



**2014 Pennsylvania Integrated Water Quality
Monitoring and Assessment Report**

**Clean Water Act
Section 305(b) Report and 303(d) List**

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EXECUTIVE SUMMARY

Pennsylvania has a population of 12,763,536 and area of 45,333 square miles. There are six major river basins - Delaware, Susquehanna, Genesee, Potomac, Ohio, and Lake Erie - with an estimated 86,000 stream and river miles and 161,455 lake acres. Seventeen square miles of Delaware Estuary and 512 acres of tidal wetlands exist in the southeast corner. In the northwest corner are 63 miles of Lake Erie shoreline. Scattered throughout the state are 403,924 freshwater wetlands. These numbers illustrate the magnitude and complexity the Pennsylvania Department of Environmental Protection (DEP) faces in assessing, protecting, and managing its water resources.

There are several goals of the 2014 Integrated Water Quality Monitoring and Assessment Report (Integrated Report). Foremost is to report on the condition of the waters in the Commonwealth. Other goals include describing the water pollution control and assessment/monitoring programs. Pollution control programs are discussed in detail in Part B, and Assessment and Monitoring in Part C. The report concludes with a discussion of groundwater in Part D.

Part A summarizes and discusses stream and lake assessments. The introduction describes the five-part list. These lists of individual waterbodies are separate from the narrative because of their size and are available on DEP's website.

In April 2007 DEP completed a ten year program to assess all Wadeable streams. The census utilized a biological assessment of the aquatic life use. Since 2007, DEP has implemented new aquatic life biological assessment methods based on the current best science. Other designated uses and non-Wadeable waters continue to be assessed as resources and time permit. As of this report, 83,438 miles of streams and rivers are assessed for aquatic life use with 67,556 miles listed as attaining that water use. Of the impaired miles, 9,031 require development of a Total Maximum Daily Load (TMDL) to reduce pollutant inputs and 6,851 have an approved TMDL. An additional 72 miles are under compliance agreements and expected to improve within a reasonable amount of time. The two largest problems are agriculture and abandoned mine drainage. The largest stressors are siltation and metals. However, other problems should not be minimized because in local areas they may impact a relatively large percentage of waters. For example, urban runoff/storm sewers is a minor problem in rural areas but major in metropolitan regions.

There are 79,986 acres of lakes assessed for aquatic life use and 42,225 acres are attaining that use. Of the impaired acres, 6,052 require a TMDL, 11,096 have an approved TMDL, and 20,611 acres are impaired but do not require a TMDL because they are not affected by pollutants. The largest problem source is agriculture and largest stressors are nutrients, suspended solids, and organic enrichment/low D.O. As discussed above, smaller problems still have regional importance.

To protect the health of those who consume fish caught in the Commonwealth, DEP monitors fish flesh for possible contaminants. When concentrations of substances known to be harmful to humans reach action levels, fish consumption advisories are

issued to inform people of the possible dangers and the actions they can take to protect themselves. Currently there are approximately 1,784 miles of fish consumption advisories in need of TMDLs and 712 with approved TMDLs. Lake listings include 29,766 acres requiring TMDLs and an additional 5,642 with approved TMDLs. There is a statewide fish consumption advisory of no more than one meal per week for all waters to protect against the ingestion of unconfirmed contaminants. The fish consumption listings in this report have triggered action levels more restrictive than the one meal per week. It should be noted that DEP directs much of its fish tissue sampling to areas where there is a greater chance of problems. As a result, it is not surprising to see a higher number of stream miles and lake acres impaired for this use compared to the stream miles (6,211) and lake acres (33,016) attaining this use.

Aquatic life use was the original focus of the statewide surveys because with a rapid and efficient biological assessment of aquatic macroinvertebrates (insects, snails, clams, etc.) it was possible to canvas the state over a ten year period. In addition, aquatic life use is a good measure because it is reliable as an indicator of long term pollution problems. Since completing the statewide census for aquatic life use, DEP is emphasizing developing assessment methodologies, programs, and partnerships to increase recreational and potable water supply use assessments.

Of the 4,994 stream miles assessed for recreational use, 3,109 were attaining. There are 1,784 impaired miles requiring a TMDL and 20 with an approved TMDL. Lake recreational use was assessed for 81,390 acres with 76,186 attaining, and 5,204 impaired requiring a TMDL. The potable water supply use was assessed for 3,358 stream miles with 3,275 attaining, 71 impaired requiring a TMDL, and 12 with approved TMDLs. Lake potable water supply use was assessed for 58,859 acres with 58,224 attaining, and 635 impaired requiring a TMDL.

Part B is the narrative describing the Commonwealth's water pollution control programs. The section begins with a description of efforts to prevent pollution before it becomes a problem. On other fronts, DEP has programs to encourage reduction in pollution that also provide cost savings to the treatment facilities. Examples of these successes are provided.

