PWD’s commitment through the SRRF will address priority stormwater and pathogen concerns while promoting the importance of watershed partnerships.</p> |

3.2.1 SAN Agriculture Workgroup

The strategic goal of the SAN Agricultural Workgroup is maximize reduction and/or prevention of agricultural impacts to water quality. The SAN Agricultural Workgroup has four strategies to address this goal: support implementation of projects that demonstrate BMPs and creative solutions for agriculture in priority areas, provide a forum for partner and agency communication and coordination around agricultural impacts and issues and the formulation for creative ideas and approaches to solving related problems, promote agricultural BMP success and understanding of agricultural water quality issues and solutions to target audiences in the Schuylkill River watershed through education and outreach, and monitor the impacts of agricultural BMP installations on stream water quality. PWD regularly attended quarterly SAN Agriculture Workgroup meetings. The minutes for the meetings in 2013 are included in Appendix A.

3.2.2 PWD In-City Agricultural BMPS

In 2013, PWD visited all agricultural areas in the City of Philadelphia, such as horse stables and small urban farms. At some sites, projects have been implemented in the past and PWD recorded updated images of BMPs. Detailed information about these projects may be found in the WCP. In 2009, PADEP, United States Department of Agriculture (USDA), Resource Conservation and Development Council and PWD implemented a project to address stormwater at Belmont Stables which is located near the PWD Belmont WTP. The project included construction of a concrete manure containment pad with bollards to protect the walls, excavation of a basin and diversion swale, and construction of a protective post and rail fences around the basin. Since its completion, new stormwater issues have emerged and PWD investigated the opportunity for further work with Belmont Stables in 2013. Several stormwater management BMPs were presented Philadelphia Parks and Recreation by a PWD engineer, and PWD hopes to partner with Belmont Stables in the future.

3.2.3 Natural Lands Trust and Erdenheim Farm

In 2013, PWD sought information on the projects implemented at Erdenheim Farm in Lafayette Hill located on the Wissahickon Creek. These projects include the planting of a 14-acre native meadow, the stabilization of a meandering channel, and construction of a shallow stormwater basin and forebay, a basin constructed to allow sediment from incoming stormwater to settle before reaching the main stormwater basin. These projects intend to reduce erosion of Erdenheim Farm and detain stormwater prior to discharging to Wissahickon Creek. Additionally, a 96-acre parcel of Erdenheim Farm was purchased by Natural Lands Trust for preservation from development in 2009. PWD reached out to Natural Lands Trust to express interest in collaboration on future projects at Erdenheim Farm.

3.2.4 Land Use in the Schuylkill River Watershed

The PWD WCP includes the most recent land cover data available at the time of publication, the USGS 2006 National Land Cover Dataset (NLCD). A map of the Schuylkill River watershed overlain by the 2006 NLCD is presented in Appendix C. When the USGS publishes an updated NLCD, PWD will create an updated land cover map of the Schuylkill River watershed and include this map in WCP annual reports.

3.2.5 Visual Assessments for Agriculture BMP Projects

PWD is developing a protocol to visually assess the condition of previously installed agricultural BMP projects. A draft visual assessment document has been developed with input from SAN members and has been tested during a tour of BMP projects in Berks County in October 2013. The purpose of the assessment is to track projects, and establish a process within the SAN Agriculture Workgroup for photographing and recording project information on a regular basis. PWD will compile photos and record information from visual assessments into individual site records for the Schuylkill River Restoration Fund (SRRF) grant recipient farms. Copies of the draft visual assessment form and the site record form are included in Appendix D.

3.2.6 Agricultural BMP Monitoring for *Cryptosporidium*

PWD in collaboration with Lehigh University researched the concentration of *Cryptosporidium* in the Saucony Creek watershed, which is influenced by agricultural runoff and WWTP effluent, from spring 2012 to spring 2013. In the Saucony Creek watershed, agricultural BMPs are actively being planned and implemented by SAN partners including Berks Conservancy (BC), Berks County Conservation District (BCCD) and the Natural Resource Conservation Service (NRCS). PWD and Lehigh University selected sampling sites along the Saucony Creek that include an upstream control site, sites downstream of agricultural runoff, a WWTP outfall, and a site upstream of the Kutztown Drinking WTP. Lehigh University sampled once every two weeks at all sites for one year. During that time, Lehigh detected a total of 11 oocysts in 120 total samples. These are considered very low levels of *Cryptosporidium*, and Lehigh University and PWD were unable to draw any conclusions from the data. PWD plans to identify future locations in agricultural areas of the Schuylkill River watershed where BMPs will be installed, so that monitoring for *Cryptosporidium* may be initiated.

3.2.7 Promotion of SAN Agriculture Projects

In 2013, PWD created a factsheet explaining the *Cryptosporidium* research project with Lehigh University in the Saucony Creek watershed and implementation of agricultural BMPs. The factsheet is available to the public on the SAN website, www.Schuylkillwaters.org, and is also included in Appendix E. PWD and PDE are developing a second promotional piece: a BMP guide for agriculture in the Schuylkill. The goals of this promotional effort are to educate farmers on stormwater BMPs and their importance, increase farmers' interest in implementing

BMPs from a financial perspective, and highlight projects completed through the SAN and watershed partnership that leverage financing.

3.2.8 CAFO Identification in the Watershed

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. In 2013, PWD received updated CAFO data from PADEP including primary animals in the operations and number of animal equivalent units. An updated map is included in Appendix F of this report. The data will be verified by the SAN Agriculture Workgroup in 2014.

3.2.9 Schuylkill River Restoration Fund Grants for Agriculture BMP Projects

PWD contributes financial support to and participates in the SRRF grant selection process. PWD directly supported the award of SRRF grants to agricultural BMP projects at Havens Farm in 2012 and Leid Farm in 2013. In addition to identifying and advocating for high priority projects, PWD evaluates and supports other projects helping to select three additional farms to receive SRRF grants for BMP implementation in 2012 and 2013. The SRRF projects are discussed in more detail in Section 4.2.1.

3.3 Animal Vectors

Animals in the Schuylkill River watershed serve as mechanical vectors of *Cryptosporidium*, transferring viable oocysts from original hosts. Geese in particular are vectors, as identified in PWD and Lehigh University source tracking studies (Jellison et al., 2009; Jellison, 2010a). Table 6 and Table 7 outline the SWPP ongoing and proposed initiatives that aim to reduce the impact of animal vectors near PWD's Queen Lane and Belmont intakes and expand implementation of animal vector control in the Schuylkill River watershed. This section explains the progress made in 2013 towards each initiative listed.

Table 6: Ongoing Animal Vectors SWPP Initiatives

| Project Location | Project Overview |
|----------------------------|---|
| Philadelphia | <p>3.3.1 Belmont Meadow Extension and Intake Project</p> <p>Maintain plantings at the site of the Belmont Meadow Extension/Intake project. Continue to monitor goose activity around the Belmont intake.</p> |
| | <p>3.3.2 Education and Outreach on Threat of Animal Vectors in the City</p> <p>Continue education/outreach efforts concerning the threat of animal vectors and the role they play in the cycle of pathogen contamination. These efforts may include working with Fairmount Park to expand existing programs, such as the dog waste program, and developing new programs that focus on the relationship between geese and drinking water quality.</p> |
| Schuylkill River Watershed | <p>3.3.3 Lehigh University <i>Cryptosporidium</i> Source Tracking</p> <p>Continue to support Lehigh’s source tracking research to further identify and understand the animals that serve as mechanical vectors of <i>Cryptosporidium</i> in the watershed.</p> |

Table 7: Proposed Animal Vectors SWPP Initiatives

| Project Location | Project Overview |
|----------------------------|--|
| Philadelphia | <p>3.3.4 Goose Measures at Fairmount Park Properties</p> <p>Identify and implement appropriate goose control measures at Fairmount Park properties, including Peter’s Island, and incorporate educational signage in these areas.</p> |
| | <p>3.3.5 Waterfowl Management at PWD Facilities</p> <p>Complete implementation of the USDA waterfowl management program at the Queen Lane WTP, Belmont WTP and Baxter WTP along with PWD’s three WWTPs.</p> |
| Schuylkill River Watershed | <p>3.3.6 Animal Vector Education and Outreach in the Watershed</p> <p>As part of the Source Water Protection Program’s education and outreach efforts, raise awareness of the threat animal vectors pose to our drinking water supplies. These efforts may focus on supporting Lehigh’s efforts to publish scientific journal articles.</p> |

3.3.1 Belmont Meadow Extension and Intake Project

The Belmont meadow project goal was to deter non-native Canada geese, vectors for *Cryptosporidium*, from dwelling and feeding around the Belmont intake. This was achieved by installing fencing along Peter's Island, installing educational signage, and planting trees, shrubs, and two meadows. The project began in 1999 with the implementation of the Phase I meadow, and was completed in 2004 with the Phase II extension meadow. The plants create an inhospitable environment by obstruction the sight of the geese and increasing their fear of predators (PWD, 2011). In 2013, the Belmont meadow and intake plantings are being maintained by Philadelphia Parks and Recreation to continue deterring geese from the area.

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

In 2013, PWD continued education and outreach efforts concerning the management of animal vectors in the Schuylkill River watershed. In partnership with PDE, PWD annually hosts the Spokes Dog contest. Two dogs are selected to be "Philly Water's" best friends, and serve for one year as ambassadors educating dog owners on the importance of picking up pet waste. Additionally, Penn Praxis, Philadelphia Parks and Recreation, Fairmount Park Conservancy and University of Pennsylvania Project for Civil Engagement are collaborating on "A Community Vision Plan for East and West Fairmount Park." PWD is in communication with this collaborative to encourage the alignment of source water goals with the Community Vision Plan for the park. Opportunities may become available to include additional educational signage in Fairmount Park about how geese are vectors of pathogens.

3.3.3 Lehigh University Cryptosporidium Source Tracking

PWD continues to support Lehigh University research into the prevalence of *Cryptosporidium* in the Schuylkill River watershed. Lehigh University has the capability to genotype *Cryptosporidium* species in field samples and assist PWD in tracking sources of *Cryptosporidium*. In the current research project at Queen Lane and Monoshone Creek, Section 3.1, samples from the Monoshone Creek were processed for genotyping, although no *Cryptosporidium* oocysts have been detected thus far.

3.3.4 Goose Measures at Fairmount Park Properties

In 2013, under a PWD contract with the USDA, goose control measures were implemented at a number of Fairmount Park locations, including Pleasant Hill Park, FDR Park and Golf Course, Concourse and Centennial Park, and Peter's Island. Under this contract, geese are removed and eggs and nests are treated to reduce the population. This effort is discussed in greater detail in Section 4.5 of this report.

3.3.5 Waterfowl Management at PWD Facilities

In 2013, under a PWD contract USDA, goose control measures were implemented at PWD's three drinking WTPs, three WWTPs and Oak Lane Reservoir. Under this contract, geese are removed and eggs and nests are treated to reduce the population. This effort is discussed in greater detail in Section 4.5 of this report.

3.3.6 Animal Vector Education and Outreach in the Watershed

PWD continues to support Lehigh University efforts in *Cryptosporidium* related research and the publishing of scientific articles by incorporating PWD source water protection goals into Lehigh University research goals. Additionally, PWD shares Lehigh University literature and research findings on deer and geese as vectors of human-infectious *Cryptosporidium* with upstream water utilities to support the implementation of vector control techniques.

3.4 Education and Outreach

Education and outreach initiatives are a critical component of PWD's SWPP because point 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's watershed partnerships, which are maintained by various programs within PWD. Table 8 and Table 9 outline the SWPP ongoing and proposed initiatives that maintain watershed partnerships and continue to promote the importance of source water protection. This section explains the progress made in 2013 towards each initiative listed.

Table 8: Ongoing Education and Outreach SWPP Initiatives

| Project Location | Project Overview |
|----------------------------|--|
| Philadelphia | <p>3.4.1 Watershed Partnerships in the City Remain an active participant in the watershed partnerships and begin integrating drinking water issues into the scope of work for the Wissahickon Watershed Partnership.</p> |
| | <p>3.4.2 Annual Water Quality Report Continue to submit a comprehensive annual water quality report that emphasizes critical source water issues and, in particular, educates customers as to the research initiatives and implementation strategies PWD is using to reduce the risk of <i>Cryptosporidium</i> contamination.</p> |
| | <p>3.4.3 Water Quality Council Continue to convene the Water Quality Council (WQC) to address water quality issues on a holistic basis. Utilize the committee as a forum for providing feedback to strengthen the WCP.</p> |
| | <p>3.4.4 Improve Environmental Quality of Philadelphia Fairmount Park System Continue to work with Fairmount Park to improve the environmental quality of the City’s parks and streams through land management practices and BMP implementation.</p> |
| | <p>3.4.5 Maintain Fairmount Water Works Interpretive Center Continue to maintain the FWWIC and promote source water protection through the center’s various exhibits and learning programs.</p> |
| | <p>3.4.6 Philly RiverCast Continue to operate Philly RiverCast and promote the web-based recreational warning system.</p> |
| Schuylkill River Watershed | <p>3.4.7 Active Members of SAN Pathogens/Compliance and Agricultural Workgroups Continue to be an active member of the SAN Pathogens/Compliance and Agricultural workgroups and support initiatives outlined in the annual workplans.</p> |
| | <p>3.4.8 Collaboration with Partnership for the Delaware Estuary Continue to collaborate with PDE on various education and outreach initiatives, including the publication of guidance materials and organization of public programs and meetings surrounding water quality concerns.</p> |
| | <p>3.4.9 Schuylkill River Restoration Fund Continue to support the SRRF to achieve implementation of BMPs at high-priority sites in the watershed.</p> |

Table 9: Proposed Education and Outreach SWPP Initiatives

| Project Location | Project Overview |
|------------------|---|
| Philadelphia | <p>3.4.10 Implement In-City Source Water Programs in East Falls, Roxborough and Manayunk</p> <p>Implement in-city source water programs in the East Falls, Roxborough, and Manayunk neighborhoods along the Schuylkill River. These programs will involve the implementation of stormwater management practices, storm drain labels and a dog waste control program. Through the programs, communities will become more involved in protecting their waterways as they develop a better understanding of the impacts of daily activities on their drinking water source.</p> |

3.4.1 Watershed Partnerships in the City

PWD and the Pennsylvania Environmental Council are collaborating to pilot a new grant program, Soak It Up! Adoption. This program provides grants to civic organizations to help maintain green stormwater infrastructure. This infrastructure is designed under the *Green City, Clean Waters* initiative to reduce stormwater runoff captured in CSOs.

3.4.2 Annual Water Quality Report

PWD annually mails source water protection information to customers in the annual Drinking Water Quality Report. The most recent [Report](#), published in 2013 shares information on the calendar year 2012 Schuylkill and Delaware River SWPPs, source water protection, SAN projects, pharmaceuticals and *Cryptosporidium* source tracking. The report also includes sources for additional information on source water protection issues. Although the EPA does not require this breadth of information on source water protection to be in the annual water quality report, PWD takes a proactive approach to customer education.

3.4.3 Water Quality Council

In 2001, the Water Quality Citizens Advisory Council (CAC) was formed by a merger of the Stormwater and the Drinking Water Quality CACs. The merger of the two CACs, into what is now referred to as the Water Quality Council, complements the WCP as a holistic approach to water quality issues (PWD, 2011). PDE currently facilitates the Water Quality Council committee meetings.

3.4.4 Improve Environmental Quality of Philadelphia Fairmount Park System

As described earlier in Section 3.3, Penn Praxis, Philadelphia Parks and Recreation, Fairmount Park Conservancy and University of Pennsylvania Project for Civil Engagement are collaborating on “A Community Vision Plan for East and West Fairmount Park.” Community meetings have been held to hear the public’s perspective on the park and vision for the future. PWD has been following the process and is assisting in developing an approach to incorporate source water protection education and outreach with the Community Vision Plan for Fairmount Park.

3.4.5 Maintain 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, in innovative exhibits and interactive educational programs. In 2013, the FWWIC celebrated its 10-year anniversary and continued to receive visitors, school groups, community groups, attendees for special exhibits, visiting authors and lecturers.

3.4.6 Philly RiverCast

PWD continues to promote and maintain Philly RiverCast. The website has received nearly 600,000 visits since its launch in 2005. In 2013, PWD created a website specific email address for user questions and concerns, and developed a terms and conditions of use policy for Philly RiverCast. These additions are expected to be incorporated into the website in early 2014.

3.4.7 Active Members of SAN Pathogens/Compliance and Agricultural Workgroups

PWD regularly attends quarterly SAN Pathogens/Compliance and Agricultural Workgroup meetings. The 2013 meeting minutes are included in Appendix A. Education and outreach was featured in several events hosted by both SAN workgroups in 2013. In March 2013, PWD and the SAN Pathogens/Compliance group held an EWS training for water suppliers, and in the fall of 2013 began planning for the wet weather and high flow workshop for WWTP operators (Section 3.1).

In 2013, the SAN Agricultural Workgroup organized a public tour of SAN BMP projects on farms in Berks County. This public tour was funded in part by PWD. The workgroup also produced a factsheet describing PWD and Lehigh University's *Cryptosporidium* research in the Sacony Creek watershed, available on the SAN website www.Schuylkillwaters.org. The Saucony Creek Brewing Company held a kickoff event in June 2013 in Philadelphia for their Stonefly India Pale Ale. A portion of each sale of Stonefly India Pale Ale goes towards agricultural BMP projects in Berks County in the Schuylkill River watershed. In 2013, the Saucony Creek Brewing Company contributed over \$3,000 to the Berks Watershed Restoration Fund. Lastly, in 2013, PDE, PWD and the SAN Agriculture Workgroup began to develop an agricultural BMP guide for the Schuylkill River watershed (Section 3.2).

3.4.8 Collaboration with Partnership for the Delaware Estuary

PWD continued collaboration with PDE on various education and outreach initiatives. This included engaging Philadelphia residents in the prevention of stormwater pollution to the Schuylkill and Delaware Rivers and facilitating coordinated action, communication and projects for the SAN. In 2013, PDE coordinated the 2013 Philly's Best Friend Spokes Dog Competition, organized an annual clean water art contest for Philadelphia students receiving over 1,000 entries, and hosted the annual Coast Day chosen as the opening act for the WHYY Connections Festival. Additionally, PDE aided coordination of the annual Schuylkill Scrub cleanup effort, collected photo entries for the Schuylkill Shots photo contest, and is currently working to create outreach materials to educate farmers and surrounding communities on the benefits of agricultural BMPs.

3.4.9 Schuylkill River Restoration Fund

PWD continues to support the SRRF. In 2013, PWD staff participated in the review of grant applications and the selection of the recipients. PWD contributed \$100,000 to the Restoration Fund. The SRRF is discussed in more detail in section 4.2.1 of this report.

3.4.10 Implement In-City Source Water Programs in East Falls, Roxborough and Manayunk

First steps have been made in implementing source water programs in East Falls, Roxborough and Manayunk neighborhoods. Two projects in the area received grants from the SRRF in 2012 and 2013. The first project was the installation of a native meadow at Cook-Wissahickon Elementary School which enhanced stormwater control a filtration and extended habitats of the nearby Fairmount Park. The second is a parklet project in Roxborough where concrete grid pavers, a rain garden, stormwater runoff controls and native trees and scrubs will replace a vacant asphalt lot. Additionally, rain gardens were completed at two schools in the area, Lingelbach Elementary and Lankenau High School, with the support of PDE, the SAN and PWD, through Schuylkill Action Students (SAS) in 2012. SAS targets schools for restoration projects because they are large landowners in the Schuylkill River watershed and provide an opportunity to combine watershed restoration efforts with student and community education. These projects will serve as demonstrations of source water protection in these neighborhoods.

3.5 Additional 2013 Highlights

SAN 10-Year Anniversary Celebration

In May 2013, the SAN celebrated 10 years of watershed partnership. For the event, the SAN put together a 10-year progress report highlighting its accomplishments in the Schuylkill River watershed. The SAN completed over 175 projects addressing agricultural pollution and 200 projects to reduce stormwater. More than \$365 million was invested in infrastructure upgrades, most of which was supported by PENNVEST, a major partner in the SAN. In the Schuylkill watershed 214,000 acres of land are permanently protected. The SAN also completed a number of stormwater guides engaging the community and many other projects addressing non pathogen related pollution issues. A copy of the SAN 10-year progress report is included in Appendix G.

Outreach to Watershed Community

PWD conducted outreach to the watershed protection community. In October 2013, PWD was asked to present strategies for watershed collaboration and leveraging resources during the EPA Delaware River Basin Source Water Collaborative webinar. PWD also supported the SAN annual meeting which drew watershed partners to participate in a day of innovative presentations and collaborative discussions on the future of financing watershed protection in the Schuylkill River watershed. Additionally, PWD directed outreach to elected officials in

Washington D.C. regarding the importance of addressing watershed priorities by leveraging resources through watershed partnerships.

Venice Island

In November 2011, PWD broke ground on a \$46 million construction project on Venice Island located between the Schuylkill River and the Manayunk Canal in the Manayunk neighborhood in Philadelphia. The main component of the project is a four million gallon underground storage tank that temporarily stores diverted flow from a sanitary sewer during intense rain storms. When the rainstorm passes, wastewater in the storage basin is returned to the sanitary sewer where it flows to a PWD WWTP. The project also recognizes the recreational value of Venice Island and will replace and augment facilities demolished during construction of the storage tank. New amenities include a performing arts center, children's play area, renovated parking lot, and athletic courts. The project is on schedule, the storage basin is operating, and the recreational facilities and parking lot are expected to be completed by early 2014. A ribbon cutting ceremony to officially open the public space is scheduled for April 2014.

Section 4 2013 Progress towards Watershed Control Program Plan Initiatives

In addition to the implementation of Source Water Protection Program (SWPP) initiatives, the Watershed Control Plan (WCP) includes implementation of structural and non-structural measures to physically reduce the loading of *Cryptosporidium* in the Schuylkill River watershed. These control measures address priority sources of *Cryptosporidium* identified to be wastewater effluent, agricultural land runoff, and animal vectors. The WCP control measures consist of the following: quantifying the water quality implications of UV installation at the Upper Gwynedd and Fleetwood WWTPs; supporting the installation of manure storage basins on at least five separate farms; supporting the installation of vegetated buffers on at least five farms; supporting the completion of at least five Comprehensive Nutrient Management Plans (CNMPs) at farms throughout the Schuylkill River watershed; implementing a riparian buffer to deter animal vectors at a select site; and, implementing a PWD waterfowl management program. The WCP control measures and their implementation timeframe are summarized in Table 10 below.

Table 10: Watershed Control Program Plan Initiatives and Implementation Schedule

| Project Type - Priority Source Addressed | Project | Implementation Timeframe | | | Project Lead and Partners |
|--|--------------------------------------|--------------------------|----------------------|-------------------------------|--|
| | | Project Initiation | Construction Started | Project/Construction Complete | |
| Structural - WWTP Effluent | UV Installation - Upper Gwynedd WWTP | | | | N/A |
| Structural - WWTP Effluent | UV Installation - Fleetwood WWTP | | | | N/A |
| Structural - Ag Land Use/Runoff | Farm - Manure Storage Basin #1 | 2012 | 2012 | 2013 | NRCS, BCCD, BC, SAN Ag Workgroup Partners, PWD |
| | Farm - Manure Storage Basin #2 | 2013 | 2013 | 2014 | |
| | Farm - Manure Storage Basin #3 | 2014 | 2014 | 2015 | |
| | Farm - Manure Storage Basin #4 | 2015 | 2015 | 2016 | |
| | Farm - Manure Storage Basin #5 | 2016 | 2016 | 2017 | |
| | Farm - Vegetated Buffers #1 | 2012 | 2012 | 2013 | |
| | Farm - Vegetated Buffers #2 | 2013 | 2013 | 2014 | |
| | Farm - Vegetated Buffers #3 | 2014 | 2014 | 2015 | |
| | Farm - Vegetated Buffers #4 | 2015 | 2015 | 2016 | |
| | Farm - Vegetated Buffers #5 | 2016 | 2016 | 2017 | |
| Non-Structural - Ag Land Use/Runoff | Nutrient Management Plans - 5 Farms | 2012-2017 | N/A | 2017 | NRCS, BCCD, SAN Ag Workgroup Partners, PWD |
| Structural - Animal Vectors | Riparian Buffer Plantings - 1 Site | 2014 | 2014 | 2014 | PWD, SAN Partners |
| Non-Structural - Animal Vectors | Waterfowl Management Program | 2011 | N/A | 2017 | PWD, USDA |

4.1 UV Installation at Wastewater Treatment Plants

4.1.1 Upgraded Wastewater Treatment Plants

Since the development of the WCP, PWD has noted the progress of the Upper Gwynedd and Fleetwood WWTP upgrade projects. The Fleetwood UV disinfection system became operational in January 2013 (Fleetwood Borough, 2013). The Upper Gwynedd UV disinfection system became operational in 2011 (Environmental Engineering & Management Associates,

Inc., 2013). The North Wales WWTP closed and diverted flow to Upper Gwynedd in June 2013 (Carroll Engineering Corporation, 2013).

In the past, PWD has learned of UV disinfection system installations at wastewater plants in the watershed through news and other publically available sources. In 2013, PWD and the Schuylkill Action Network (SAN) Pathogens/Compliance Workgroup initiated an effort to track wastewater in the Schuylkill River watershed as described in Section 3.1.9 of this report. Through this effort, PWD will have a more complete understanding of the level of wastewater treatment upstream of the Queen Lane and Belmont intakes, and can better track upgrades to WWTPs such as UV disinfection.

4.1.2 *Cryptosporidium* Loading from Wastewater Treatment Plants

To estimate a range of *Cryptosporidium* loading from WWTP effluent in the Schuylkill River watershed, minimum and maximum loadings were calculated in the WCP using Equation 1 and Equation 2, respectively and are further detailed in Section 7.5.1.2 of Appendix A of the WCP (PWD, 2011). Average effluent discharge rates from WWTPs in the Schuylkill River watershed are taken from the 2008 *Schuylkill Action Network Pathogens Workgroup Study of Cryptosporidium Occurrence in Wastewater Treatment Plants*. Minimum and maximum estimates of oocysts per liter in WWTP effluent receiving secondary treatment are based on pooled values from literature and in effluent receiving tertiary treatment an additional log removal is assumed (Crockett, 2007). The results are summarized in Table 11.

Equation 1: Maximum Oocysts Loading from all Schuylkill River Watershed WWTPs:

$$\sum_{\text{all WWTPs in Schuylkill River watershed}} [\text{average effluent discharge rate} * 365 \text{ days} * \text{maximum oocysts per liter treated wastewater}] = \text{maximum oocysts per year discharged into Schuylkill River watershed}$$

Equation 2: Minimum Oocysts Loading from all Schuylkill River Watershed WWTPs:

$$\sum_{\text{all WWTPs in Schuylkill River watershed}} [\text{average effluent discharge rate} * 365 \text{ days} * \text{minimum oocysts per liter treated wastewater}] = \text{minimum oocysts per year discharged into Schuylkill River watershed}$$

Table 11: Schuylkill River Watershed Loading from WWTP Effluent

| Schuylkill River Watershed Loading | Min Estimate (oocysts/year) | Max Estimate (oocysts/year) |
|------------------------------------|-----------------------------|-----------------------------|
| WWTP Effluent | 5.09E+09 | 6.51E+14 |

4.1.3 *Cryptosporidium* Loading Reduction from UV Installation at WWTPs

In the WCP, the range of potential *Cryptosporidium* inactivation and loading reduction from the addition of UV disinfection at two WWTPs, Upper Gwynedd and Fleetwood, is calculated using in Equation 1 and Equation 2 with average effluent discharge rates for only Upper Gwynedd and Fleetwood WWTPs and an assumed additional 3 log (99.9%) removal. The calculation is further detailed in Section 7.5.3.1 of Appendix A of the WCP (PWD, 2011). The

results of these calculations are presented in Table 12 and compared to the WCP target loading reduction in Section 5.

Table 12: Loading Reduction Estimates from UV Installation at WWTPs

| Structural Control Measure | Min Potential Inactivation (oocysts/year) | Max Potential Inactivation (oocysts/year) |
|-----------------------------------|--|--|
| UV Installation - Upper Gwynedd | 1.41E+08 | 1.80E+13 |
| UV Installation - Fleetwood | 2.61E+07 | 3.34E+12 |

4.2 Agricultural Best Management Practices

In the WCP, PWD outlines a number of actions to reduce *Cryptosporidium* in the Schuylkill River watershed from agricultural runoff. These included five manure storage basins and five vegetated buffers on separate farms. PWD's contributions to the Schuylkill River Restoration Fund (SRRF) and involvement in the SAN Agriculture Workgroup are the main vehicles for identifying projects and implementing them. Projects funded by the SRRF and the SAN are described the following sections.

4.2.1 Schuylkill River Restoration Fund Farms

In 2006, Exelon, SAN, and the Schuylkill River Heritage Area (SRHA) established the Exelon Restoration Fund, now the SRRF. The SRRF provides grants to support projects that improve and protect water quality in the Schuylkill River watershed. Initially, Exelon provided all the funding to fulfill a financial requirement in their DRBC docket for the Wadesville Mine Demonstration Project. Beginning in 2009, PWD became the second yearly contributor to the SRRF. Partnership for the Delaware Estuary (PDE) became a donor in 2010 and Aqua PA followed in 2012. 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. SRHA, managed by the nonprofit Schuylkill River Greenway Association, oversees the SRRF and distributes grant money.

PWD has been part of the grant recipient selection process since the creation of the SRRF. Each year since 2009, PWD has contributed \$100,000 annually to the SRRF. As a contributor to the SRRF, one to two project applications per year are deemed high priority to PWD. These projects are advocated for by PWD in grant award deliberations.

Since the development of the WCP, five farms received funding from the SRRF, two in 2012 and three in 2013. In 2012, the PWD high priority project was agricultural best management practice (BMP) installation at Havens farm, and in 2013 the PWD high priority project was agricultural BMP installation at Leid farm. In addition, PWD also evaluated and supported three additional

agricultural BMP projects: Davis farm, Schroeder farm, and Weaver farm. Farms receiving SRRF grants also receive match funding and project support from SAN partners including Natural Resource Conservation Service (NRCS), Berks Conservancy (BC), Berks Conservation District (BCCD), PENNVEST, local townships and water suppliers. The two PWD high priority projects are described here in detail, and summary information for the three additional SRRF farms is presented.

Havens Farm

The Havens farm is the 2012 PWD high priority project, and is located in the Mill Creek sub-watershed. The Havens farm received SRRF grants in 2011 for Phase I and 2012 for Phase II of a five-year BMP implementation project.



Figure 1: Havens Farm Project

Figure 1a shows BMPs implemented at Havens farm during Phase I, which include a vegetated buffer and extensive fencing to prevent livestock from accessing the stream on the property. Phase I also constructed the first of three manure storage facilities and a roofed heifer barn with dry manure storage. As of fall 2013, Havens farm was ready to begin Phase II construction on a new 6-month liquid manure storage basin to replace the old earthen lagoon with a failing clay lining, Figure 1b. Phase II also includes a second roofed heifer dry manure storage, and barnyard stormwater controls.

A. Leid Farm

The Leid Farm is the 2013 PWD high priority project, and is located in the Saucony Creek sub-watershed. The 2013 SRRF grant provided critical cash match for the first and second year of a four-year BMP implementation project. Phase I of the project is scheduled to be completed by summer 2014.



Figure 2: Leid Farm Project

The BMPs include a 6-month ground liquid manure storage basin for dairy, heifer and barnyard manures; barnyard controls; stormwater controls; and an animal walkway. Figure 2a shows the nearly complete manure storage basin. Figure 2b shows standing water on the farm due to rainfall runoff and a high groundwater table. This water will be captured and infiltrated into the ground as part of the planned stormwater controls. A satellite photo of the Leid farm is shown in Figure 2c. The arrow points to an earthen lagoon formerly used for liquid manure storage, which is now the site of the new manure storage basin.

Davis Farm

The Davis farm in the Maiden Creek sub-watershed received funding from the SRRF in 2012, which provided critical match for the first year of a three-year BMP implementation project. The Davis farm is now equipped with a number of BMPs that reduce contaminated runoff from entering an unnamed tributary to the Upper Maiden Creek.



Figure 3: Davis Farm Project

Due to the landscape of the farm, rainfall runoff would become contaminated with manure as it flowed through an animal area. Now, runoff drains towards a new grassed waterway and is directed to the tributary without becoming contaminated by the animal area. An animal walkway with a crossing over the grassed waterway prevents clean runoff water from being contaminated by cattle crossing to the pasture as shown in Figure 3a. A new manure storage basin, Figure 3b, provides six months of storage for manure that would otherwise be stored in a lagoon on the property. Figure 3c shows the area for cattle is now graded toward the manure basin with curbing to collect waste and prevent contaminated runoff from escaping. Figure 3d shows a vegetated buffer protecting the stream on the property where cattle formerly had access. The grazing area for the cattle was relocated away from the stream.

T. Schroeder Farm

The second farm awarded a SRRF grant in 2013 is the Schroeder Farm located in the Maiden Creek sub-watershed. The grant provided critical cash match for the first and second years of a

four-year BMP implementation project. Phase I is to be completed by summer 2014 and includes a roofed heifer barn, liquid manure storage basin, barnyard controls, stormwater controls, animal walkway, and stream crossing.

V. Weaver Farm

The third farm to receive a SRRF grant in 2013 is the Weaver farm, an organic dairy farm in the Saucony Creek sub-watershed. The SRRF grant provided cash match for the first year of a three-year BMP implementation project.



Figure 4: Weaver Farm Project

Phase I was completed in 2013 and includes a six month liquid manure storage basin, waste transfer to the basin, barnyard controls, and rain gutters. Figure 4a shows the new liquid manure storage basin under construction. In Figure 4b, cattle are collecting around a feed truck. Additional BMPs include an animal walkway with fencing, and grazing controls. A satellite photo showing the former earthen lagoon used to store liquid manure is identified by the arrow in Figure 4c.

4.2.2 *Cryptosporidium* Loading from Agricultural Land

To estimate a range of *Cryptosporidium* loading from agricultural land runoff in the Schuylkill River watershed, minimum and maximum loadings were calculated in the WCP using the runoff method and the animal population method detailed in Section 7.5.1.1 in Appendix A of the WCP (PWD, 2011). To estimate the *Cryptosporidium* loading using the agricultural runoff method, the estimated number of oocysts from two agricultural land use types (pasture/hay and row crops) are summed. The method uses agricultural land acreage in Queen Lane’s Zone B (PWD, 2002), event mean concentrations of *Cryptosporidium* (PWD, 2006), rainfall in Hamburg, Pennsylvania (World Climate), and the average of high and low runoff coefficients for the two land use types (McCuen, 2004). The runoff method is described by Equation 3. To estimate the *Cryptosporidium* loading using the animal population method, the estimated number of oocysts from beef cattle, dairy cattle, and calves, swine, sheep and horses are summed using numbers of animals in the watershed (USDA, 2002) multiplied by infection prevalence and oocyst shedding rates from available literature sources as noted in Appendix I. The animal population method is described by Equation 4. The results are summarized in Table 13.

Equation 3: Agricultural Runoff Method (Minimum Estimate):

$$\sum_{\text{pasture/hay and row crop land use types}} [\text{Acres agricultural land} * \text{event mean concentration for } \textit{Cryptosporidium} * \text{rainfall per year} * \text{average runoff coefficient}] = \text{oocysts per year introduced to Schuylkill River watershed}$$

Equation 4: Animal Population Method for Farm BMP Projects (Maximum Estimate):

$$\begin{aligned} & \sum_{\text{dairy cattle, beef cattle, calves}} [\text{number of animal type} * \text{estimated prevalence of infection in animal type} * \\ & \text{oocysts shed per day per animal} * 365 \text{ days}] \\ & + \sum_{\text{swine, sheep, horses}} [\text{number of animal type} * \text{estimated prevalence of infection in animal type} * \\ & \text{animal mass} * \text{weight of manure per day per weight animal} * 365 \text{ days} * \text{oocysts per weight manure}] \\ & = \text{oocysts per year introduced to Schuylkill River watershed} \end{aligned}$$

Table 13: Schuylkill River Watershed Loading from Agricultural Land Runoff

| Schuylkill River Watershed Loading | Min Estimate (oocysts/year) | Max Estimate (oocysts/year) |
|------------------------------------|-----------------------------|-----------------------------|
| Agricultural Land Use | 6.65E+12 | 7.75E+14 |

4.2.3. *Cryptosporidium* Loading Reduction from Agricultural BMP Projects

To estimate the Schuylkill River watershed *Cryptosporidium* loading reduction from the agricultural BMPs installed, the WCP follows a set of assumptions. First, a “standard” farm with several set parameters is assumed. All assumptions were confirmed as appropriate for the

Schuylkill River watershed with Larry Lloyd from BC and Nick Ramsey from NRCS. The characteristics of the standard farm are as follows:

- 120 acre dairy farm
- 80 cows (includes heifers) and 10 calves

Second, *Cryptosporidium* removal rates of 2 log (99%) and 100% are assumed for vegetated buffers and manure storage basins, respectively. Additional information may be found in Section 7.5.3.2 in Appendix A of the WCP (PWD, 2011).

Using the assumed “standard” farm characteristics, *Cryptosporidium* removal rates by BMPs and the same methods described for the estimation of the Schuylkill River watershed *Cryptosporidium* loading from agricultural runoff, minimum and maximum estimates for the impact of five manure storage basins and five vegetated buffers are calculated in the WCP, Table 14.

Table 14: *Cryptosporidium* Loading Reduction Estimates from Agricultural BMPs

| Structural Control Measure | Estimated Min Reduction (oocysts/year) | Estimated Max Reduction (oocysts/year) |
|---------------------------------|--|--|
| Manure storage basins - 5 farms | 1.10E+10 | 1.20E+13 |
| Vegetated buffers - 5 farms | 1.09E+10 | 1.19E+13 |

In 2013, two manure storage basins were installed with PWD’s support. The characteristics of the farms are:

Havens Farm

- 100 acre dairy farm
- 180 cows (including heifers) and 20 calves (ages 0-6 months)

Leid Farm

- 75 acre dairy farm
- 81 cows (including heifers) and 9 calves (ages 0-6 months)

The *Cryptosporidium* loading reduction per year is estimated for Havens farm and Leid farm using the agricultural runoff and the animal population methods described in Equation 3 and Equation 4, respectively. For the agricultural runoff method, the number of acres of agricultural land in the watershed is replaced with the acreage of each farm. For the animal population method, the number of farm animals in the watershed is replaced with the number of dairy

cattle and calves at the each farm because both farms are primary dairy farms. The results of these calculations are presented in Table 15 and compared to the WCP target loading reduction in Section 5.

Table 15: Loading Reduction Estimates from Manure Storage Basins Implemented

| Structural Control Measure | Estimated Min Reduction (oocysts/year) | Estimated Max Reduction (oocysts/year) |
|-----------------------------|--|--|
| Havens manure storage basin | 1.83E+09 | 4.82E+12 |
| Leid manure storage basin | 1.37E+09 | 2.17E+12 |

4.2.4 SAN Ag BMPs

Outside the SRRF, NRCS, BC, BCCD and many other SAN partners contributed to the implementation of agricultural BMPs in the watershed in 2013. Table 16 estimates the number of agricultural BMPs implemented in 2013.

Table 16: Ag BMPs Implemented in 2013 through SAN partners

| Ag BMPs Implemented in 2013 through SAN Partners* | | | | |
|---|-----------------------|--------------------------|------------------|------------------|
| Comprehensive Nutrient Management Plans | Manure Storage Basins | Riparian Buffers (acres) | Barnyard Repairs | Stream Crossings |
| 4 | 9 | >8 | 6 | 2 |

*These counts represent the number of projects completed with NRCS involvement. NRCS is responsible for much of the engineering required to complete the design and construction of many of the BMPs. However, additional projects were completed by other SAN partners making these counts a conservative estimate.

4.3 Comprehensive Nutrient Management Plans

Supporting the implementation of five Comprehensive Nutrient Management Plans (CNMPs) is another PWD action item outlined in the WCP. Manure management issues at farms are often addressed through the nutrient management plan process led by NRCS. The SAN and NRCS consider the completion of a CNMP, which includes a nutrient management plan and a conservation plan, at a farm a criteria for funding eligibility in the Schuylkill River watershed. As outlined in the WCP, PWD plays a role in the completion of CNMPs by supporting the implementation of agricultural BMPs, and working to ensure adequate resources are available to complete additional CNMPs. The farms that received SRRF grants had a CNMP in place prior to receiving the grants in 2012 and 2013. Additionally, NRCS initiated four CNMPs in 2013.

4.4 Riparian Buffer Plantings

PWD is committed to helping implement one riparian buffer in the Schuylkill River watershed as part of the WCP. The site has not been determined as of 2013, but will be a geese impacted site with potential to affect water quality at the Queen Lane intake. However, through the SRRF and the SAN, a number of riparian buffers have been planted throughout the watershed.

4.4.1 SRRF Riparian Buffer Plantings

During the last two years of SRRF grant awards, two riparian buffer planting projects received funding. In 2012, a project for stormwater improvements to the Hunsberger Woods Park in Collegeville was selected and constructed in the fall of 2013. The project includes trees planted in the riparian area of a tributary to the Perkiomen Creek.

In 2013, the SRRF selected the Schuylkill Action Students (SAS) Stormwater Management Projects at three schools to receive funding. One project, at Upper Perkiomen High School, includes a riparian restoration on Green Lane Reservoir property by planting 50 native trees and 25 native plants. The project is scheduled for implementation in spring of 2014.

4.4.2 SAN Riparian Buffer Plantings

In 2013, SAN members planted and improved riparian buffers throughout the Schuylkill River watershed. NRCS planted 8.1 acres of riparian buffer. BCCD planted 100 trees and shrubs on an unnamed tributary to Plum Creek in the Tulpehocken Creek sub-watershed. BCCD and BC planted 20 trees and 7.5 lbs. of seed mix on an unnamed tributary to Mill Creek in the Saucony Creek sub-watershed.

4.5 Waterfowl Management

To address animal vectors of *Cryptosporidium*, PWD is committed to geese management in 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 and Concourse and Centennial Park. Geese management is conducted at PWD facilities including the Belmont WTP, Queen Lane WTP, Baxter WTP, Southeast WWTP, Southwest WWTP, Northeast WWTP, and Oak Lane Reservoir.

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

The number of geese removed and nests and eggs treated in 2012 and 2013 at Fairmount Park properties are shown in Figure 5. A total of 177 Canada goose nests containing 926 eggs were treated, and 631 geese were removed from Fairmount Park properties in 2012 and 2013 through October. The number of geese removed and dispersed and nests and eggs treated in 2013 at PWD facilities are shown in Figure 6. A total of 37 Canada goose nests containing 205 eggs were treated, 4,388 were dispersed and 15 were removed from PWD facilities in 2013 through October. Little to no goose activity typically occurs in November and December.

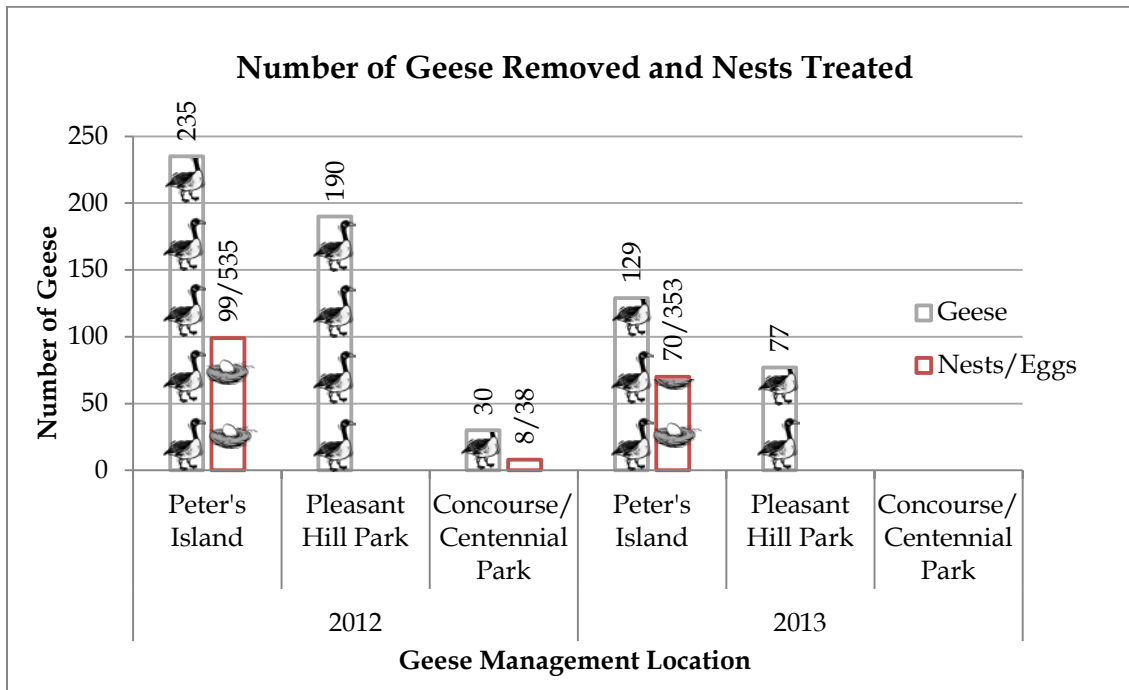
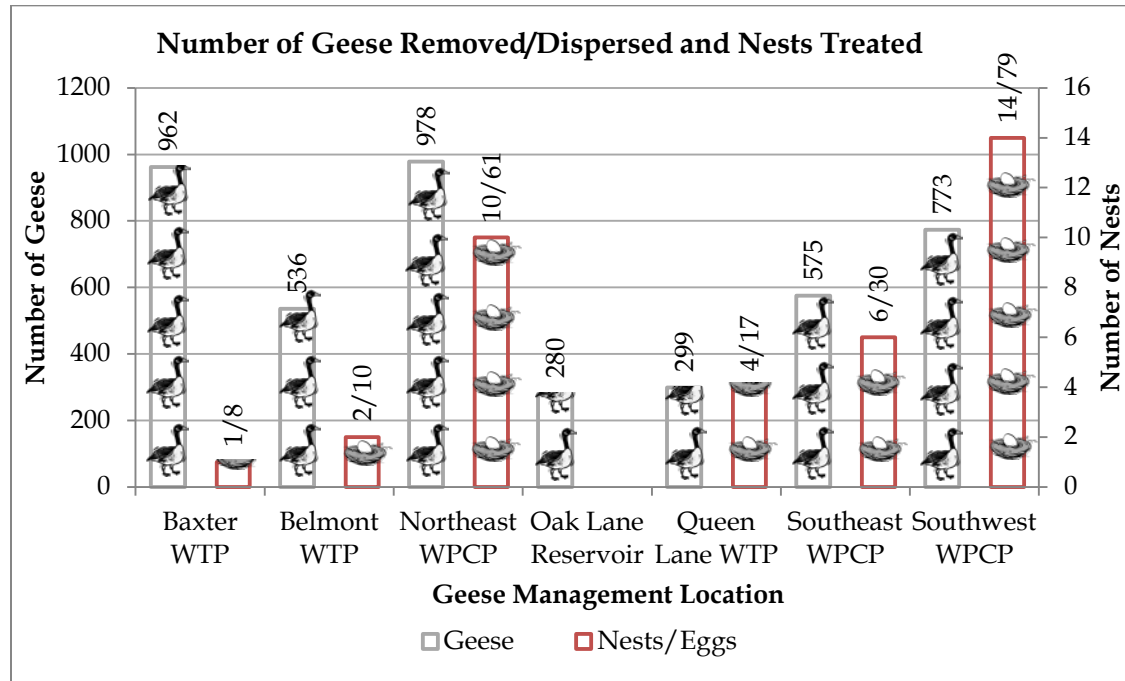


Figure 5: Geese Management at Fairmount Park Properties in 2012 and 2013



*15 geese were removed and all others were dispersed by harassment conducted multiple times per week.

Figure 6: Geese Management at PWD Facilities in 2013

Section 5 2013 Watershed Control Plan Progress

5.1 Watershed Control Plan Project Summary

PWD has been a part of many projects and partnerships that support the WCP. Below is a summary of the action items PWD committed to as WCP deliverables and the progress made thus far. The UV installation projects upstream of the Queen Lane intake at Upper Gwynedd WWTP and Fleetwood WWTP, which PWD has followed through publically available information, are both fully operational. PWD directly contributed to the SRRF, which awarded grants to support the construction of two manure storage basins at two separate farms in the Schuylkill River watershed. Four new farms implemented a CNMP through NRCS in 2013. Geese were removed and nests and eggs treated at Fairmount Park properties and PWD facilities. The WCP progress in 2013 is summarized in Table 17.

Table 17: WCP Project Progress Summary

| | WCP Project Type | Project Description | Project status |
|----------------------------------|---------------------------|---|-----------------------|
| 2013 | WWTP Upgrade | UV installation at Upper Gwynedd WWTP | Fully Operational |
| | WWTP Upgrade | UV installation at Fleetwood WWTP | Fully Operational |
| | Farm BMP | Manure storage basin at Havens Farm | Under Construction |
| | Farm BMP | Manure storage basin at Leid Farm | Complete |
| | Nutrient Management Plans | 4 Comprehensive Nutrient Management Plans | Complete |
| | Waterfowl management | Geese removed and eggs treated at Fairmount Park properties and PWD facilities 2013 | Complete/Ongoing |
| 2014 | Farm BMP | | |
| | Farm BMP | | |
| | Nutrient Management Plans | | |
| | Riparian Buffer Planting | | |
| | Waterfowl management | | |
| 2015 | Farm BMP | | |
| | Farm BMP | | |
| | Nutrient Management Plans | | |
| | Riparian Buffer Planting | | |
| | Waterfowl management | | |
| 2016 | Farm BMP | | |
| | Farm BMP | | |
| | Nutrient Management Plans | | |
| | Riparian Buffer Planting | | |
| | Waterfowl management | | |
| 2017 | Farm BMP | | |
| | Farm BMP | | |
| | Nutrient Management Plans | | |
| | Riparian Buffer Planting | | |
| | Waterfowl management | | |
| WCP Completion Requirement Check | WWTP Upgrades | Track UV Installation at 2 plants | |
| | Farm BMPs | Manure storage basins -5 | |
| | | Vegetated buffers - 5 | |
| | Nutrient Management Plans | Nutrient Management Plans -5 | |
| | Riparian Buffer Planting | Sites - 1 | |
| | Waterfowl management | Years - 5 | |

*

There is one small alteration to the original timeline described in Table 10. In 2013, PWD had the opportunity to contribute to a second manure storage basin project instead of a vegetated buffer at a farm.

5.2 *Cryptosporidium* Watershed Loading and Target Reduction

The WCP initiatives described in Section 4 have the potential to reduce the total loading of *Cryptosporidium* to the Schuylkill River. In order to quantitatively assess the impact of PWD projects and their potential to reduce the total loading of *Cryptosporidium* to the Schuylkill River, a series of calculations are performed (Sections 4.1 and 4.2). The calculations described serve as a preliminary step in developing a quantitative method to assess *Cryptosporidium* loading from priority sources in the Schuylkill River watershed. The methods used are based on assumptions and values found in published scientific literature. Due to a lack of scientific agreement regarding the methodology and accuracy of quantitative assessments of *Cryptosporidium* sources, the results should not be used to make absolute conclusions. The uncertainties associated with quantifying total *Cryptosporidium* loading across the Schuylkill River watershed, and reductions in that loading caused by the implementation of priority projects, highlight the need for continued and expanded *Cryptosporidium* research.

The WCP estimates a range of total *Cryptosporidium* loading in the Schuylkill River watershed comprised of contributions from priority sources: WWTP effluent, agricultural land runoff and stormwater runoff. The maximum and minimum *Cryptosporidium* loading from WWTP effluent was estimated using Equations 1 and 2 and the method summarized in Section 4.1.2. The maximum and minimum *Cryptosporidium* loading from agricultural land use runoff was estimated using Equations 3 and 4 and the method described in Section 4.2.2.

To estimate the *Cryptosporidium* loading from stormwater runoff, the estimated number of oocysts from three land use types (commercial/industrial/transportation, high density residential and low density residential) are summed. The method used urban land acreage in Queen Lane’s Zone B (PWD, 2002), event mean concentrations of *Cryptosporidium* (PWD, 2006), rainfall in Hamburg, Pennsylvania (World Climate), and the average of high and low runoff coefficients for the land use types (McCuen, 2004). The results are summarized in Table 18.

Equation 5: Estimate of Oocyst Loading from Stormwater Runoff:

$$\sum_{\text{urban land use types}} [\text{number of acres of land use} * \text{event mean concentration for } \textit{Cryptosporidium} * \text{rainfall per year} * \text{average rainfall coefficient}] = \text{oocysts per year introduced to Schuylkill River watershed}$$

Table 18: Schuylkill River Watershed Loading from Stormwater Runoff

| Schuylkill River Watershed Loading | Estimate (oocysts/year) |
|------------------------------------|-------------------------|
| Stormwater Runoff | 1.14E+12 |

The methods used to perform the estimates of the total *Cryptosporidium* loading to the Schuylkill River watershed from priority sources are summarized in Table 19.

Table 19 Calculation Methods for Annual *Cryptosporidium* Loading Estimates

| Schuylkill River Watershed Loading | Minimum Loading Estimate Method | Maximum Loading Estimate Method |
|---|---|---|
| WWTP Effluent | Minimum values for oocysts/liter in secondary effluent based on pooled values from various sources of literature documented in Crockett 2007. Oocyst concentrations are multiplied by average daily flow rates at each of the 72 WWTPs in the Schuylkill River watershed. Tertiary systems are assumed to have an additional 1 log removal. | Maximum values for oocysts/liter in secondary effluent based on pooled values from various sources of literature documented in Crockett 2007. Oocyst concentrations are multiplied by average daily flow rates at each of the 72 WWTPs in the Schuylkill River watershed. Tertiary systems are assumed to have an additional 1 log removal. |
| Agricultural Land Use | Method multiplies agricultural land area, runoff volumes, and <i>Cryptosporidium</i> event mean concentration, similar to the 2002 Source Water Assessment (SWA) approach. | Method estimates infected livestock populations for the Schuylkill River watershed and oocyst shedding rates for each category of livestock. |
| Stormwater Runoff | Method multiplies various land cover areas, runoff volume and <i>Cryptosporidium</i> event mean concentrations for urban/developed land, similar to the 2002 SWA approach. | |
| TOTAL LOADING | Summation of minimum estimates of Schuylkill River watershed <i>Cryptosporidium</i> sources. | Summation of maximum estimates of Schuylkill River watershed <i>Cryptosporidium</i> sources. |

Upon determining an estimated range for the total Schuylkill River watershed *Cryptosporidium* loading, an attempt is made to establish a loading reduction target by comparing the observed average concentration of 0.076 oocysts/L at the Queen Lane intake during the Long Term 2 Enhanced Surface Water Treatment Rule (LT2) monitoring period (2001- 2003) to a desired Bin 1 concentration of 0.074 oocysts/L. The ratio of the maximum Bin 1 concentration to the observed concentration at the intake, 0.074/0.076 is used to calculate a target *Cryptosporidium* loading reduction of 2.7% in five years. Multiplying the estimated minimum and maximum total Schuylkill River watershed *Cryptosporidium* loadings by 2.7% yields minimum and maximum target reductions. The minimum target reduction is 2.11E+11 oocysts per year, and the maximum target reduction is 3.85E+13 oocysts per year.

As the WCP is implemented, the impact of projects are assessed using the same approaches used to estimate the total Schuylkill River watershed *Cryptosporidium* loading. Schuylkill River watershed *Cryptosporidium* loading reductions from control measures implemented in 2013 are estimated for UV installation at two WWTPs, and the construction of two manure storage basins at separate farms, Sections 4.1.3 and 4.2.3, respectively. The potential for reducing the total Schuylkill River watershed *Cryptosporidium* loading is then compared to the range of target

reductions established. Schuylkill River watershed loadings, target loading reduction and loading reductions from control measures are summarized in Table 20.

By summing the estimated impacts of UV installation at two WWTPs and BMP implementation at two farms, total estimates of *Cryptosporidium* loading reduction in year one of the PWD WCP are calculated. The impact of control measures implemented in 2013 is estimated to potentially account for 1.6% to 74% of the target reduction goal. As previously mentioned, the 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.

Table 20: Schuylkill River Watershed *Cryptosporidium* Loading Reduction (2.11E+11 to 3.85E+13 Oocysts per Year) Summary

| Schuylkill River Watershed Loading | | Minimum Estimate (oocysts/year) | Maximum Estimate (oocysts/year) | | |
|------------------------------------|--|--|--|--|--|
| Total Loading from Watershed | WWTP Effluent | 5.09E+09 | 6.51E+14 | | |
| | Agricultural Land Use | 6.65E+12 | 7.75E+14 | | |
| | Stormwater Runoff | 1.14E+12 | 1.14E+12 | | |
| | TOTAL LOADING | 7.80E+12 | 1.43E+15 | | |
| WCP Structural Control Measure | | Minimum Potential Reduction (oocysts/year) | Maximum Potential Reduction (oocysts/year) | Minimum Reduction as % of Minimum Target Reduction | Maximum Reduction as % of Maximum Target Reduction |
| 2013 | Upper Gwynedd WWTP UV Installation | 1.41E+08 | 1.80E+13 | 0.07% | 46.80% |
| | Fleetwood WWTP UV Installation | 2.61E+07 | 3.34E+12 | 0.01% | 8.70% |
| | Manure Storage Basin at Havens Farm | 1.83E+09 | 4.82E+12 | 0.87% | 12.51% |
| | Manure Storage Basin at Havens Farm | 1.37E+09 | 2.17E+12 | 0.65% | 5.63% |
| 2014 | Farm BMP | | | | |
| | Farm BMP | | | | |
| 2015 | Farm BMP | | | | |
| | Farm BMP | | | | |
| 2016 | Farm BMP | | | | |
| | Farm BMP | | | | |
| 2017 | Farm BMP | | | | |
| | Farm BMP | | | | |
| 5-Year Target Reduction | 2.7% of Total Schuylkill River Watershed Loading | 2.11E+11 | 3.85E+13 | 100% | 100% |
| Cumulative Loading Reduction | WWTP UV Installation | 1.67E+08 | 2.14E+13 | 0.08% | 55.50% |
| | Farm BMPs | 3.21E+09 | 6.99E+12 | 1.52% | 18.14% |
| | TOTAL LOADING REDUCTION | 3.38E+09 | 2.84E+13 | 1.60% | 73.64% |

Section 6 Expectations for 2014

In 2014, PWD will continue efforts toward goals outlined in the WCP. These include continuing addressing WWTP effluent, agricultural land runoff and animal vectors as priority sources of *Cryptosporidium*, as well as expanding education and outreach in the watershed through SWPP initiatives. It also includes completed WCP actions that specifically reduce *Cryptosporidium* the watershed. Specific focus will be on the following:

- Continued partnership with SAN for project facilitation and collaboration
- Continued funding towards SAN administration and the SAN Coordinator position
- A \$100,000 contribution to SRRF for 2014 project grants
- Involvement with the SAN Pathogens/ Compliance Workgroup to track wastewater discharge related changes in the watershed
- Involvement with the SAN Agriculture Workgroup to identify and contribute to CNMP and agricultural BMP implementation in the watershed
- Geese management at Fairmount Park properties and PWD facilities

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Appendix A: SAN Pathogens and SAN Agriculture Workgroups 2013 Meeting Minutes

Schuylkill Action Network Pathogen/Compliance Meeting Minutes

March 13, 2013

In Attendance:

EPA Region 3 - Chuck Kanetsky

Pennsylvania DEP - Joe Hebelka (Central), Kevin Smith (SE), Scott Confer (NE) (by Phone)

Philadelphia Water Department - Kelly Anderson, Elizabeth Couillard, and Alison Aminto (all by Phone)

Partnership for the Delaware Estuary - Tom Davidock

Aqua Pa - Bob Kahley

Tess Schlupp - Pennvest

Jesse Goldberg - Miller Environmental, Inc.

Early Warning System

A training program for using the Delaware Valley Early Warning System was held at the Penn State - Berks Campus on March 6, 2013. Presentations on the system's operation were made by the Philadelphia Water Department and the contractor CDMsmith. The training was attended by about 24 people from PADEP, EPA, a number of water suppliers and a few dischargers.

Overall, the training was well received and the system upgrade was found to be easy to use. In the future, we would still like to get more NPDES dischargers trained to use the system.

Wet Weather Workshop

A goal of this group was to provide training to publicly own treatment works on how to operate during higher than average rainfall events. Previous discussions mentioned using the training provided by NYDEC as a model for our workshop. PADEP is currently not available to provide this training. Tom Davidock will investigate opportunities to acquire funding to have a contractor provide the training.

Iodine - 131 Conference in Philadelphia

Kelly Anderson provided a review over the conference sponsored by the Philadelphia Water Department and the American Water Works Association. The conference was attended by the Philadelphia Water Department, EPA (Region and HQ personnel), PADEP, the Nuclear Regulatory Commission and many folks in the chemical industry. The general consensus was that the source of I-131 was a result of medical applications and that the problem was not localized to Philadelphia. Consideration will be given to developing a large study to determine occurrence. Minutes from the conference should be available shortly.

SAN 10 th Anniversary Celebration

Tom Davidock gave an overview of the agenda for the May 9 festivities. A large turnout is expected. There will be opening remarks by the agencies, followed by partnership presentations, an award ceremony and an Executive Steering Committee meeting. We should expect an invitation to SAN members by Friday, 3/22/13.

Tracking STP Upgrades and Act 537 Plans

As part of the Pathogens & Compliance 2013 workplan, we decided that to help identify priority wastewater discharges/issues in the watershed and formulate action plans to address them; we would track WWTP upgrades, new facilities, and community sewer improvement projects. We would also identify high-priority municipalities in need of Act 537 plans (10 years or old). Joe Hebelka presented a list of municipalities with Act 537 plans from the South Central Office. We have asked Kevin Smith to discuss this option with Steve O'Neil of the SE PADEP Office. Jesse Goldberg mentioned that there were a number of wildcat sewers in Ontelaunee Township. The Act 537 plan for Ontelaunee Township is 10 years old. This may be a good area to target. We will continue discussing this targeting approach at our next meeting.

SAN's 10 year Progress Report

For our 10 th Anniversary Celebration, we will be producing a progress report of SAN activities over the last 10 years. Several ideas surface for the Pathogen & Compliance workgroup including the following: a Pennvest Report, the Early Warning System, Merck, the Crypto Study, Rivercast and several possible enforcement actions such as Tamaqua, Sassamanville, and the G & G Poultry Plant. These options will be discussed again at a later date.

Maiden Creek Monitoring

Maiden Creek and the Saucony have been identified as a National Water Quality Initiative by USDA, PADEP and EPA. The SAN has been monitoring there over the last several years on a limited basis. Because of this initiative, the Berks County Conservation District has been charged to develop a more formal monitoring program. A draft plan is in development. It is anticipated that we will be monitoring 20 macroinvertebrate sites each year with some physical/chemical monitoring. Funding is being sought thru the Nonpoint Source Program.

Joe's Around the Watershed Updates

- Berks County to establish drop boxes for expired Pharmaceuticals.
- DEP calls for probe of Wildcats sewers in West Penn Township.
- Virginville is expected to have public Sewers by June.
- Tiden Township amends sewer agreement with Hamburg to add 280 homes.
- Amity supervisors discuss sewer upgrades due to increased flow.
- Geigertown asks the state to reconsider required sewer system and to deal do individual septic issues.

- Reading's Sewer upgrade is underway.
- Ruscombmanor already has 16 residents hooked up to the new sewer with 70 more to go.
- Upper Salford to hold on-lot sewage disposal up-keep seminars.
- Army Corp is not opposed to middle interceptor location along Perkiomen Creek.
- Lower Providence is still undecided on the location of the middle interceptor.
- Pottsville to spend \$25,000 to study stormwater/sanitary sewer flow separation.
- Berks County Water and Sewer will be having a program meeting on July 31 st.
- PADEP is developing new guidelines for septic systems in high quality and exceptional value watersheds.

That's all folks!

The next meeting will be held on June 26, 2013 at the PADEP Reading Field Office.

Schuylkill Action Network Pathogen/Compliance Meeting Minutes

June 26, 2013

In Attendance:

EPA Region 3 - Chuck Kanetsky

Pennsylvania DEP – Joe Hebelka (Central), Kevin Smith (SE), Steve O'Neil (SE), Eric Ammon (SC), Scott Confer (NE) (by Phone)

Philadelphia Water Department –Kelly Anderson, Elizabeth Couillard, and Alison Aminto

Partnership for the Delaware Estuary – Tom Davidock

Aqua Pa – Bob Kahley

Tess Schlupp – Pennvest

Jesse Goldberg – Miller Environmental, Inc.

William Penn Foundation

The meeting began with a discussion of the William Penn Foundation initiatives in the Schuylkill Basin. The Foundation has targeted 2 sections of the Schuylkill for implementation activities, the Middle Schuylkill and the Schuylkill Highlands. The Foundation will be partnering with SAN members. The Berks County Conservancy will lead efforts in the Middle Schuylkill and the Natural Lands Trust will have the lead in the Schuylkill Highlands. The Middle Schuylkill will target Best Management Practices on Farms and the Schuylkill Highlands will focus on land protection activities. Prioritization of activities and funding will be discussed at 2 meetings over the summer.

Early Warning System

The early Warning System was recently upgraded. Some of the SAN members are having problems with the mapping function. The Philadelphia Water Department will investigate.

SAN 10 th Anniversary Celebration & 10 Year Progress Report

Tom Davidock gave an overview of the May 9 Celebration. Approximately 100 people attended. There were opening remarks by the agencies, followed by partnership presentations, an award ceremony. The 10 year Progress Report was well received. Copies are still available. The ceremony was viewed as a great success.

Maiden Creek Monitoring

Maiden Creek and the Saucony have been identified as a National Water Quality Initiative by USDA, PADEP and EPA. The SAN has been monitoring there over the last several years on a limited basis. Because of this initiative, the Berks County Conservation District has been charged to develop a more formal monitoring program. A draft plan has been submitted to PADEP. It is anticipated that we will be monitoring 10 macroinvertebrate sites (5 fixed and 5 rotating) each year with some physical/chemical monitoring. Funding is being sought thru the Nonpoint Source Program at approximately \$20,000 annually. The Reading Area Water Authority will continue their monitoring efforts in the watershed. It is also anticipated that the William Penn Foundation will also conduct monitoring through the Academy of Natural Sciences.

Wet Weather Workshop

A goal of this group was to provide training to publicly own treatment works on how to operate during higher than average rainfall events. Previous discussions mentioned using the training provided by NYDEC as a model for our workshop. At this time, no funding sources have been found for this workshop. We will look for other funding sources next year.

Tracking STP Upgrades and Act 537 Plans

As part of the Pathogens & Compliance 2013 workplan, we decided that to help identify priority wastewater discharges/issues in the watershed and formulate action plans to address them; we would track WWTP upgrades, new facilities, and community sewer improvement projects. Steve O'Neil of the SE PADEP Office presented maps of the SE and SC Regions of PA indicating the ages of Act 537 plans. Steve also provided link to the Act 537 information and eFACTS which contains facility information. Chuck and Joe volunteered to review the Act 537 information and identify potential partners for updating the 537 plans.

Enforcement Follow-up

At our last meeting, Jesse Goldberg mentioned that there were a number of wildcat sewers in Ontelaunee Township. Jesse is following up this issue with local officials. Jesse also mentioned a concern about discharges from Quarry operations. Apparently, Quarry operations are permitted to discharge higher levels of suspended solids due to the effluent guidelines for the

industry than wastewater treatment plants. This is a concern to drinking water treatment plant operators.

Joe's Around the Watershed Updates

- West Norriton finds 150 homes with improper sewer connections.
- Amity approves \$60 fine for noncompliance with sewer ordinance.
- Exeter Township is to conduct an online trash survey.
- Ontelaunee Township will send out notices for septic pumpouts.
- West Norriton Board of Commissioners agreed to an \$80,000 fine for sewer overflows.
- Reading awarded a \$5.35 million contract to design the Fritz Island plant.
- Yuengling is in noncompliance with their NPDES pretreatment permit again.
- A BioMag Treatment system is coming to the Upper Gwynedd municipal wastewater plant.
- The Philadelphia Water Department issued an advisory for musty odors in the drinking water.
- Greater Pottsville SA is depending on Pottsville to approve a new ordinance on Stormwater.
- Glen Oley Farms residents objected to Exeter Township's sewer plans.
- A Jury found a Pottsville sewer plant operator not guilty of falsifying records.
- Walker Township is discussing holding tank regulations.
- Sewage leaks happened again from a pumping station in Washington Township.

That's all folks!

The next meeting will be held on September 11, 2013 at the PADEP Reading Field Office.

Schuylkill Action Network Pathogen/Compliance Meeting Minutes

September 11, 2013

In Attendance:

EPA Region 3 - Chuck Kanetsky

Pennsylvania DEP - Joe Hebelka (Central), Kevin Smith (SE), Steve O'Neil (SE), Eric Ammon (SC), Scott Confer (NE) (by Phone), and Cathy Port (SC) (by phone)

Philadelphia Water Department - Kelly Anderson and Elizabeth Couillard

Partnership for the Delaware Estuary - Tom Davidock

Aqua Pa - Bob Kahley

Jesse Goldberg - Miller Environmental, Inc.

William Penn Foundation

The meeting began with a discussion of the William Penn Foundation initiatives in the Schuylkill Basin. The Foundation has targeted 2 sections of the Schuylkill for implementation activities, the Middle Schuylkill and the Schuylkill Highlands. The Foundation will be

partnering with SAN members. The Berks County Conservancy will lead efforts in the Middle Schuylkill and the Natural Lands Trust will have the lead in the Schuylkill Highlands. The Middle Schuylkill will target Best Management Practices on Farms, stream restoration, and stormwater, and the Schuylkill Highlands will focus on land protection activities. An implementation plan has been submitted to the Foundation. If approved, funding could be available early in 2014.

Maiden Creek Monitoring

Maiden Creek and the Saucony have been identified as a National Water Quality Initiative by USDA, PADEP and EPA. The SAN has been monitoring there over the last several years on a limited basis. Because of this initiative, the Berks County Conservation District has been charged to develop a more formal monitoring program. A draft plan has been submitted to PADEP. It is anticipated that we will be monitoring 10 macroinvertebrate sites (5 fixed and 5 rotating) each year with some physical/chemical monitoring. Funding is being sought thru the Nonpoint Source Program at approximately \$20,000 annually. The Reading Area Water Authority will continue their monitoring efforts in the watershed (12 stations). It is also anticipated that the William Penn Foundation will also conduct monitoring through the Academy of Natural Sciences, the Stroud Research Center, possibly the Berks County Conservation District. The Berks County Conservation District has proposed to additional biological stations on areas that are being support by the Foundation.

Berks County Water and Sewer Association Annual Conference

The Berks County Water and Sewer Association held its first annual conference at Albright College in Reading, PA on July 31, 2013. It was attended by almost 100 drinking water and wastewater personnel from Berks County. Presentations were made by Larry Lloyd (Berks County Conservancy – Ag issues), Kelly Anderson (Philadelphia Water Department-Early Warning System), Jane Meeks (Berks County Solid Waste Department), Charlotte Katzenmoyer (City of Lancaster- Green Infrastructure), Catherine Port and Eric Ammon (PADEP – source water protection), and Tom Davidock (Schuylkill Action Network). The meeting was considered a great success and plans have already started for next year’s conference.

Act 537 Plans

As part of the Pathogens & Compliance 2013 workplan, we decided that to help identify priority wastewater discharges/issues in the watershed and formulate action plans to address them; we would track WWTP upgrades, new facilities, and community sewer improvement projects. Chuck had prepared a list of plans that are near 40 years old. Steve O’Neil of the SE PADEP noted that there is no longer a deadline for when these lists are to be updated. However, he did prepare a letter to a municipality suggesting that it would be a god time to update their plan. It was determined that we could use this approach with some of the systems on the list of 40 year old plans. However, the list needs to be verified. Steve and Eric agreed to

provide verification on the townships listed in their Regions. A follow-up discussion will occur at the next meeting.

Wet Weather Workshop

A goal of this group was to provide training to publicly own treatment works on how to operate during higher than average rainfall events. Recently it was noted that the City of Lansdale (CSO system) has hired consultants to evaluate their system for impacts from high flows. It was also noted that Pottstown also has a high flow maintenance plan. The workgroup will consider a couple of options for future training including having a session at next year's Berks County Water and Sewer Annual Conference or having a short special training session somewhere else in the watershed. Tom will follow-up with the contractors working with Lansdale.

Schuylkill Watershed Control Plan

The Philadelphia Water Department (PWD) is preparing an annual report on the Schuylkill Watershed Control Plan required under the Long Term 2 Enhanced Surface Water treatment Rule. PWD is looking for help in preparing information on flows and issues from wastewater treatment plants in the watershed. The workgroup agreed to support PWD in this effort. A conference call will be arranged to discuss options for utilizing the various federal and state databases. PWD also presented a 2 page fact sheet on cryptosporidium monitoring and a draft Agricultural Site Visual Monitoring Assessment Field sheet. Comments are due to Beth ASAP.

Joe's Around the Watershed Updates

- Reading's STP Consent Order Amendment under discussion with Federal Officials.
- Cumru and Kenhorst seek sewage billing problem resolution.
- Cumru offers Kenhorst \$2million for sewer system.
- Kutztown awards contract for plant upgrade.
- Drug Take Back Day - October 26.
- Upper Gwynedd and Wisahickon Valley Watershed Association apply for grant for stream restoration project.
- Pottsville's aging stone arch sewer strong despite breaks.
- Schuylkill County MA proposes to bring service to two new areas in West Brunswick Township.
- Cumru and Spring Townships balk at sewer contracts with Reading.
- North Wales and Upper Gwynedd celebrate Sewer interconnection project.
- Glen Oley Farms residents objected to Exeter Township's sewer plans, more test planned.
- Shoemakers consider operator for wastewater plant.
- Pottstown has the highest rate of Stormwater in the sewers in PA.
- Exeter Township chicken plant back in business.
- Franconia to send out notices to property owners who haven't connected to sewer.

- East Norriton -Plymouth-Whitpain JSA will increase borrowing costs by \$100,000 each year.
- Delaware Riverkeeper threatens to sue EPA if it fails to act against PA Act 41 septic system impacts on antidegradation regulations).

That's all folks!

The next meeting will be held on December 11, 2013 at the PADEP Reading Field Office.

Schuylkill Action Network Pathogen/Compliance Meeting Minutes

December 11, 2013

In Attendance:

EPA Region 3 - Chuck Kanetsky

Pennsylvania DEP - Joe Hebelka (Central), Steve O'Neil (SE), Scott Confer (NE) (by Phone)

Philadelphia Water Department -Kelly Anderson (by phone), Alison Aminto, and Elizabeth Couillard

Partnership for the Delaware Estuary - Tom Davidock

Aqua Pa - Bob Kahley

Jesse Goldberg - Miller Environmental, Inc.

William Penn Foundation

The meeting began with a discussion of the William Penn Foundation initiatives in the Schuylkill Basin. The Foundation has targeted 2 sections of the Schuylkill for implementation activities, the Middle Schuylkill and the Schuylkill Highlands. The Foundation will be partnering with SAN members. The Berks County Conservancy will lead efforts in the Middle Schuylkill and the Natural Lands Trust will have the lead in the Schuylkill Highlands. The Middle Schuylkill will target Best Management Practices on farms and the Schuylkill Highlands will focus on land protection activities. A grant application has been submitted to the Foundation. The Pennsylvania Environmental Council and Temple University will also receive funding to work on stormwater projects across the lower Schuylkill. If approved, funding could be available in January 2014. In addition, extensive monitoring will be conducted by numerous partners in the watershed funded by the Foundation and other partners. The SAN will try to develop a compendium of monitoring activities in the watershed.

Act 537 Plans

As part of the Pathogens & Compliance 2013 workplan, we decided that to help identify priority wastewater discharges/issues in the watershed and formulate action plans to address them; we would track WWTP upgrades, new facilities, and community sewer improvement

projects. Our list of plans that are near 40 years old was reviewed. It was determined that age alone is not a good indicator for updating plans. The SE and SC Regional offices of DEP identified a small number of potential candidates for updating plans. A few have already been contacted by DEP. We will follow-up on progress at the next meeting.

Wet Weather Workshop

A goal of this group was to provide training to publicly own treatment works on how to operate during higher than average rainfall events. Recently it was noted that the City of Lansdale (CSO system) has hired consultants to evaluate their system for impacts from high flows. It was also noted that Pottstown, Norristown, Upper Gwynedd, and Oaks have high flow maintenance plans. The workgroup will consider a Workshop at Albright College for late Spring. The next step will be for DEP and EPA to develop a wet weather guidance statement.

Schuylkill Watershed Control Plan

The Philadelphia Water Department (PWD) and DEP had a meeting in early October to review Chapter 94 annual reports. PWD is preparing a spreadsheet based on the information contained in these reports on the Schuylkill Watershed. The spreadsheet will contain information on locational data, treatment process, hydraulic loadings, and capacity projections. The goal is to have relevant and up to date information on the wastewater practices in the Watershed. The initial focus will be in the SE Regional Office.

Quarries

An issue was identified in Maiden Creek as a result of a discharge from a Quarry. Apparently, the quarry is discharging high levels of a clay-like material into Maiden Creek. This material is covering the bottom of the stream and dis-coloring the stream itself. DEP was notified, but additional follow-up is needed. The Pathogens/Compliance Team will discuss this issue with the Pottsville Mining Office and EPA enforcement personnel.

Joe's Around the Watershed Updates

- Schwenksville sewer plant spills 5,000 gallons into Perkiomen Creek.
- Pottsville man confronts authority on Sewer moratorium.
- Spring City to upgrade wastewater treatment plant.
- Reading uses Hazen & Sawyer to map sewer system.
- Port Clinton has public meeting on proposed sewer project.
- Souderton seeks decrease in sewer fines.
- Lower Gwynedd authorizes work on severely deteriorated sewer pipe.
- Strausstown questions sewer fine imposed by DRBC.
- Yuengling to put wastewater plant at former ice cream factory.
- Norristown sewage treatment plant gets upgrade.
-

That's all folks!

The next meeting will be held on March 5, 2014 at the PADEP Reading Field Office.

Schuylkill Action Network Agriculture Workgroup 02.13.13 Meeting Notes

Attendees:

Laura Hopek, Lehigh Conservation District
Kim Fies, Berks County Ag Land Pres
Chuck Kanetsky, EPA
Larry Lloyd, Berks Conservancy
Ross Stowell, Berks Conservation District Associate Director
Nick Ramsey, NRCS
Joe Hebelka, DEP-Central Office
Pier Ignozzi-Shaffer, Trout Unlimited
Dan Grieg, Berks Conservation District
Kate Keppen, Berks Conservation District
Christine Esterline, Berks Conservation District
Chip Bilger, Western Berks Water Authority
Tom Davidock, Partnership for the DE Estuary
Jesse Goldberg, Miller Environmental
Lyn O'Hare, SSM Group

- **Review of 10.17.12 meeting notes**
- **Update on grant requests/funding efforts**
 - Growing Greener – Kate was told that grant announcements would be announced shortly; DEP is talking about moving the grant round to summer.
 - EQIP/Watershed Initiative: Nick said \$250K was allocated for each watershed; plenty of applications; NRCS will contract with farmers in the next couple months.
 - CRP enrollment: Re-enrollment will be soon. 44 land parcels will expired and come out of contract.
 - Section 310 Watershed Implementation Plans: Kate no 319 plan completed for Berks County
 - Berks Watershed Restoration Fund: Western Berks donated funds in 2012.
 - Schuylkill River Restoration Fund – Letters of Intent due 3/28/13; fundraising event scheduled to encourage organizations to invest in SRRF.
 - Water Resources Education Network: apps open; Lehigh municipal officials and stormwater workshop
 - Schuylkill Highlands – grant application should be available around May
 - Land Transaction workgroup - \$4K for land protection on priority lands
 - CFA: Act 13 funds available
- **Projects in Progress**
 - SRRF projects – Larry said Havens will continue

- SAN Data Collection – SSM is developing a geodatabase as an in-kind volunteer; Tom and Lyn are gathering project information for input; output for SAN 10-year event
- Maiden Creek macro study – completed in January; improvements seen in several locations
- Willow Creek: 600 trees to plant in 2013; Maiden Creek Authority – 40 in Dec, 40 in spring
- American Rivers (Cacoosing): issue with gas line crossing
- PWD/Lehigh crypto monitoring – update in May
- PENNVEST (Kopfer/Havens): Kopfer mostly done; Havens heifer barn installed; working on composting barn
- DEP Enviro Ed: Master Gardeners plaza; Kutztown Middle planting trees/shrubs
- Wyomissing Watershed Coalition: meeting held 1/31 for Wyo residents; did some macro surveys; farms identified for projects
- Mill Creek redesignation: no report
- Boyertown forest stewardship plan: Larry finished plan
- Zartman (Tully): BCCD waiting for letter from Buckeye, exposed pipe in stream
- **Education/Outreach**
 - Philly Craft Beer Festival (March 2)
 - DVEWS training (March 6)
 - Take Pride in Blue Marsh Day (May 20)
 - RAWA steering committee – 5-year update (Feb 19)
 - WBWA presentation at WWOAP (August)
 - Berks Water & Sewer Committee (March)
- **Planning**
 - The SAN 10th Anniversary event is scheduled for May 9 at the Audubon Center, more details to follow
- **Stormwater**
 - Schuylkill Action Students projects – Tom – Two are funded in Berks County
- **Other**
 - Workgroup plan for next meeting
 - BCALP numbers for 2012:
 - 23 farms (3,000 ac) in BCALP
 - 139 farms (11,000 ac) in ranking process
 - 75% of SAN farms in program
 - \$1.3M from Berks County, \$1.3M match from state = 2,000 acres preserved

Next Meeting:

Wednesday May 15, 2013 at 10:00 AM - Berks Agricultural Center

Schuylkill Action Network Agriculture Workgroup

05.15.13 Meeting Notes

Attendees:

Ross Stowell, Interested Citizen
George Torak, Western Berks Water Authority
Kim Murphy, Berks Conservancy
Kim Fies, Berks Agricultural Land Preservation
Christine Esterline, Berks Conservation District
Tom Davidock, Partnership for the DE Estuary
Chuck Kanetsky, EPA
Jess Goldberg, Miller Enviro/RAWA
Joe Hebelka, DEP
Kelly Anderson, Philadelphia Water Dept
Nicole Charlton, Philadelphia Water Dept
Laura Hopek, Lehigh Conservation District
Nick Ramsey, Natural Resources Conservation Service
Kate Keppen, Berks Conservation District
Kristen Jellison, Lehigh University
Kyle Doup, Lehigh University
Larry Lloyd, Berks Conservancy
David Wise, Stroud Water Research Center
Dan Cannistraci, Lehigh University
Lyn O'Hare, SSM Group

- **INTRODUCTIONS/NEW MEMBERS**
- **Review of February 2012 Meeting Notes**
- **SPECIAL PROGRAM INTRODUCTION**
 - William Penn Foundation Initiative - Kim Murphy
 - This is a 10-year strategic plan within the Delaware River Basin. Eight cluster areas have been selected for project funding. We are located in the Middle Schuylkill, which will focus on ag restoration in the Tulpehocken, Maiden Creek, Manatawny, and Upper Perkiomen watersheds.
- **SPECIAL PRESENTATION:**
 - Lehigh University - Sacony Creek crypto monitoring project
- **Update on grant requests/funding efforts**
 - Growing Greener grant round update - apps available around June 1 or 8, will have 2 months to prepare applications. Call Jineen with any ideas for grant proposals.
 - EQIP/Watershed Initiative (Maiden/Sacony) - approximately \$1M in Berks/Schuylkill Counties; signed 4 dairy contracts
 - CREP enrollment - Re-enrollment opened in May; 40-45 parcels coming out in in September

- Section 319 Watershed Implementation Plans – new guidelines have been distributed – Conservation District/RAWA working on 10 monitoring locations for macro/chemical/bio assessments
- Berks Watershed Restoration Fund – funding for projects in Kutztown; East Penn; RAWA
- Schuylkill River Restoration Fund fundraiser – discussion on potential dates with SRHA
- **Projects in Progress**
 - SRRF projects – Conservancy will submit applications for Schroeder, Weaver, Lee; need letter of support from Ag Workgroup
 - Maiden Creek watershed monitoring program – macro survey in early May for 2 sites in Lehigh County
 - Saucony Creek Brewing Company update – no report
 - RAWA invasive removal – no report
 - Willow Creek – Finished spring planting; Maiden Creek Twp and Giorgio both planting trees
 - American Rivers – Cacoosing – On hold due to permitting issues
 - PENNVEST (Kopfer/Havens) – Kopfer needs stabilization; Havens has some contractor issues, Tour scheduled May 23
 - DEP Environmental Ed – BCCD wrapping up BMP Park; meetings scheduled with Reading High School and Kutztown Elementary.
 - Wyomissing Creek Watershed Coalition (Coldwater Heritage) – completed sampling; bioassessment in progress
- **Education/Outreach**
 - BCCD Pennvest Tour – May 23 - Kate
 - Blue Marsh Get Outdoors Day - June 15
 - SAN Ag Tour – June 28 - Tom
 - Berks County Water & Sewer Association – July 31 workshop
 - NRCS Tully Celebration – August 29
 - NRCS Conservation Catalogue – revised 2013
 - Maiden Creek Watershed Association – wine tasting fundraiser
 - Berks Conservation District thanked Western Berks Water Authority and Reading Area Water Authority for their support for the Envirothon
- **Planning**
 - SAN Geodatabase and New Project Collection Data form – All organizations please use the new form (on SAN website) so that ongoing projects can be input into project database
- **Watershed Land Collaborative**
 - WLC Workgroup - planning forested area outreach; transaction assistance for easements; municipal outreach
- **Stormwater**
 - Schuylkill Action Students projects – Conrad Weiser Middle School; also on lookout for new project school partners
- **Other**

- Larry Lloyd – Dr. Peter Gravatt from EPA in DC had nice remarks about implementation model at the SAN celebration.
- Joe Hebelka – PSU information on water quality from dairy herds; PA American in Berks County helped with pharmaceutical event, and collected 1,370 lbs of pharmaceuticals, with 400 lbs from drop boxes.

Next Meeting:

WEDNESDAY AUGUST 7 – 10:00 AM At Berks Agricultural Center –

Schuylkill Action Network Agriculture Workgroup 08.07.13 Meeting Notes

Attendees:

Ross Stowell, Berks Conservation District Associate Director
Justin Raffauf, Berks Conservancy intern/Trout Unlimited
George Torak, Western Berks Water Authority
Jesse Goldberg, Miller Environmental/Reading Area Water Authority
Matt Genchur, PA Rural Water Association
Chuck Kanetsky, EPA
Joe Hebelka, DEP-Central Office
Beth Couillard, Phila Water Department
Kelly Anderson, Phila Water Department
Tom Davidock, SAN Coordinator/Partnership for the DE Estuary
Kim Fies, Berks County Ag Land Preservation
Larry Lloyd, Berks Conservancy
Nick Ramsey, Natural Resources Conservation Service/USDA
Misha Vargas, Natural Resources Conservation Service/USDA
David Wise, Stroud Water Research Center
Christine Esterline, Berks Conservation District
Kate Keppen, Berks Conservation District
Lyn O'Hare, SSM Group

- **Review of May 2013 Meeting Notes** – no corrections
- **Update on grant requests/funding efforts**
 - Growing Greener grant round update – Stroud will submit a GG application for an Ag BMP implementation program on 8/16. A letter of support was requested and approved.
 - William Penn Foundation/Middle Schuylkill Cluster – Letter of Support; Proposal status – due in early September, with a January notification; currently selecting focus areas. Partner meeting scheduled 8/21.
 - EQIP/Watershed Initiative (Maiden/Sacony) – About 27 contracts for \$1.3M in Schuylkill basin and some Ches Bay. 6 farms/\$600K for watershed initiative. Deadline to sign up for 2013 Farm Bill is September.
 - CREP enrollment – Ongoing – 7 of 20 are re-enrolling in program; 10 new contracts

- Berks Watershed Restoration Fund – Kutztown, RAWA and WBWA have all donated to the fund.
- Schuylkill River Restoration Fund – no new sources; existing funding is steady
- EPA funding for small water/wastewater systems - \$12.7M nationally for upgrades and treatment techniques
- **Projects in Progress**
 - SRRF projects – 3 projects in progress – Schroeder/Leid/Weaver, with an EQIP match
 - Maiden Creek watershed monitoring program – 12 locations selected; also looking at mussels in Pine Creek
 - RAWA invasives removal – Berks Conservancy requested removal assistance in Willow Creek area. RAWA applied beetles to purple loosestrife with good results
 - Willow Creek – Planted about 1,500 trees; finished in fall.
 - American Rivers – Cacoosing – Passed cultural resources section for dam removal in late winter.
 - PENNVEST (Kopfer/Havens) – Kopfer is finished; Havens about 30% completed, to be finished in December 2013.
 - DEP Environmental Ed – Projects are completed.
 - Wyomissing Creek Watershed Coalition (Coldwater Heritage) – monitoring is completed; developing plan
 - SAN Geodatabase and New Project Collection Data form – distributed copies of the spreadsheet for project input.
 - Phila Water Dept Watershed Control Plan – scientific monitoring before/after modeling for removal of contaminants.
- **Education/Outreach**
 - NRCS/BCCD/BC Tully Celebration – August 29
 - Western Berks Golf Event – September 23
 - DRBC webinar – August 15
 - Berks Agriculture Resource Network (BARN) annual farm tour in October
 - PWD – Agriculture education document in progress; factsheet on Sacony landowners
 - RAWA/Hamburg/Furnace Creek – (Coldwater Heritage) – signage at Pinnacle
 - BCCD – Urban Initiative in Topton Creek - \$300K
 - BCCD- \$200K for green infrastructure at Reading HS
- **Planning**
 - SAN Annual Conference – November 15 at Reading Area Community College
- **Watershed Land Collaborative**
 - WLC Workgroup – working in Highlands Cluster; using prioritization tool for protection areas.
- **Stormwater**

- Schuylkill Action Students projects – 3 new projects: Conrad Weiser Middle School in Berks, 2 others in Montgomery County; also working at Robeson Elementary and Kutztown Middle School
- **Other**
 - Nick – look at soil health display in Ag Center
 - Joe – potential CAFO in Moselem Springs area

Next Meeting:

WEDNESDAY NOVEMBER 6, 10 AM at the Berks Agricultural Center

Schuylkill Action Network Agriculture Workgroup 11.06.13 Meeting Notes

Attendees:

David Wise, Stroud Center
Matt Ehrhart, Stroud Center
Bill Angstadt, Angstadt Consulting
Ashton Hogarth, SSM Group
Sierra Gladfelter, Schuylkill Headwaters
Larry Lloyd, Berks Conservancy
Bob Kahley, Aqua PA
George Torak, Western Berks Water Authority
Joe Hebelka, DEP-Central Office
Dan Greig, Berks Conservation District
Chip Bilger, Western Berks Water Authority
Matt Walborn, Western Berks Water Authority
Jess Goldberg, Miller Environmental/RAWA
Kimberly Fies, Berks Ag Land Preservation
Tom Davidock, SAN Coordinator/Partnership for the DE Estuary
Kevin Smith, DEP-Southeast Region Office
Beth Coulliard, Philadelphia Water Dept
Nick Ramsey, NRCS
Ross Stowell, Concerned Citizen
Lyn O'Hare, SSM Group

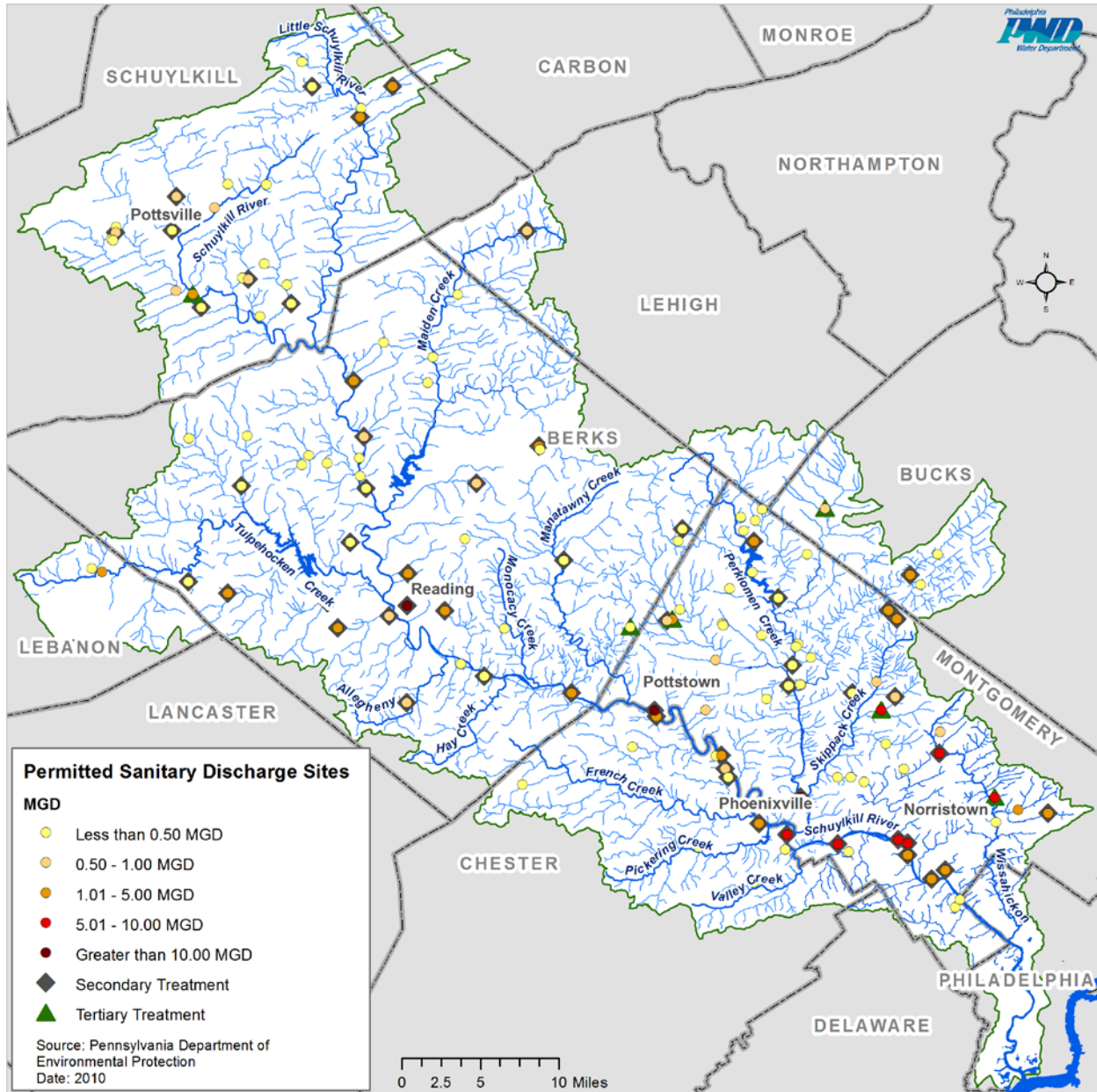
- **INTRODUCTIONS/NEW MEMBERS**
 - Guest: Sierra Gladfelter, Education/Outreach Coordinator, Schuylkill Headwaters Association. Sierra will be conducting a new watershed course for students through a grant from Audubon. Two students from each county can participate. The program needs donations for student scholarships: \$500 for one student for the week.
- **Review of August 2013 Meeting Notes**
- **Update on grant requests/funding efforts**

- William Penn Foundation/Middle Schuylkill Cluster -Proposal status - some of the proposed projects have been funded; additional talks with WPF in January.
- Berks Watershed Restoration Fund - Borough of Kutztown, Western Berks Water Authority, Reading Area Water Authority, and the Saucony Creek Brewing Company have made donations that will fund conservation planning and project cost-share within Berks County.
- Fish & Boat (Cacoosing and Hospital Creek dams) - Spring activity
- Coldwater Heritage grant - Working with Hamburg Municipal Authority in Furnace Creek for educational signs and macros; grant deadline in December.
- Bill Angstadt mentioned the Regional Partnership for Conservation; Tom will follow up.
- Applications for the DEP's Environmental Education grants are due January 6, 2014.
- **Projects in Progress**
 - SRRF projects - Conservancy working on projects at Schroeder/Weaver/Leid; finishing up Havens
 - Maiden Creek watershed monitoring program - selected 12 sampling sites for ongoing monitoring. Maiden Creek Watershed Association will be a partner.
 - □□RAWA invasives removal - Japanese Hops need to be removed in Willow Creek
 - Willow Creek - Conservancy has 1 year to finish planting 1,600 trees and ongoing maintenance.
 - PENNVEST (Kopfer/Havens) - Conservation District has completed project; Kate will show PowerPoint highlights at next meeting.
 - Wyomissing Creek Watershed Coalition (Coldwater Heritage) - Conservation District developing draft maps for Ag education in Wyomissing watershed.
 - PWD Watershed Control Plan - In progress; finalize at the end of the year.
 - BCCD Topton Creek/Reading HS - Topton will use about \$300K for streambank restoration projects; Rading HJS will have about \$200K for green infrastructure and stormwater projects
 - EPA 319 Implementation Plan - William Penn Foundation
- **Education/Outreach**
 - NRCS/BCCD/BC Tully Celebration - August 29 - about 40 attendees
 - Western Berks Golf Event - September 23 - donation of \$3,500 to Berks Watershed Fund
 - PWD/PDE - Ag Education materials - Ag guide on BMPs scheduled for spring 2013
 - DEP - Online Permit Application Tool available
 - Berks Conservation District - Innovative Ag Workshop on Feb 13
- **Planning**
 - SAN Annual Conference - November 15 at RACC

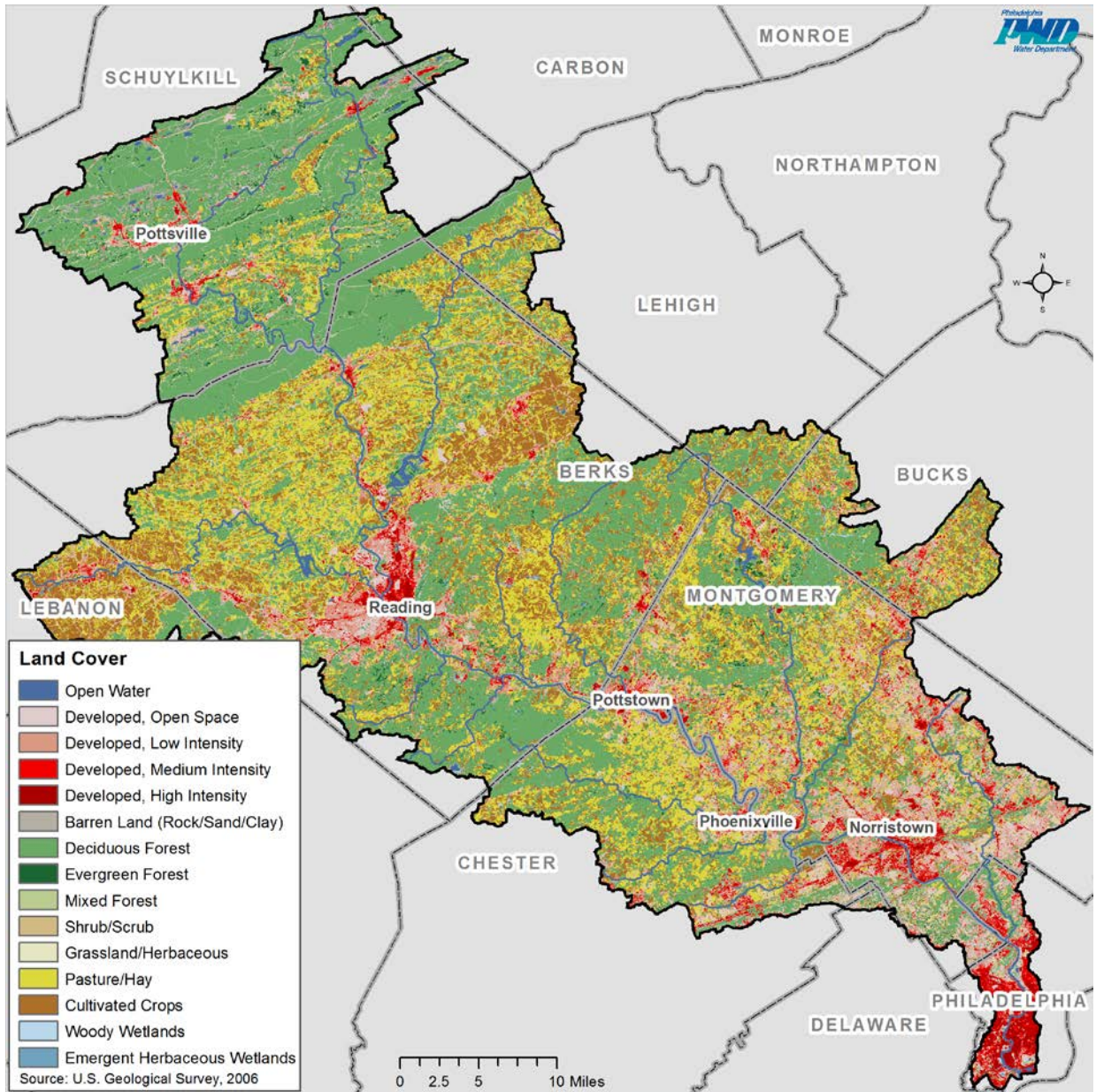
- **Watershed Land Collaborative**
 - WLC Workgroup Meetings - No report
- **Stormwater**
 - Schuylkill Action Students projects - Robeson Elementary and Kutztown Middle both participated in fall plantings
- **Other**
 - State of the Environment breakfast with Berks Conservancy - Nov 14

Next Meeting: Wednesday February 12, 2014 - 10:00 AM

Appendix B: WWTPs in the Schuylkill River Watershed Map



Appendix C: Schuylkill River Watershed Land Cover Map



Appendix D: Agricultural BMP Project Tracking

PROJECT DATA RECORD SHEET

| Site Record: Agriculture Projects | | | | |
|--|---|-------------|--------------------------|-------|
| Last Updated: | | | | |
| Past visual monitoring dates: | | | | |
| SITE LOCATION | | | | |
| Site Name/Owner Name: | | | | |
| Notes: | | | | |
| Township: | | | | |
| Latitude/longitude: | | | | |
| Stream Name on property (if applicable): | | | | |
| Tributary to: | | | | |
| Sub-watershed: | | | | |
| Watershed: | | | | |
| Acres pasture/hay: | | | | |
| Acres row crops: | | | | |
| | | | | |
| FUNDING | | | | |
| Phase 1. Years: | | | | |
| Planned BMPs: | | | | |
| SRRF: | | | | |
| Other Funders: | | | | |
| | | | | |
| Phase 2. Years: | | | | |
| Planned BMPs: | | | | |
| SRRF: | | | | |
| Other Funders: | | | | |
| | | | | |
| Phase 3. Years: | | | | |
| Planned BMPs: | | | | |
| SRRF: | | | | |
| Other Funders: | | | | |
| | | | | |
| BMPS: | | Description | Yes/No or Year Completed | Phase |
| | Streambank fencing | | | |
| | animal trails or walkways/fencing | | | |
| | animal crossing | | | |
| | heavy use area protection/barnyard controls | | | |
| | stormwater management | | | |
| | manure storage unit | | | |
| | stream bank buffer | | | |
| | non-structural | | | |
| | | | | |
| ANIMALS: | | | | |
| | Total no. of cattle: | | | |
| | No. of beef cattle: | | | |
| | No. of dairy cattle: | | | |
| | No. of heifers: | | | |
| | No. of calves: | | | |
| | No. swine | | | |
| | No. horses | | | |
| | No. sheep | | | |
| | | | | |

FIELD VISUAL MONITORING FORM (AGRICULTURAL SITES)

Monitor

Monitor's Name: _____

Organization: _____

Date: __/__/____

Phone Number: (____)____-_____

Email: _____

Site

Site Name _____

Sub-watershed/Creek: _____

Organizations involved with project:

Weather

- Today: Sunny Partly Cloudy Overcast Rain Frozen Precipitation
- Current Temperature: _____ C/F
- Weather - past 48 hours: Sunny Partly Cloudy Overcast Rain Frozen Precipitation
- Precipitation - past 48 hours: None Trace Light Heavy

Recently Constructed BMPs

- Stream bank fencing (Year completed: _____)
 - ▶ Total length of fencing installed _____
 - ▶ Description: _____
- Stream bank buffer (Year completed: _____)
 - ▶ Approx. length of buffer: _____ Approx. width of buffer: _____
 - ▶ Description of buffer plantings: _____
- Animal trails or walkways (MM/YY completed: __/____)
 - ▶ Purpose of walkway connection _____
 - ▶ Description: _____
- Cattle crossing (s) (Year completed: _____)
 - ▶ Description: _____
- Heavy use area protection/barnyard controls (MM/YY completed: __/____)
Roofing, concrete, curbing, grading etc.
 - ▶ Description: _____
- Stormwater controls (Year completed: _____)
Gutters, rain spouts, etc.
 - ▶ Description/areas runoff diverted from: _____
- Manure Storage Basin(s) (Year completed: _____)

- ▶ Description (include dimensions or volume): _____

- Other _____ (Year completed: _____)
 - ▶ Description: _____

Cattle stream access

- Manure observed in stream or on stream banks
- Livestock have access to the stream
- Livestock have access to the riparian zone
- Livestock do not have access to stream or riparian zone

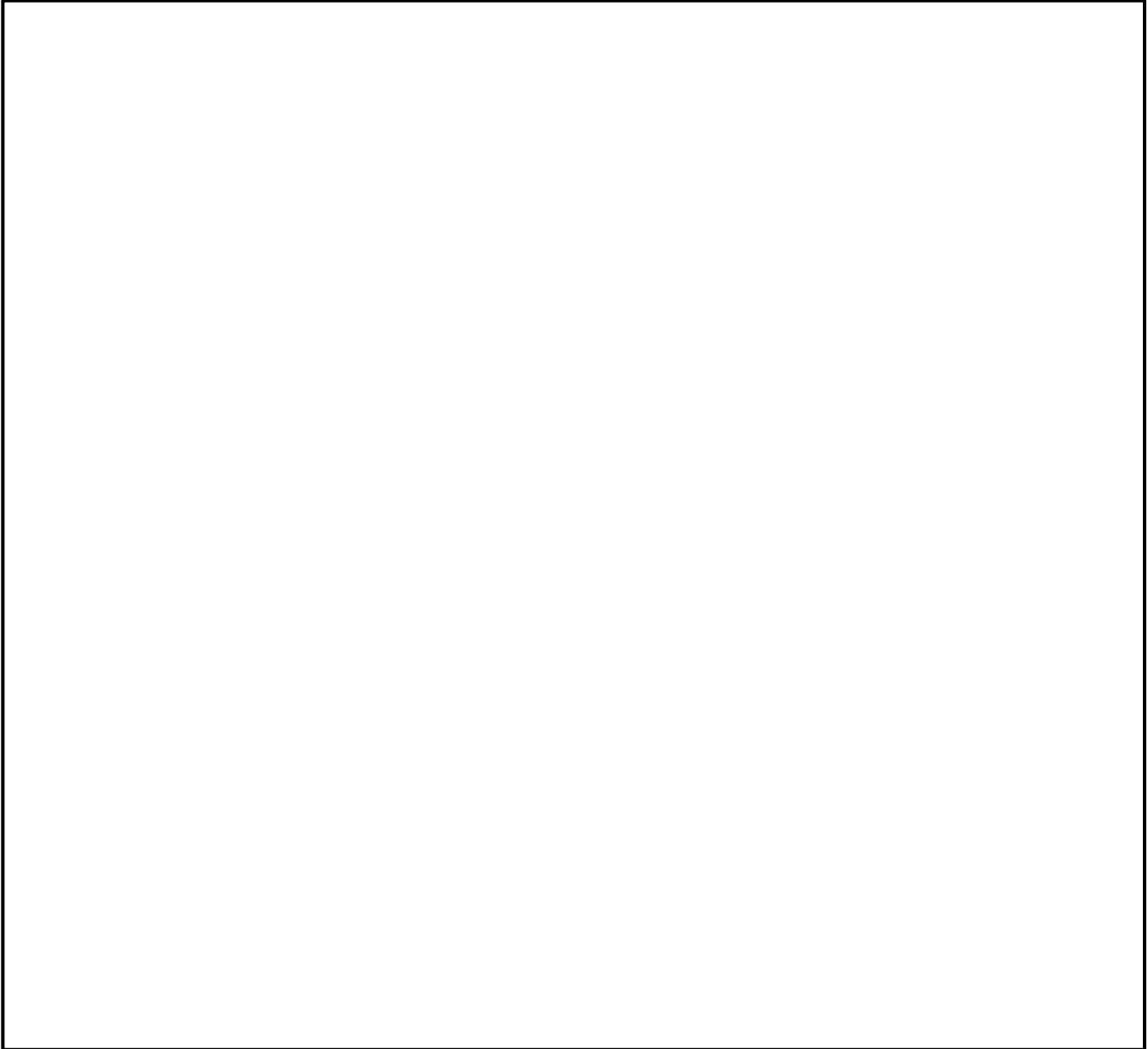
Previously completed BMPs

- Stream bank fencing
 - ▶ Fencing keeping livestock out of the stream and riparian zone: Yes No
 - ▶ Length/ description of any damaged or missing fencing segments: _____

- Stream bank buffer
 - ▶ Buffer plantings survival: Nearly 100% 75% 50% Less than 50%
- Animal trails or walkways
 - ▶ Animal walkway in use? All the time Most of the time Sometimes Rarely
 - ▶ Effectively maintained? Yes No; muddy or eroded areas present
- Cattle crossing
 - ▶ Condition of cattle crossing:
 - Good; in place and functioning Poor; blocked, damaged, removed, etc.
 - ▶ Animal walkway in use?
 - All the time Sometimes Rarely
- Heavy use area protection/barnyard controls
 - ▶ Condition? Good Poor or poorly maintained
- Stormwater controls
 - ▶ Condition of stormwater controls:
 - Functioning as intended Minor damage affecting function Not functioning
 - ▶ Unintended areas receiving rainwater due to damaged diversions (e.g. Animal Heavy Use Area, manure storage): _____
- Manure storage basin(s)
 - ▶ Condition of manure storage basin: Good Poor: leak/damage observed
 - ▶ Manure storage basin in use: Yes No; manure storage located in other area
- Other: _____
 - ▶ Description: _____
 - ▶ Condition: _____

Site Diagram

Include a diagram of the site- either a plan drawing or a sketch. Assign numbers to photo stations and label stations in sketch. Indicate direction of photo shot with an arrow. If sketching, please include features such as building structures, roadways, manure storage areas, animal heavy use areas, pasture/crop land, stream, riparian buffer, existing BMPs and other landmarks.



Notes:

Photo Monitoring

Please include at least one photo of the stream on the property each monitoring period. Photo(s) should document the appearance of the water, banks and riparian buffer particularly where cattle have or previously had access to the stream. Can also submit just photos if labeled with site, date and description.

Photo Points

| Photo Station Number | Exposure Number/Label | Marked on Diagram? | Direction of photo/focal or reference point | Description |
|----------------------|-----------------------|--------------------|---|---------------------|
| | | | | STREAM PHOTO |
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Spot Photos

| Exposure Number/Label | Description |
|-----------------------|-------------|
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| | |

Appendix E: Lehigh *Cryptosporidium* Sampling in the Saucony Factsheet

Cryptosporidium Sampling in the Saucony

Lehigh University and Philadelphia Water Department

What is *Cryptosporidium* and where does it come from?

Cryptosporidium (or "Crypto") is a waterborne pathogen that causes the gastrointestinal disease, Cryptosporidiosis. It can live in the intestines of infected humans and animals and is spread through fecal to oral contamination. Crypto oocysts have hearty outer shells that allow them to survive for long periods in the environment and also make them resistant to chlorination. For more information on *Cryptosporidium* and the spread of Cryptosporidiosis, visit www.cdc.gov/parasites/crypto.

Why sample for *Cryptosporidium* in the Saucony?

Thanks to a number of local organizations including the Schuylkill Action Network, Berks Conservancy, Berks County Conservation District, Natural Resource Conservation Service and many others, agricultural best management practices (BMPs) such as streambank fencing, manure storage basins, riparian buffer restoration and streambank crossings have been implemented on farms in the Saucony watershed. These measures prevent contaminants from runoff including Crypto from entering the streams that provide our drinking water. We would like to demonstrate the success of these projects by monitoring for *Cryptosporidium* where agricultural BMPs have been implemented. To do this, Lehigh University and PWD selected sampling sites for research along the Saucony at an upstream control site, downstream of known sources of Crypto including agricultural land and a wastewater treatment outfall, and upstream of the Kutztown drinking water plant.



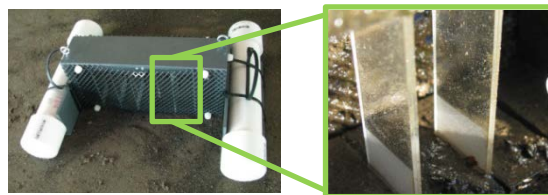
How do we collect *Cryptosporidium* samples from streams?

The Environmental Protection Agency (EPA) uses filters to collect samples of Crypto. Water is pumped from the stream through the filter which captures everything larger than one micrometer present in the water, including Crypto.



Filter sampling method

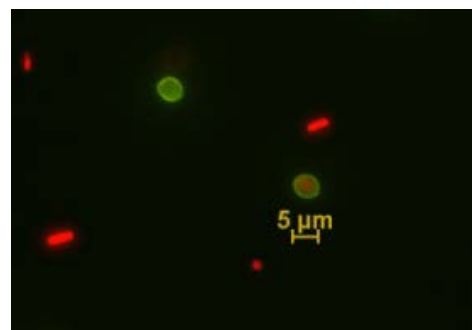
Another method is being developed by Lehigh University. Glass slides about three inches tall are placed in a biofilm sampling device and placed in a stream for two weeks. A biofilm naturally grows on the slides while they are in the stream, and Crypto oocysts attach to the biofilm surface as they pass.



Biofilm sampling method

What happens at the lab?

Once collected, the filters and glass slides go to the lab where the Crypto oocysts are separated from the sediment, algae and other environmental material in the sample. This is done using magnetic beads with a special surface developed to attach to Crypto. The sample is then treated with fluorescence making the Crypto glow green so they can be counted under the microscope.



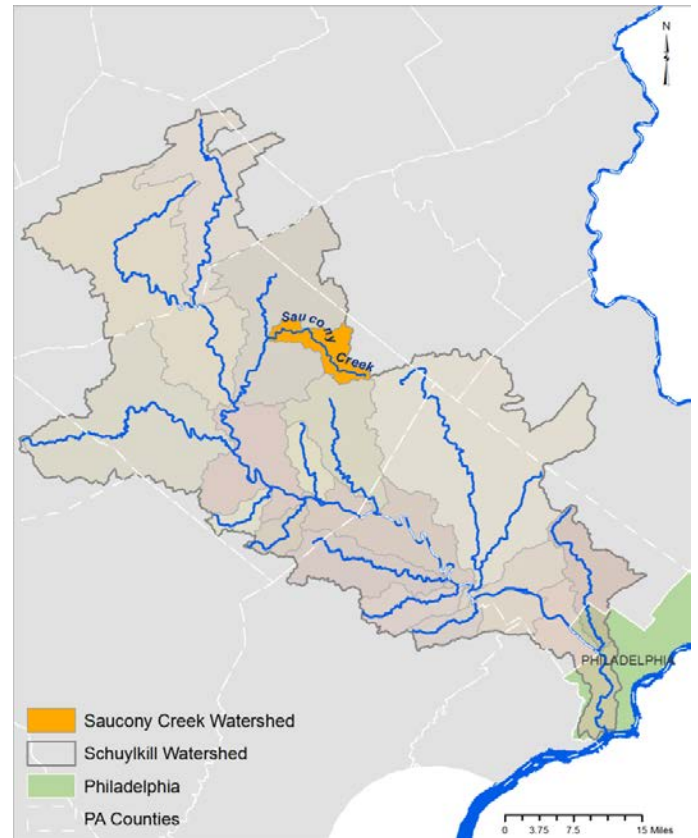
Two oocysts seen through the microscope

Why is the Philadelphia Water Department interested?

Like so many others upstream, the City of Philadelphia is committed to preserving the Schuylkill River and its many tributaries as an invaluable resource providing drinking water, recreation and many other benefits to the citizens of the region. When the US Environmental Protection Agency developed the Long Term 2 Enhanced Surface Water Treatment Rule (or 'LT2 Rule') with the purpose to reduce the risk of illness caused by *Cryptosporidium* and other microorganisms in drinking water, it set in motion great partnerships and on-the-ground projects to address the issue. To comply with the LT2 Rule, Philadelphia chose to maintain a Watershed Control Plan for the entire Schuylkill watershed not only protecting Philadelphians from waterborne illnesses but reducing the amount of *Cryptosporidium* and other microorganisms in the waters far upstream. A Watershed Control Plan identifies potential sources of *Cryptosporidium* upstream of a drinking water intake and defines initiatives that will be undertaken to reduce the input from those sources. In Philadelphia's Watershed Control Plan, PWD recognizes the limited scientific data available on *Cryptosporidium* and its sources. More advanced knowledge will help Philadelphia to most effectively target its resources in reducing Crypto loads in the watershed. PWD's project with Lehigh University in Berks County was developed to research the sources and viability of Crypto where Best Management Practices (BMPs) were being installed on agricultural properties in the watershed. The Saucony Creek watershed seemed an excellent fit, and with much help from partners in the watershed, several sampling locations were selected.



Biofilm sampler in Saucony Creek



What did we find in the Saucony Creek?

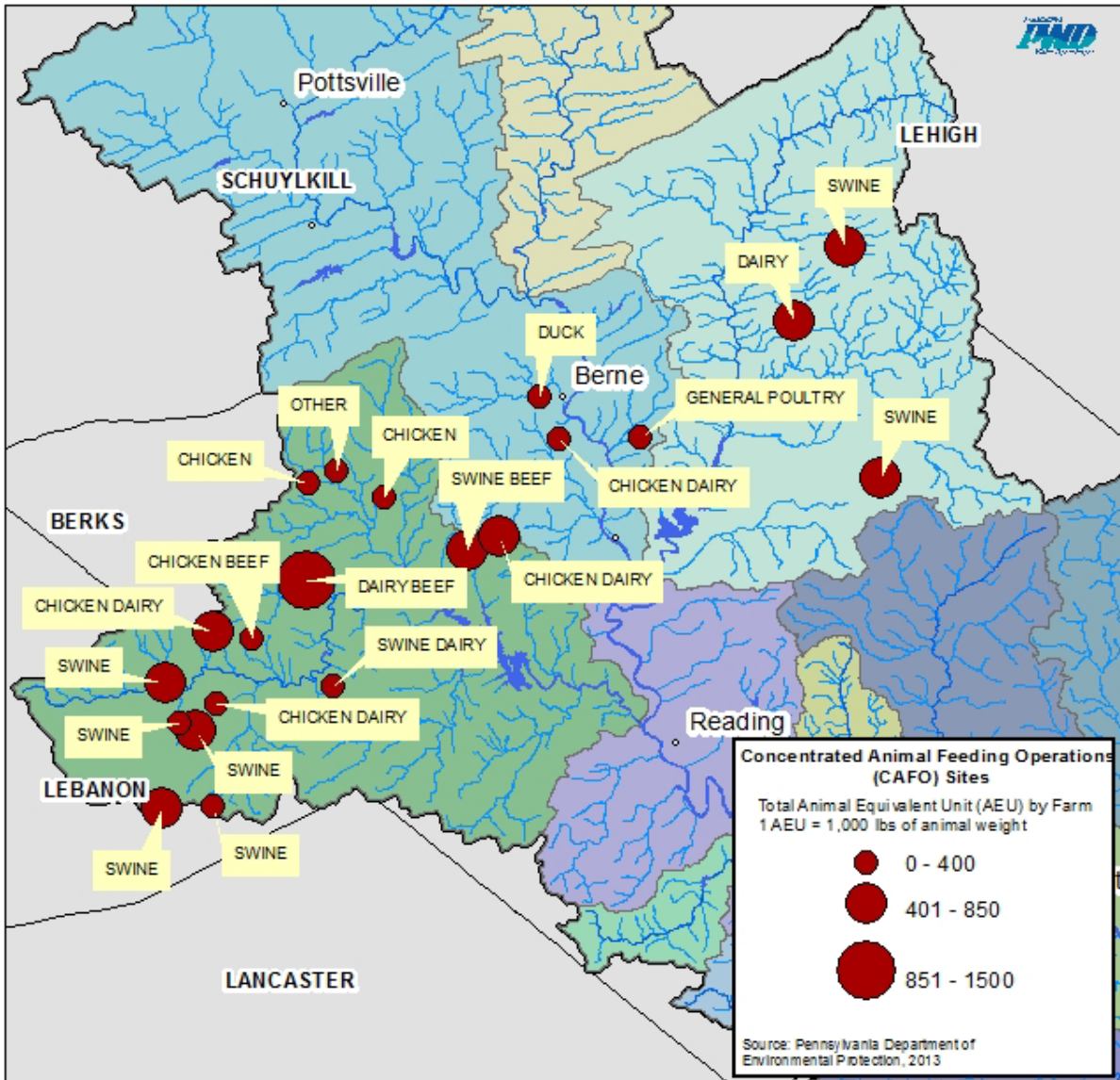
Lehigh University sampled once every two weeks in the Saucony from spring 2012 to spring 2013. During that time, Lehigh found very low numbers of *Cryptosporidium* in the samples. One or two Crypto oocysts were detected on a few sampling days, but in most samples, no oocysts were detected. Although this does not provide much information in determining the impacts of BMPs on Crypto in waterways, it is good news for the Saucony! This year, Lehigh University and Philadelphia Water Department plan to monitor sites in Philadelphia further developing the new biofilm sampling method and switching focus to *Cryptosporidium* from other point sources. PWD and Lehigh plan to continue monitoring in agricultural areas where BMPs will be installed and are in the process of identifying future sampling locations.



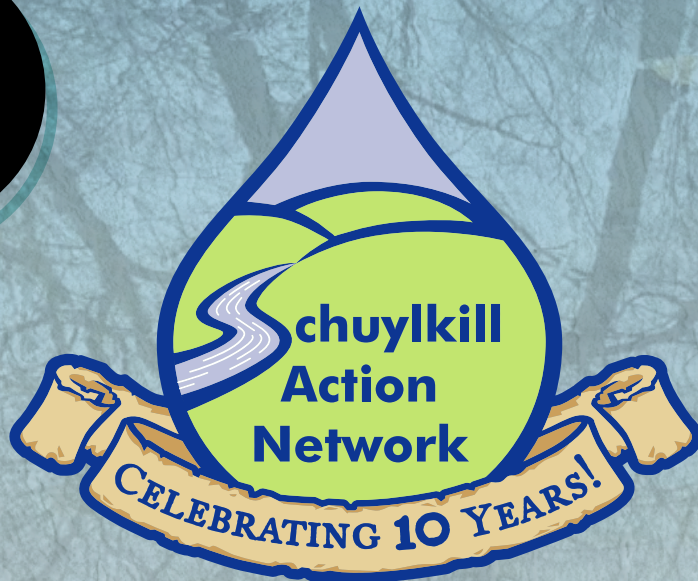
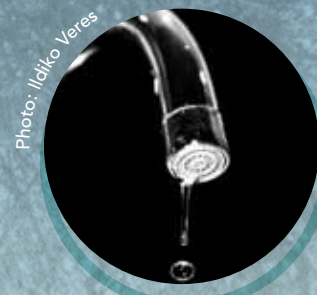
Borough of Kutztown Water Treatment Plant



Appendix F: CAFOs in the Schuylkill River Watershed Map



Appendix G: SAN 10-Year Progress Report



Members of the Schuylkill Action Network share information, expertise, and technology to help each other achieve a shared vision of clean water and a healthy environment for the Schuylkill River and its tributaries.



Partnership for the Delaware Estuary
110 South Poplar Street, Suite 202
Wilmington, DE 19801
1-800-445-4935
www.DelawareEstuary.org



Philadelphia Water Department
Public Education Unit
1101 Market Street, 3rd Floor
Philadelphia, PA 19107
215-685-6300
www.PhillyWatersheds.org
www.FairmountWaterWorks.org

The Partnership for the Delaware Estuary, a National Estuary Program, leads science-based and collaborative efforts to improve the tidal Delaware River and Bay, which spans Delaware, New Jersey, and Pennsylvania.



www.state.nj.us/drbc



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
www.depweb.state.pa.us



www.epa.gov/region03

Funding for this project was provided by the Philadelphia Water Department as well as the PA Department of Environmental Protection and the US Environmental Protection Agency through the Drinking Water State Revolving Fund.

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©2013 Designed by Frank McShane

Background photo: Sarah Whitman



2003-2013 Progress Report

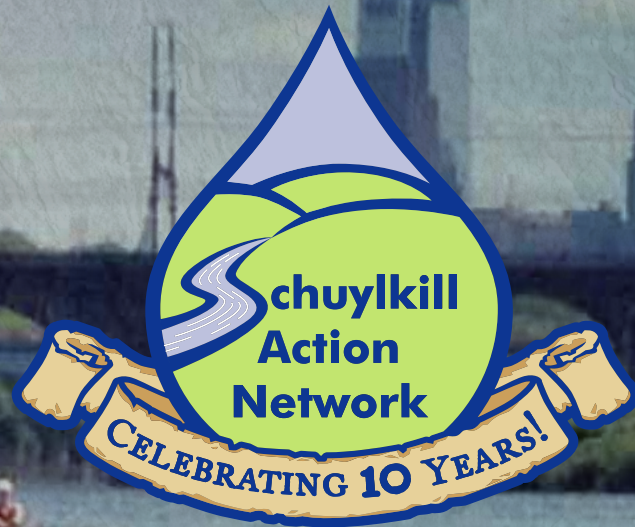


PROTECTING SCHUYLKILL WATERS
www.SchuylkillWaters.org





Photo: Gary Brown



A Decade of Watershed Partnership

For the past 10 years, the Schuylkill Action Network (SAN) has been working in partnership with local watershed organizations, land conservancies, businesses, schools, water suppliers, and local, state and federal governments to collaborate on projects and activities to protect and restore the Schuylkill Watershed. This initiative, which is coordinated by the Partnership for the Delaware Estuary, helps direct resources towards the most pressing watershed needs.

The SAN not only serves as a national model for source water protection, but it is proof that we can create positive and lasting change by working together. Over 150 partners have helped to improve the health of the watershed, protect drinking water, and increase the appreciation and value by the public of our rivers and streams. The following information in this report highlights some of the projects and activities undertaken to do this. While the work in the watershed is far from complete, we are confident that we have the partners and priorities in place to lead us through another successful 10 years of protecting Schuylkill waters.

Front Cover photo credits:
Philadelphia skyline: Dominic Mercier
Turtles: Alicia Zimmerman
Father, son, and dog: Ildiko Veres
Kayaker: Michael Moulton
Heron: Walt Hug
Child on bridge: Dominic Mercier

The Schuylkill River is cleaner and healthier than it has been in well over a century.

Photo: Daniel Swablik

Photo: Teresa Mendez-Quigley



Photo: Carol Deihl

Drinking Water Protection

Following the passage of the Clean Water Act in the early 1970s, we started to think very differently about our rivers and streams and how they impact our daily lives. The Schuylkill River, which was once seen as a place to dispose waste, is now a vital resource for our quality of life. The river provides opportunities for recreation, helps to meet our energy needs, and is a major source of freshwater to the Delaware Estuary, a major economic driver for the region. However, one of its most important benefits is something we all rely on every day, drinking water.

More than 2 million people get their drinking water from the river and streams in the Schuylkill watershed, making protecting it a very important goal for water suppliers. Over a decade ago, the Philadelphia Water Department (PWD) embarked on a very ambitious effort to identify and prioritize all of the potential pollution threats to the Schuylkill River, which provides about half of the city's drinking water. This process led to the creation of a protection plan for the river, laying out a road map for addressing these threats.

One of the primary goals of this plan was to create a mechanism for regional coordination across geographic, regulatory, and jurisdictional boundaries. The Schuylkill Action Network (SAN) was created shortly thereafter to help accomplish this goal. Both the SAN and the PWD take a watershed-wide approach to protecting drinking water sources by partnering with upstream communities, other regional water suppliers, businesses, governments, and watershed protection groups.

Over the past 10 years, we are seeing a new approach to watershed management emerge — one that focuses on collaboration. Through the vast network of SAN partners, hundreds of projects have been completed and more than \$400 million invested to protect and restore this important resource. The PWD's initial Schuylkill River Protection Plan has been complimented with additional planning and protection efforts and involvement of other Schuylkill water suppliers. Over the last 10 years, nearly every public drinking water supplier that gets their water from Schuylkill reservoirs, rivers, or streams, has developed an approved source water protection plan. Through this shared effort, watershed priorities can be more effectively evaluated and priorities fluidly addressed — continuing the positive change in protecting Schuylkill waters.

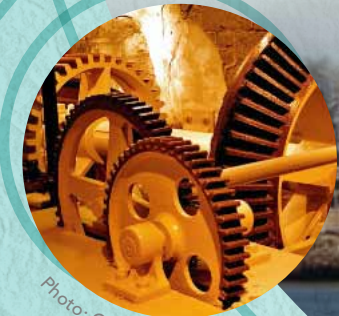
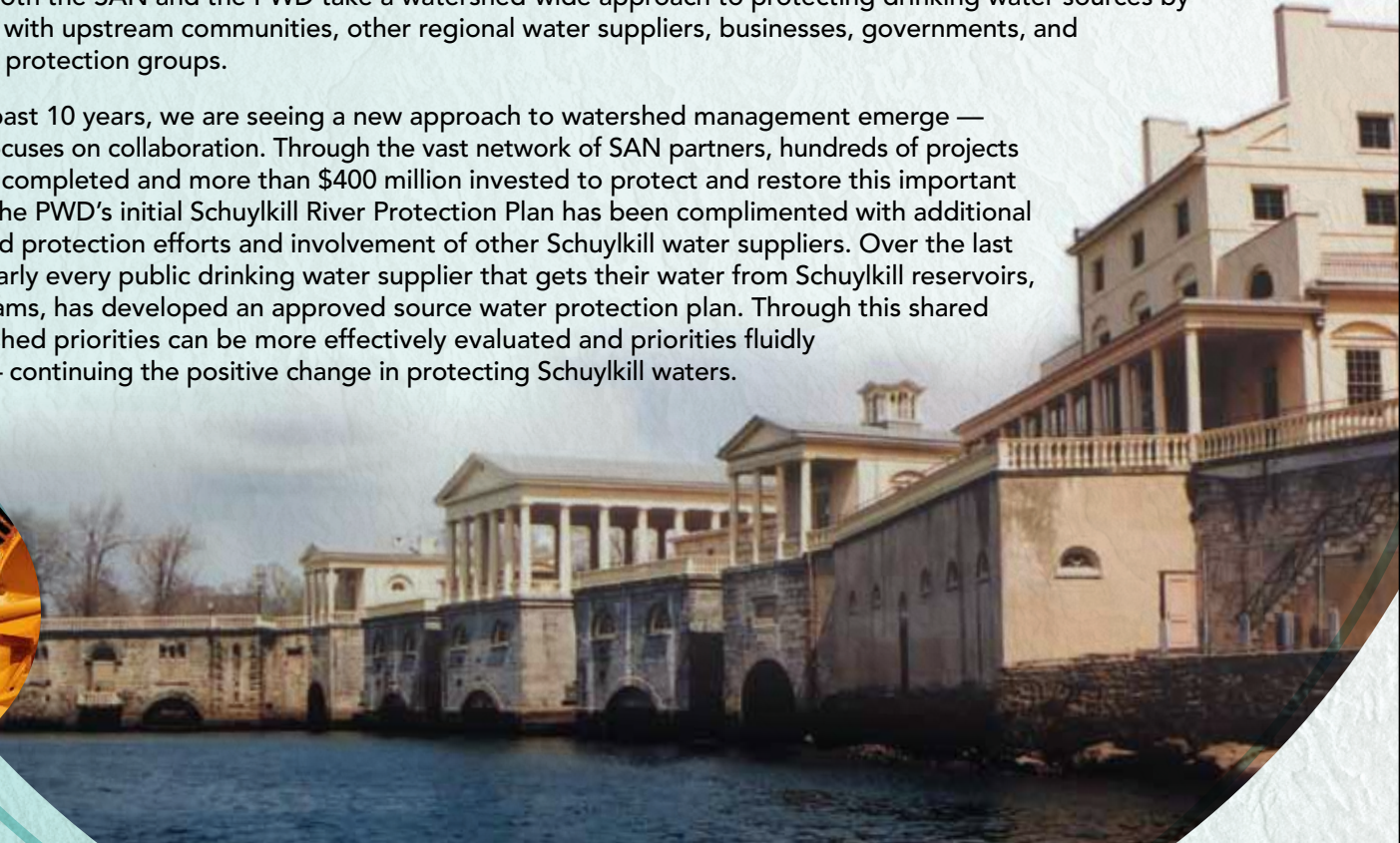


Photo: Ozzie Moss



Agriculture Workgroup

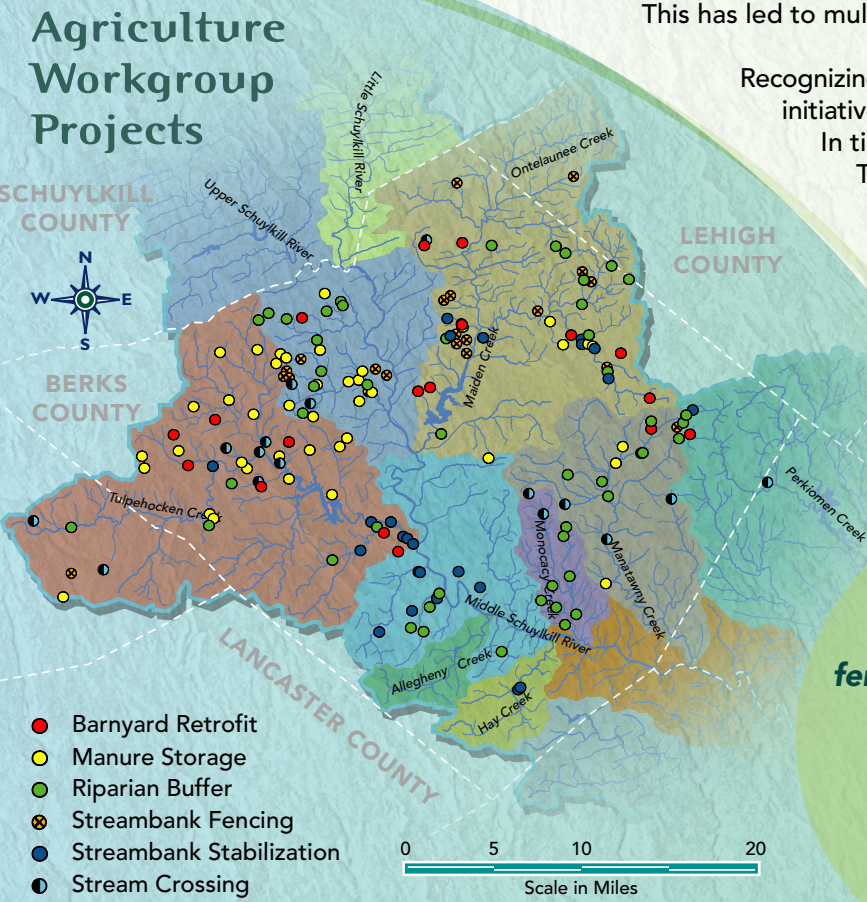
The Agriculture Workgroup has been an incredible model for partnership success! Working primarily in Berks County, the largest agriculture area in the watershed, the workgroup has been able to take great strides in reducing pollution from farms. An amazing group of agencies, non-profit organizations, businesses, and farmers have created a series of Source Water Protection projects on farms that prove a network can have a huge impact on the health of our rivers and creeks.

Over the past 10 years, the Berks Conservancy, Berks Conservation District, Natural Resources Conservation Service (NRCS), and Berks Ag Land Preservation groups have completed more than 175 farm improvement projects such as streambank fencing, riparian buffer planting, animal crossings, and other structural practices. Rather than doing projects one at a time, the workgroup has been taking a "whole-farm" approach, addressing all of the major pollution problems at each site. This has led to multiple partner collaborations and new sources of funding.

Recognizing the need to document improvements and measure the level of success, the workgroup led an initiative to collect information on stream health on select farms where projects have been completed. In time, these results may be used to help remove streams from the state's impaired streams list. The workgroup is also involved in other monitoring efforts, including a collaborative study on the sources of *Cryptosporidium*, a harmful bacteria to people, which is being led by the Philadelphia Water Department and Lehigh University.

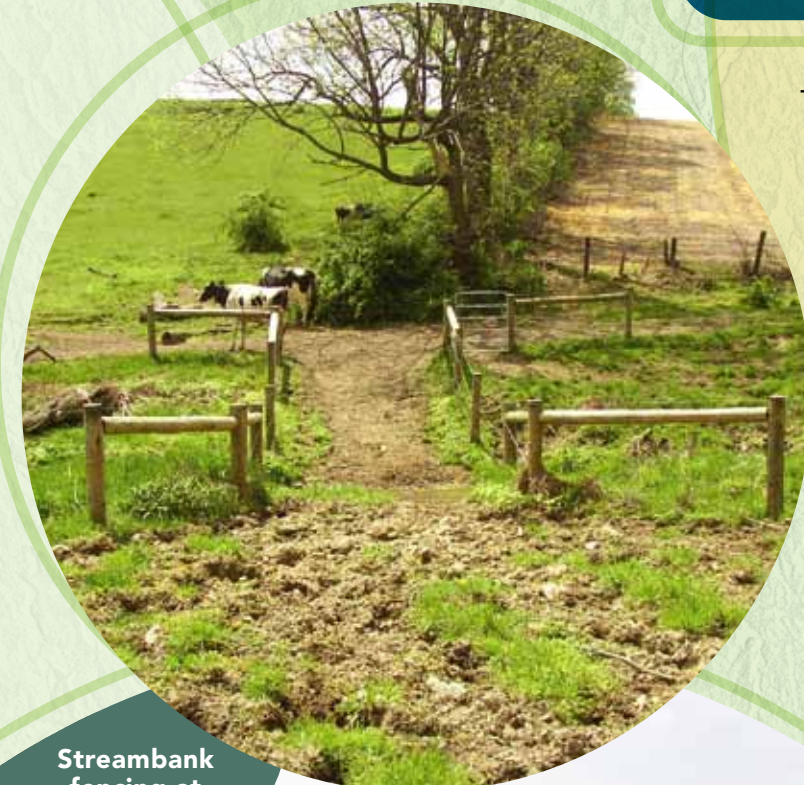
All of this work is leading to improvement of critical water supplies for downstream users. Local water suppliers including the Kutztown Water Company, Reading Area Water Authority, and the Western Berks Water Authority each contribute their expertise and finances to help address agriculture pollution in the watershed. To help direct local resources to solve these problems, the Berks Conservancy started the Berks Watershed Restoration Fund. In 2012, the fund welcomed one of its newest supporters, Kutztown's Saucony Creek Brewing Company, who will be donating some proceeds of their Stonefly IPA back into the watershed.

Agriculture pollution is caused by pesticides, fertilizers, and animal waste washing into streams every time it rains. Over 175 projects have been completed to address this.



Project Spotlight: Davis Farm

The Davis Farm project is an excellent example of the improvements that can be made when proper practices are installed to reduce polluted runoff from agricultural areas. This "before" example of a livestock farm shows a collapsed barnyard with manure runoff going directly into the adjacent creek. The farm didn't have a storage facility, so manure was spread on fields 365 days per year. Today, a manure storage facility prevents runoff from entering the stream and reducing pollution to the Saucony Creek. More work is planned for this project, including surface grading and seeding, animal walkways, streambank fencing, and new pasture areas for grazing.



Streambank fencing at Epting Farm



BEFORE Davis Farm



AFTER Davis Farm



Abandoned Mine Drainage Workgroup

Over \$14 million has been invested to complete 45 projects to reduce the impact of AMD in the watershed.

Over 200 miles of streams in the headwaters of the Schuylkill River are degraded from pollution resulting from Abandoned Mine Drainage (AMD). Although the sources for AMD are found in only the upper portions of the Schuylkill watershed, the impacts can be felt downstream all the way to the Delaware River. Over the past 10 years, the SAN AMD workgroup has made significant progress in cleaning up many of these problems by concentrating on remediating or eliminating mine drainage, restoring floodplains, and educating and involving the public in the effort to establish the river as a resource.

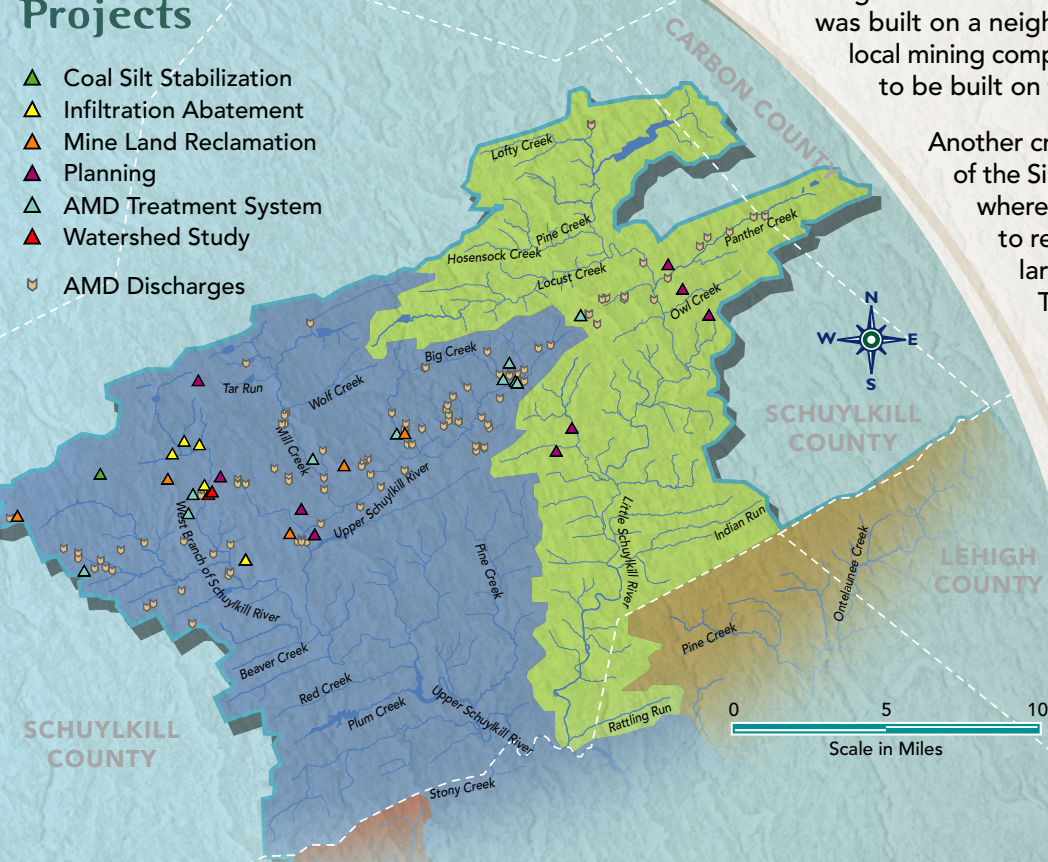
Treating AMD presents many challenges that require creativity and collaboration between local communities, watershed groups, mine operators, and government agencies. One such project is located in the small community of Mary D, where AMD discharges from abandoned boreholes into the Schuylkill River. The only available area to treat this discharge was at the community baseball field. Through the efforts of the SAN partners, funding was raised and a new recreation facility complex was built on a neighboring property donated by a local mining company, allowing a treatment wetland to be built on the former site.

Another creative project is located at the site of the Silver Creek AMD treatment system, where a series of ponds were constructed to remove iron and other metals from a large discharge to the Schuylkill River. The project is used as an educational area to demonstrate new re-vegetation practices, serves as a source of water for the local fire company, and in the near future, will host an educational walking trail.

There have been significant accomplishments addressing AMD because of the efforts and dedication of the local partners that make up this workgroup. Over the past 10 years, more than \$14 million have been invested in the watershed to implement nearly 45 projects. Dozens of partners have worked together to develop new treatment technologies, leverage resources, and implement projects to clean up the river.

AMD Workgroup Projects

- ▲ Coal Silt Stabilization
- ▲ Infiltration Abatement
- ▲ Mine Land Reclamation
- ▲ Planning
- ▲ AMD Treatment System
- ▲ Watershed Study
- ▲ AMD Discharges



Silver Creek AMD BEFORE



Silver Creek AMD AFTER



Project Spotlight: Pine Knot Watershed

The Pine Knot Discharge is the largest source of iron and manganese pollution in the Schuylkill Watershed, spilling over 35 million gallons of polluted water into the Schuylkill River each day. Much of this spillage originates from stormwater seeping into the mine system through fractures in the surface above. Since there is not enough room to build a treatment system for a discharge of this size, work is being done to make the discharge smaller. For the past several years, the workgroup has been involved in conducting a feasibility study for treating the discharge. The 20 square mile watershed that drains to the Pine Knot discharge is complex due to intense underground and surface mining. The project includes intensive data collection by the U.S. Geologic Survey and modeling of surface and groundwater impacts on the mine discharge. The U.S. Army Corps of Engineers created model simulations of runoff and infiltration during a storm event. The Schuylkill Conservation District and Schuylkill Headwaters Association have been leading a series of projects to keep water on the surface and out of the underground mine pool. While there is still much work to do and more information to collect to fully address this problem, this creative and collaborative approach is helping meet the challenge.



Pathogen and Compliance Workgroup

The source water assessment report for the Schuylkill River watershed found that improper waste water collection and treatment impacts the quality of drinking water supplies, recreational activities, and aquatic life through contributions of pathogens and other pollutants. The Pathogen and Compliance Workgroup is taking steps to address this issue by working with waste water utilities, regulatory agencies, and local leaders on a variety of planning, reporting, maintenance and operation, and appropriate enforcement activities.

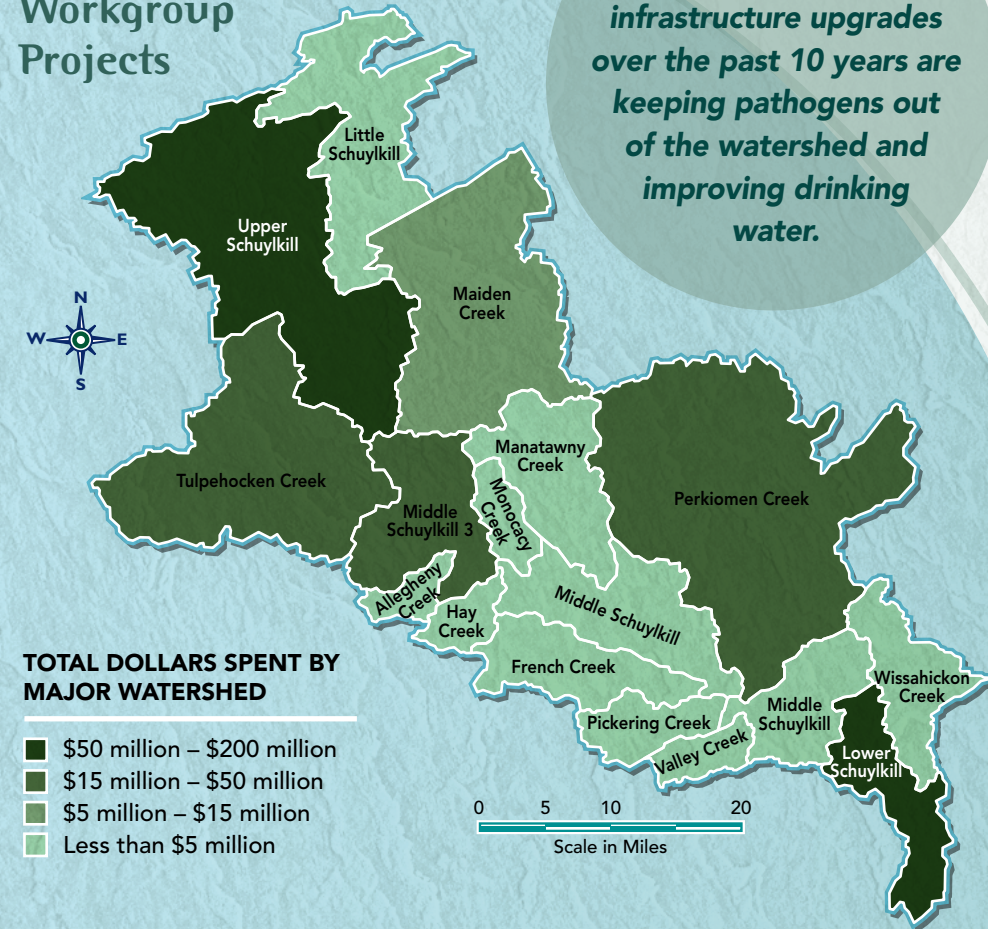
Tackling this issue in a watershed the size of the Schuylkill is not always easy. There are over 3,500 permitted dischargers, 78 large sewage treatment plants, and thousands of household septic systems that may cause pathogen problems in the watershed. The workgroup is focused on providing technical assistance to sewage treatment plant operators within the watershed, reducing sewage discharges, improving sewer system capacity, and improving the operation and maintenance of on-site septic systems.

Over the past 10 years, many improvements have been made in the watershed to address these problems. One recent example of success can be found in Tamaqua, PA. In late 2010, PA DEP identified 81 suspected unpermitted discharges to Wabash and Panther Creeks. PA DEP worked with the borough of Tamaqua to verify the discharges and develop a plan and time table to connect them to the borough's sewer systems. Throughout the watershed, the majority of these types of discharges, commonly referred to as wildcat sewers, have been eliminated or are being addressed.

Ailing infrastructure in the watershed is often a cause of the pathogen problem. The workgroup has been assisting waste water treatment plants with upgrades and improvements in technology. Supporting this, PENNVEST, a major partner in the workgroup, invested over \$360 million to upgrade sewage treatment plants, expand sewage conveyance systems, and reduce nonpoint source pollution impacts in the watershed. One significant accomplishment for the workgroup is the Reading Sewage Treatment Plant, which is the largest municipal discharger to the Schuylkill. The treatment plant had been a source of pollution to the watershed for many years, but in 2005 after entering into a Consent Decree, upgrades are being planned and improvements made to the system.

More than \$365 million worth of infrastructure upgrades over the past 10 years are keeping pathogens out of the watershed and improving drinking water.

Pathogen and Compliance Workgroup Projects



The workgroup's regulatory community has also led enforcement efforts when necessary. In 2006, 25 gallons of potassium thiocyanate, a chemical commonly used in vaccines, was released by Merck into a sewage treatment plant, killing over 1,000 fish and threatening water supplies. In late 2007, Merck agreed to a \$20 million settlement and paid over \$1.5 million in fines.

In the next several years, the workgroup will strive to maintain the current level of coordination and communication provided by wastewater treatment compliance practitioners, while identifying new opportunities to improve compliance and reduce threats to drinking water outbreaks. The workgroup will also maintain its focus on reducing illegal discharges, supporting and promoting the Delaware Valley Early Warning System (see below), and supporting planning efforts aimed at reducing pathogen introduction in the watershed.



Project Spotlight:



Delaware Valley Early Warning System



Early notification of changes in river water quality are important to public water suppliers whose drinking water intakes are on both the Schuylkill and Delaware Rivers. In 2004, the Philadelphia Water Department, with funding provided by the Pennsylvania Department of Environmental Protection and the U.S. Environmental Protection Agency, developed the Delaware Valley Early Warning System. The system provides a secure and centralized location through which the Early Warning System participants, including water utility personnel, emergency responders, government agencies, and industry representatives, can share information about source water quality and emergency or contamination events. The system is operated and maintained by the Philadelphia Water Department with contributions from the users.



Stormwater Workgroup

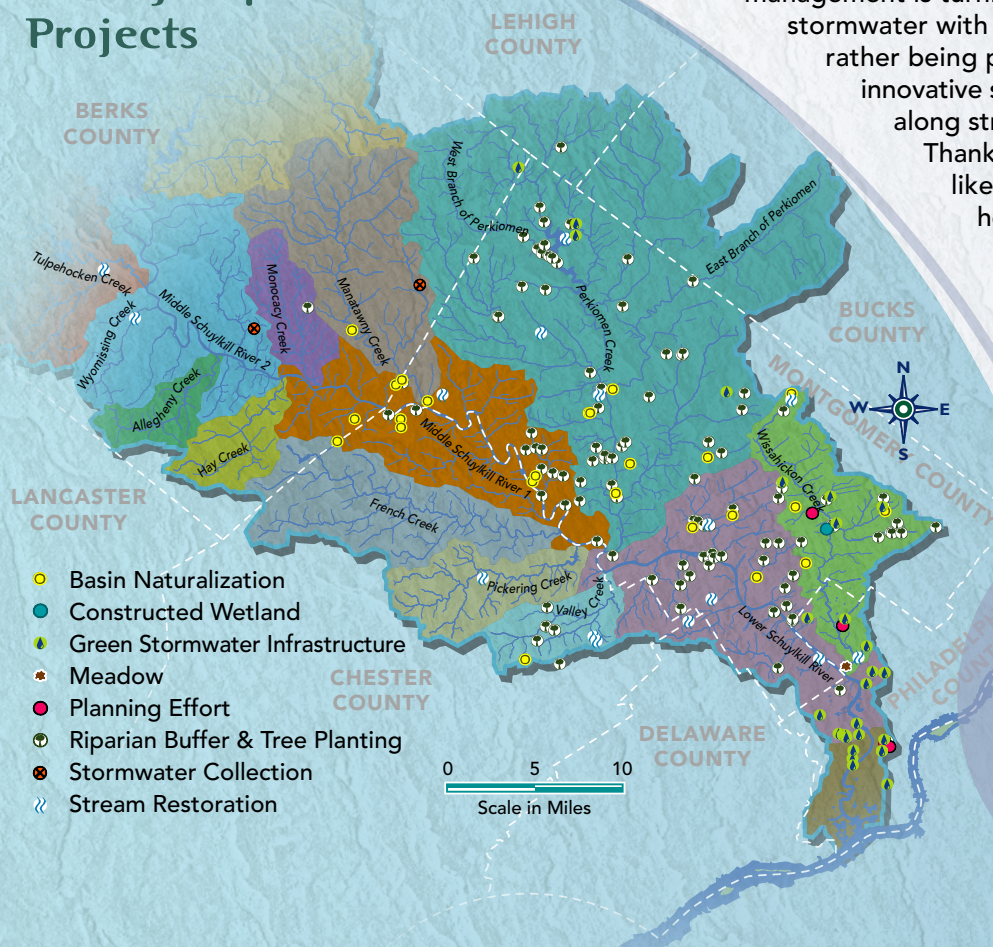
Stormwater is one of the biggest sources of pollution in the Schuylkill Watershed. For decades, open space and forests in the watershed were replaced with hard, impervious surfaces such as buildings, paved roads, sidewalks, and parking lots. The runoff created by these developed areas was often compounded with more concrete in the form of pipes and channels to transfer stormwater to streams. When it rains, water flows over these hard surfaces and carries dirt, trash, and other land-based pollutants into our creeks and rivers and then out to the Delaware Bay.

But today, stormwater management is looking far less gray because of the collaborative efforts of organizations such as the SAN Stormwater Workgroup. Workgroup partners have been helping local governments, businesses, and informed citizens change the way we think about stormwater; and because of this, the tide of stormwater management is turning decidedly green. Using the model of Mother Nature, we are now treating stormwater with water-loving plants and trees, which allows water to soak back into the ground rather than being piped to the closest stream. This is all happening through the installation of innovative stormwater practices such as swales, naturalized basins, green roofs, tree plantings along streams, rain gardens, and other activities designed to capture and absorb runoff. Thankfully, we are starting to see this take place on larger scales. Innovative programs like the Philadelphia Water Department's *Green City, Clean Waters* initiative are helping to prove that these better stormwater management options can not only work, but make both economic and environmental sense.

Over the past 10 years, the SAN stormwater workgroup has served as an advisory committee for state and local governments, an ordinance review board for municipalities, and a support group for large and small projects throughout the Schuylkill watershed. Working together, our member organizations have developed collaborative grant proposals and held educational and training workshops for various audiences.

More than \$21 million has been invested to complete over 200 projects to reduce stormwater pollution problems throughout the watershed.

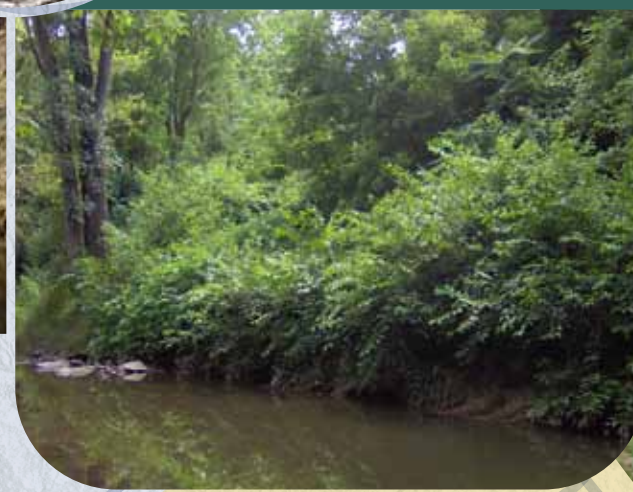
Stormwater Workgroup Projects



BEFORE (Fall 2005)
Norristown Farm Park
streambank stabilization



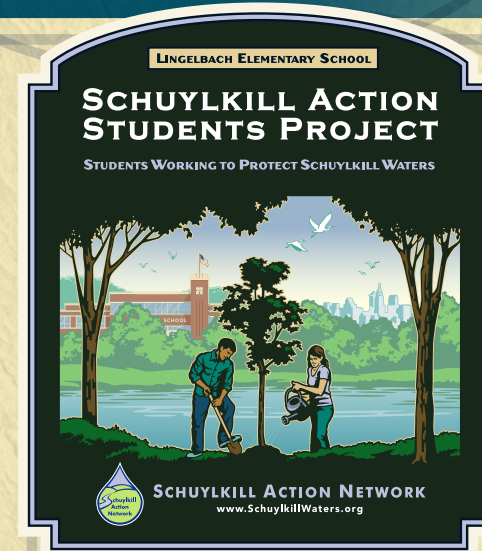
AFTER (August 2008)
A healthy, stable streambank



Project Spotlight: Schuylkill Action Students



One of the most serious threats to the water quality of the Schuylkill River Watershed is stormwater pollution. At greatest risk from this pollution and need for protection are the many smaller and more vulnerable headwater streams. In an effort to address this need, the SAN Stormwater Workgroup initiated the Schuylkill Action Students program, which aims to complete innovative stormwater practices on school campuses along these streams. Schools, which are one of the largest landowners in the watershed, provide a direct connection to many critical waterways. Completing projects with schools also creates a unique opportunity to engage students, families, and regional stakeholders. Since its start in 2011, the initiative has helped schools complete over a dozen projects, including rain gardens, tree plantings, meadows, and stabilizing streambanks.

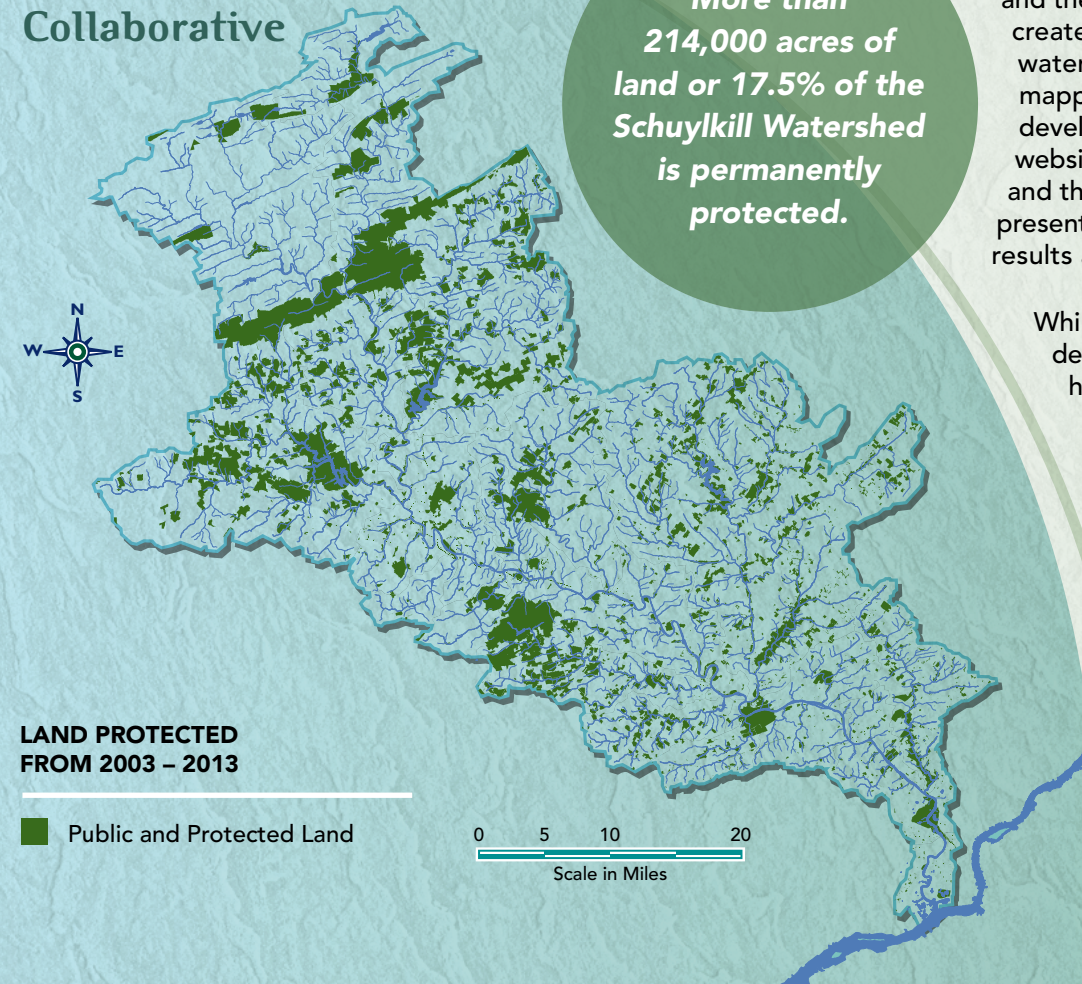


Watershed Land Protection Collaborative

The SAN's Watershed Land Protection Collaborative (WLC) has come a long way since its inception in 2005. The WLC began as a subset of the Stormwater workgroup, and gained enough momentum and interest to become a full-fledged group. The WLC was conceived to provide the expertise and energy to identify and protect land most critical for drinking water protection needs. It is the only SAN workgroup that focuses on preventing impairments, and serves as an important forum for collaboration between agencies such as the PA Department of Environmental Protection (DEP) and the PA Department of Conservation and Natural Resources (DCNR). Over the last seven years, the WLC created and refined a list of priority lands and generated programs to support action on the findings.

Watershed Land Protection Collaborative

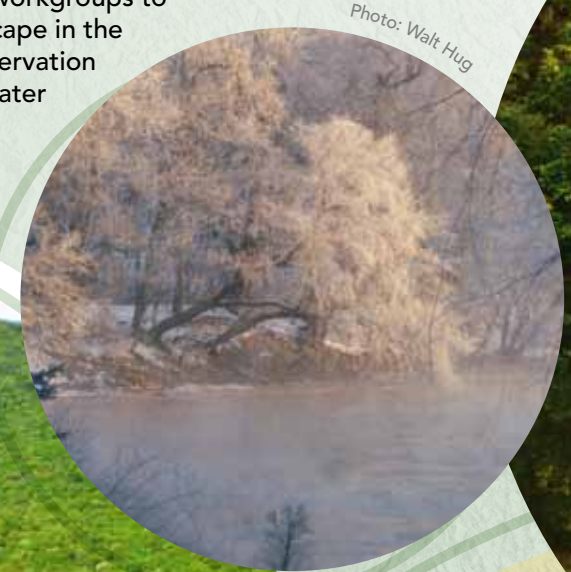
More than 214,000 acres of land or 17.5% of the Schuylkill Watershed is permanently protected.



The original prioritization work was funded through a PA DEP Growing Greener grant. WLC member organizations, Natural Lands Trust, Philadelphia Water Department, and the Delaware Valley Regional Planning Commission, led the charge to create the prioritization tool which ranked land in the Schuylkill River watershed based on its value in protecting drinking water. The mapping was completed in 2007, and the WLC shifted focus from developing a robust tool to promoting its use. The Priority Land website was created (<http://www.schuylkillprioritylands.org>), and the group drove traffic to the site through brochures and presentations. The site gives users access to prioritization results and information about the prioritization process.

While the WLC's initial work was data-driven (in order to develop the tool), the group's efforts from 2009 onward have been increasingly focused on utilizing the tool for on-the-ground outreach and results. The group completed and analyzed two case studies where partner organizations Berks County Conservancy and Montgomery County Lands Trust used the tool to improve zoning and identify land protection priorities in two different municipalities. More recently, the WLC reached out to municipal officials of townships in priority areas to inform them about the importance of their land and how to use the tool to develop conservation goals. In 2011, the WLC, along with the Schuylkill River Heritage Fund advisory board, started a land transaction assistance program to help complete transactions for the protection of priority lands.

Moving forward, the WLC has set a five-year goal of maintaining or increasing the pace of priority lands protected, and endeavors to continue its on-the-ground work through land trusts and conservancies to aid in priority land preservation. The workgroup continues to conceive of new and interesting ways to engage municipal officials and water purveyors in conservation efforts, and anticipates working with other SAN workgroups to meet its goals. By promoting a sustainable landscape in the Schuylkill River watershed through strategic conservation and efficient land resource use, the integrity of water supplies for future generations can be protected.



Project Spotlight: Land Transaction Assistance Program

In 2011, the SAN WLC initiated the Land Transaction Assistance Program, which provides small grants to assist with transaction costs for permanent land protection projects (conservation easements, full fee acquisitions, donations, etc.) within the Schuylkill River watershed. Grants can be awarded to qualified non-profit tax-exempt 501(c)(3) conservation organizations or units of government. The purpose of these grants is to incentivize and facilitate the protection of high-priority lands for water quality and habitat protection in the Schuylkill River watershed. Funding for the program has been provided by the Partnership for the Delaware Estuary, Philadelphia Water Department, and Exelon Nuclear Corporation; and is administered through the Schuylkill River Restoration Fund. To date, the land transaction assistance program has helped complete a total of six easements covering more than 500 acres.

Photo: Schuylkill County Municipal Authority

Education and Outreach Workgroup

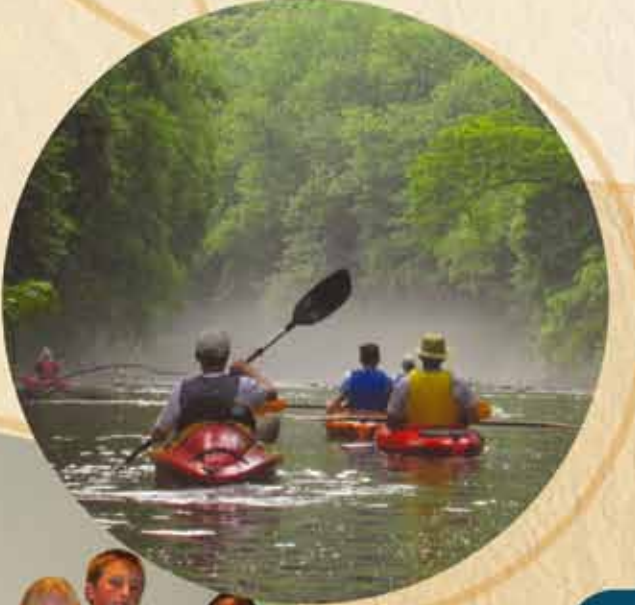


A clean and healthy Schuylkill River is only possible if we all pitch in and do our part. Over the past 10 years, the SAN Education and Outreach Workgroup has taken steps to educate the community on ways they can help protect and restore the river. One of the first tasks completed by the workgroup was the creation of a tool to get all of the SAN partners working together: the **SchuylkillWaters.org** website. The website provides a wealth of information about the SAN, its projects, and the River itself. It also has a behind the scenes feature where committee members can share information and easily communicate with each other. In addition to the website, the workgroup created various informative displays, outreach materials, banners, even several videos to help get the word out on protecting Schuylkill waters.

After streamlining the SAN's internal communications, the workgroup took aim at promoting opportunities for people to get out and enjoy the river. While the Schuylkill is an important resource for drinking water, it is also a place where people go to have fun and recreate. Each year, the Schuylkill hosts some great public river events and activities including regattas, sojourns, triathlons, and river festivals. Countless people are also returning to the river to boat, fish, walk, bike, or run along the Schuylkill River Trail. The workgroup also wanted to help people take a more active role in keeping the watershed clean. For the past four years, the SAN has helped host the Schuylkill Scrub, a series of watershed-wide cleanup events. In 2012, over 90 cleanups with thousands of volunteers took place throughout the watershed.

The workgroup has also found ways to raise the awareness of the importance of the river. Each year, the SAN honors students whose projects help to keep our rivers and creeks clean through the Drinking Water Scholastic Awards. The workgroup also provides resources to teachers to link watershed activities with school curriculum through teacher trainings, outreach materials, and curriculum support. In 2012, the workgroup also offered a new opportunity for individuals to show their appreciation of the river through the Schuylkill Shots photo competition. Over 150 images were entered into the contest capturing great examples of why the river is important to so many people.

To learn more about the Schuylkill River, SAN projects, or become a member, visit us online at www.SchuylkillWaters.org.



Project Spotlight: Stormwater Guides

Stormwater is an issue that impacts many communities throughout the watershed. With new safeguards, flooding concerns, and changing climates, stormwater is a topic that is on the minds of many. It is also a cause of over 30% of all polluted streams in the watershed. To help solve this problem and engage communities and landowners in the solution, the SAN developed a series of stormwater education guides and outreach materials. These publications provide innovative examples of managing stormwater for homeowners, schools, municipalities, and businesses. They are available for download at www.schuylkillwaters.org/san_publications.

The workgroup is also expanding highly successful outreach programs by replicating them throughout the watershed. Stormwater guides, described below, teach property owners how to capture and filter polluted runoff on their property. A pilot pharmaceutical take back program, teaching people the proper way to dispose of their unused medications, is reaching completion. Also, a spokesdog competition to help educate dog owners of the importance of picking up pet waste is just getting underway. It has been exciting to see the rewards of over a decade's worth of outreach in the Schuylkill. The workgroup has many more ideas in store and looks forward to another 10 years of success.



Photo: John Ratana

River Events Stastitics 2005-2012

| | |
|----------------------------------|----------------|
| Dad Vail Regatta | 26,600 |
| Past Triathlons | 3,000 |
| Philadelphia Insurance Triathlon | 26,500 |
| Philadelphia Women's Triathlon | 5,769 |
| PWD Fishing Festival | 1,451 |
| Schuylkill Dragon Boat Races | 21,650 |
| Schuylkill River Festival | 21,000 |
| Schuylkill River Sojourn | 2,108 |
| SheRox Philly Triathlon | 6,038 |
| Stotesbury Cup Regatta | 40,600 |
| TOTAL PARTICIPANTS | 154,716 |

Schuylkill River Restoration Fund

The Schuylkill River Restoration Fund is starting its eighth year working to improve the quality and quantity of the Schuylkill River waters through its unique partnership and grant program. Since its inception, over \$2.2 million have been contributed to the fund from Exelon Nuclear Corporation, the Philadelphia Water Department, Aqua Pennsylvania, and the Partnership for the Delaware Estuary.

Over 30 projects have been funded through this program since it was created in 2006. Projects focusing on abandoned mine drainage, agricultural remediation, stormwater runoff improvements, and protecting high priority land are supported through this initiative. All projects address priority problems and help protect drinking water supplies in the Schuylkill watershed.

One of the most unique aspects of this project is the public/private partnerships that are highlighted not only through our funding partners and our grant constituents, but also through our leadership team. Individuals from the Environmental Protection Agency, PA DEP, Delaware River Basin Commission, Philadelphia Water Department, Exelon Nuclear Corporation, the Partnership for the Delaware Estuary, and the Schuylkill Action Network make up the Advisory Committee that oversees the program.

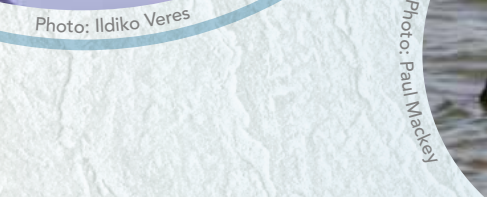
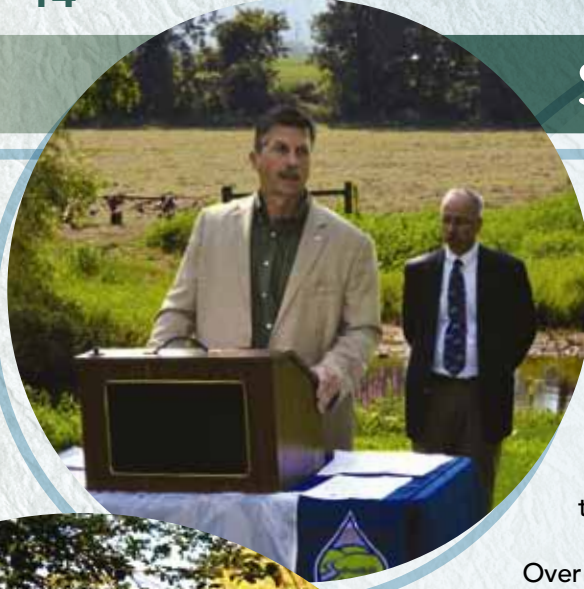


Photo: Ildiko Veres

Photo: Paul Mackey



BEFORE
Eroded streambank



AFTER
Healthy streambank

Photo: Rebecca Chanoux



Become a Schuylkill Waters Partner

The Schuylkill River Restoration Fund has helped to direct critical resources to restore and protect our Schuylkill Waters. In addition to the 2 million people that rely on the river for drinking water, the Schuylkill River plays a critical role as an economic engine for the region. This funding initiative allows businesses, water suppliers, and other watershed stakeholders to invest in one of our most significant natural resources.

By participating as a fund donor, you can be assured that your contributions will be targeted at science-based projects that will result in measureable improvements to the watershed. Over the past seven years, all money disturbed through the fund has been matched by over 50% of public and private dollars. All contributions are tax-deductible and can be targeted to certain geographic regions or to address specific watershed areas. To learn more about the fund and find out how you can become a watershed partner, please contact the Schuylkill River Heritage Area or SAN Coordinator.



SCHUYLKILL RIVER NATIONAL & STATE HERITAGE AREA

Schuylkill River Heritage Area
484-945-0200
TFenchel@schuylkillriver.org
www.SchuylkillRiver.org

Schuylkill Action Network Coordinator
Tom Davidock
302-655-4990, ext. 109
tdavidock@DelawareEstuary.org
www.DelawareEstuary.org



Photo: Kelly Jo Lewis



Photo: Kim Glodok



Photo: Dawn Barger

Schuylkill Action Network Members

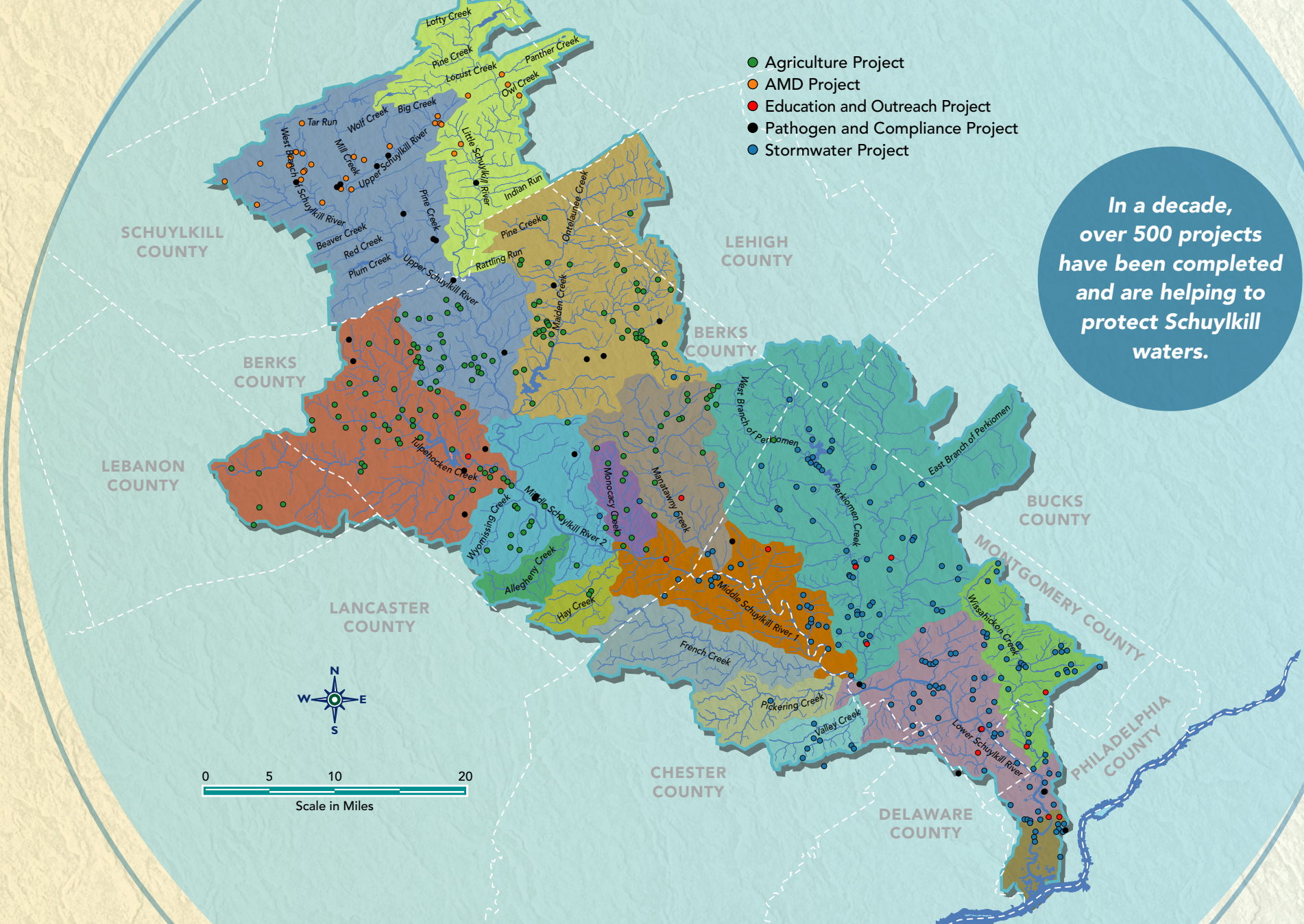
AD Marble & Company
 AKRF Inc.
 Albright College
 Alfred Benesch & Company
 Ambler Borough Water Department
 AMEC
 Aqua Pennsylvania
 Audubon Pennsylvania
 Barry Isett and Associates
 Berks County Agricultural Land Preservation
 Berks County Conservancy
 Berks County Conservation District
 Berks County Planning Commission
 Berks Gas Truth
 Birdsboro Municipal Authority
 Blythe Township Municipal Authority
 Boyertown Water Authority
 Bucks County Planning Commission
 Center for Watershed Protection
 Chester County Department of Environmental Health Protection
 Chester County Planning Commission
 Chester County Water Resources Authority
 Christopher Dock High School
 City of Philadelphia
 City of Reading
 Clean Water Action
 Conrad Weiser Middle School
 Delaware County Planning Department
 Delaware River & Bay Authority
 Delaware River Basin Commission
 Delaware Valley Regional Planning Commission
 Destination Schuylkill River
 Drexel University
 East Falls Development Corporation
 East Greenville Borough Water Department
 East Norriton Middle School
 Eastern PA Coalition for Abandoned Mine Reclamation
 EcoExpress – GreenTreks
 Evans Elementary School
 Exelon Corporation

F.X. Browne Inc.
 Friends of Mingo Creek
 Friends of the Wissahickon
 Geo-Life, Inc.
 Germantown Academy
 Green Valleys Association
 Greenfield Elementary School
 Greenspace Alliance
 GreenTreks
 Hamburg Municipal Water & Sewer Authority
 Hay Creek Watershed Association
 Heritage Conservancy
 Keep Tap Water Safe
 Kent Surveyors and Engineers
 Kutztown Middle School
 L. Robert Kimball & Associates, Inc.
 Land & Stream Improvements, LLC
 Lankenau High School
 Lebanon County Conservation District
 Lehigh County Conservation District
 Limerick Elementary School
 Lingelbach Elementary School
 Lower Merion Conservancy
 Lower Merion Historical Society
 M&M Solutions
 Maiden Creek Watershed Association
 Meliora Design
 Michael Baker Jr., Inc.
 Miller Environmental, Inc.
 Minersville Area Water Authority
 Miquon School
 Montgomery County Planning Commission
 Montgomery County
 Montgomery County Conservation District
 Montgomery County Lands Trust
 Muhlenberg Township
 Native Return, LLC
 Natural Lands Trust
 Natural Resource Conservation Service
 Nature Conservancy
 North Wales Water Authority

Owen J. Roberts Middle School
 PA Department of Conservation and Natural Resources
 Partnership for the Delaware Estuary
 Penn State Public Broadcasting
 Penn State University
 Pennsylvania American Water Company
 Pennsylvania DCNR Bureau of Forestry
 Pennsylvania Department of Environmental Protection
 Pennsylvania Environmental Council
 Pennsylvania Farm Bureau
 Pennsylvania Fish and Boat Commission
 Pennsylvania Forestry Association
 Pennsylvania Game Commission
 Pennsylvania Horticultural Society
 Pennsylvania Organization for Watersheds and Rivers
 Pennsylvania Rural Water Association
 Pennsylvania Sea Grant
 PENNVEST
 Perkiomen Watershed Conservancy
 Philadelphia Water Department
 Pomona Grange
 Port Indian Civic and Boating Association
 Pottstown Borough Water Authority
 Radnor Conservancy
 RCAP Solutions
 Reading Area Community College
 Reading Area Water Authority
 RETTEW Associates, Inc.
 River Alert Information Network (RAIN)
 Riverbend Environmental Education Center
 Robeson Elementary School
 Rosetree Consulting
 Saucony Creek Brewing Company
 Schuylkill Canal Association, Inc.
 Schuylkill Center for Environmental Education
 Schuylkill County Conservation District
 Schuylkill County Municipal Authority
 Schuylkill County Planning Commission
 Schuylkill Haven Borough Water

Schuylkill Headwaters Association
 Schuylkill River National and State Heritage Area
 Schuylkill RiverKeeper
 Sierra Club
 Southeastern PA Resource Conservation & Development Council
 Spotts, Stevens and McCoy, Inc.
 Spring City Borough
 Stormwater PA
 Stroud Water Research Center
 Sustainable Business Network
 Sustainable Choices
 Tamaqua Area Water Authority
 Temple University
 The Paradise Watchdogs
 Towson University Center for GIS
 Trout Unlimited
 U.S. Army Corps of Engineers
 U.S. Department of Agriculture
 U.S. Environmental Protection Agency
 U.S. Fish & Wildlife Service
 U.S. Forest Service, NA S&PF
 U.S. Geological Survey
 U.S. Office of Surface Mining
 UJMN Architects & Designers
 Unicorn Management Consultants LLC
 University of Pennsylvania
 Upper Merion School District
 Upper Merion Township
 Upper Perkiomen School District
 URS Corporation
 Ursinus College
 Valley Creek Restoration Partnership
 Valley Forge Watershed Association
 Villanova University
 Water Resources Education Network
 West Reading Elm Street
 Western Berks Water Authority
 Whitpain Township
 William Penn Foundation
 Wissahickon Restoration Volunteers
 Wissahickon Valley Watershed Association
 Women's Health & Environmental Network

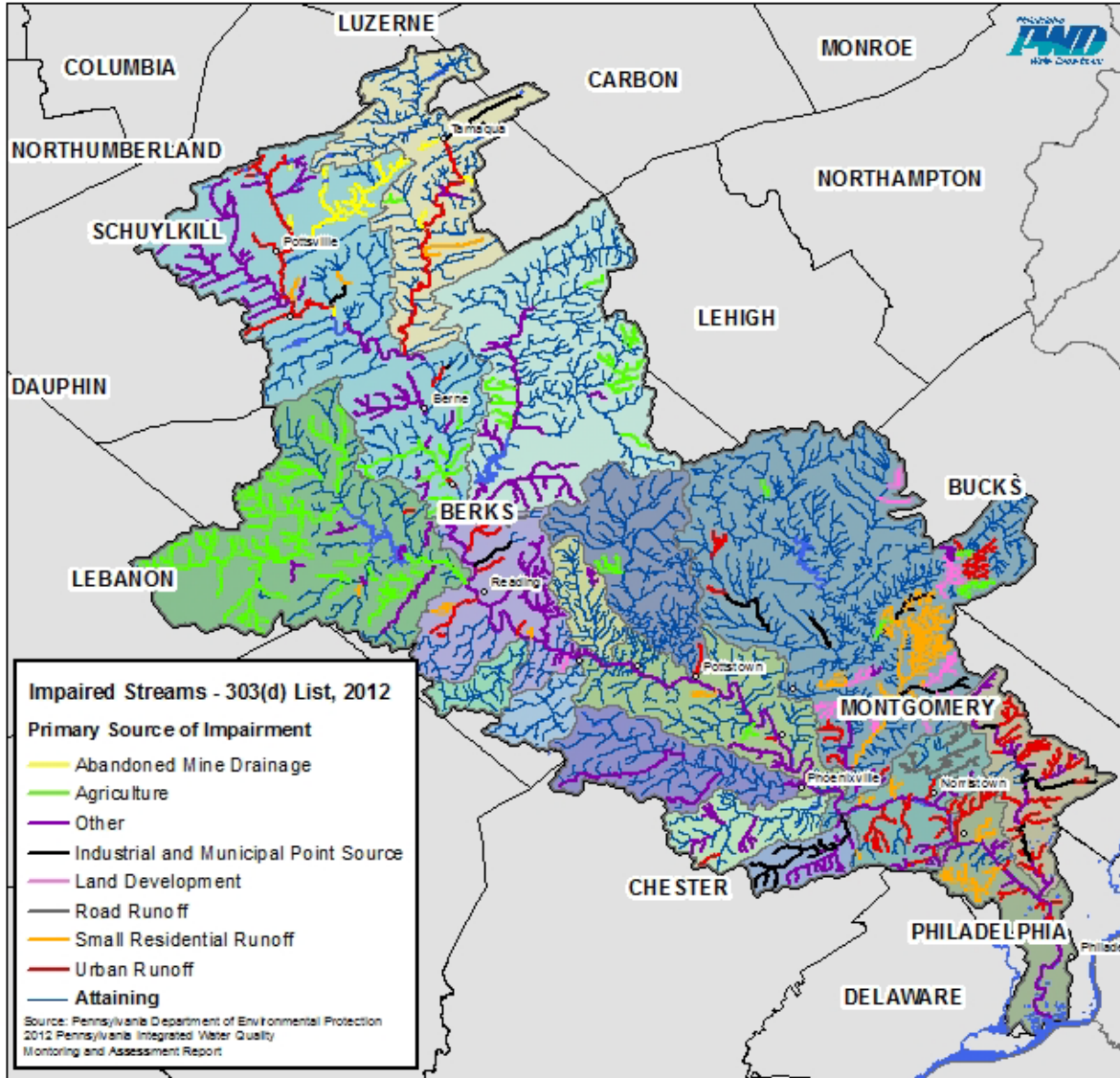
Schuylkill Watershed Projects: 2003-2013



In a decade, over 500 projects have been completed and are helping to protect Schuylkill waters.

Appendix H: 303(d) List of Impaired Streams

Primary Sources of Impairment



| Listed as Impaired in 2010 but Attained in 2012 | | | |
|--|---------------------------|--------------------|--------------|
| Stream Name | Cause | Year Listed | Miles |
| Goose Run | Nutrients | 2002 | 8.3 |
| | Organic Enrichment/Low DO | 2002 | 8.3 |
| Little Sacony | Siltation | 2004 | 1.8 |
| Tulpehocken | PCB | 2002 | 13.8 |

Source: PA DEP 2012 Pennsylvania Integrated Water Quality Monitoring and Assessment Report

Appendix I: Additional Literature Sources for *Cryptosporidium* Loading Estimates

| | beef cattle, dairy cattle, calves | swine, sheep, horse |
|---|--|---|
| Estimated Prevalence of Infection in Animals | (Cox et al., 2005); (Fayer et al., 2006); (USDA, 1993) | (Cox et al., 2005); (Johnson et al., 1997) |
| <i>Cryptosporidium</i> oocysts per day per animal | (Atwill et al., 2003) | -- |
| <i>Cryptosporidium</i> oocysts per weight feces | -- | (Cox et al., 2005) |
| Weight manure per day per animal | -- | (ASAE, 2003) |