As evident in the Part B narrative, the Commonwealth's permitting and National Pollution Discharge Elimination System (NPDES) program is complex and deals with a large number of inspections and permits including regulating and permitting treatment facilities for 10,500 industrial and sewage dischargers. Pennsylvania is a large producer of coal and natural gas and all mining and extraction activities require permits and inspection. It is DEP's responsibility to issue permits that assure stormwater from earthmoving and construction activities is managed properly so as not to cause damage to streams or adversely affect their hydrology. County conservation districts work with DEP on stormwater protection. DEP also regulates combined sewer overflows (CSO) and manages and protects wetlands.

Part B also includes a discussion of non-point source programs. Pennsylvania's Non-point Source (NPS) Program was developed in response to Section 319 of the federal Clean Water Act to address problems caused by pollution from non-point sources. Unlike point source pollution, which comes from pipes, the causes of non-point source

pollution can be difficult to define or quantify. Sometimes referred to as “polluted runoff,” a large portion of non-point source pollution is generally caused by stormwater runoff across the land or infiltration of pollutants into the groundwater.

Often non-point source problems require treating and controlling pollution runoff from large areas. Treatment and control is accomplished through what are known as best management practices (BMPs). BMPs are often specifically adapted to a particular location and problem. Examples include improving farming practices, reclamation of abandoned mines, installation of sediment ponds, and planting riparian buffers. A major function of the non-point source program is to identify the need for and initiate funding of BMP projects. In addition, since 2007, the non-point source program has been identifying improving waters to potentially delist from Category 5 to Category 2, and as a result 333 stream miles (total miles for all 4 uses) and 12,445 lake acres (total acres for all 4 uses) were identified as being restored and moved from Category 5 to Category 2 during the reporting cycle.

The NPS program works with the TMDL program. A TMDL model outputs a load reduction of, for example, sediment. That sediment load reduction must be achieved to meet water quality goals and the reductions are achieved through the use of non-point source BMPs. The NPS program provides technical assistance, education, and funding necessary to put the BMPs in place. Education is an important facet of the NPS program. It often takes a consortium of interested and active people concerned about their watershed to achieve NPS controls. The purpose and goals of the TMDL program are outlined following the section on the NPS program.

Growing Greener II funds were exhausted in 2009, however multiple funding sources that include Section 319, Growing Greener I, USDA Farm Bill funds and Conservation Reserve Enhancement Program (CREP) fund are important to the success of non-point source controls and programs as illustrated in the Part B narrative. In 2012 and 2013 these programs funded numerous BMP and restoration projects.

The combined efforts of the NPDES and NPS programs to identify and correct problems have resulted in many water quality improvements. In 2007, DEP began an ongoing process of identifying areas where restoration efforts were underway and targeting them for monitoring. When monitoring indicates the waters are restored, Department biologists document the improvements and remove the problem from Category 5 of the List (impaired waters requiring a TMDL) and place it in Category 2 (waters attaining at least one use). Thirteen such sites were identified and sampled in 2012/2013.

Part C is the Surface Water Quality Monitoring and Assessment discussion. It begins with a discussion of the Water Quality Standards Program which includes water uses, water quality criteria, and Pennsylvania’s Antidegradation Program.

The next three sections discuss monitoring programs including intensive surveys, ambient fixed station monitoring at Water Quality Network (WQN) sites, and lake monitoring.

The Citizen Volunteer Monitoring Program (CVMP) was reduced due to budget cuts in 2009 however, the Department still values citizen volunteer monitoring as an important

activity with the goal of working with interested groups in projects that generate quality assured data related to DEP's highest priorities. Ongoing projects include: bacteria sampling with the intent of assessing streams for recreational use and monitoring the effects of restoration efforts with the intent of tracking the improving water quality of streams and lakes.

EPA's Integrated Listing guidance requires states to gather and use all existing and readily available data generated by sources outside DEP. This data must meet quality assurance and procedural guidelines outlined by DEP. Data solicitations were sent to over 500 outside sources in an effort to satisfy this requirement.

The Assessment and Listing Methodology is a collection of protocols used to conduct field surveys and evaluate information for assessments. These protocols are the basis for the streams and lakes information contained in the Integrated Report narrative and the five part list. These protocols were subjected to peer review. Before being adopted, the entire methodology was made available for public review during the spring of 2009 and fall of 2013. The methodology is lengthy and as a result is reported separately from this narrative and is available on DEP's website.

The next several sections present detailed tables summarizing stream and lake use support. These tables formed the basis for the discussions presented at the beginning of the Executive Summary. The lakes section also contains discussions on restoration and control efforts. Some funding is available from DEP to restore and/or protect lakes. Control measures are codified in DEP's Rules and Regulations at Section 96.5(b) - Discharges to Lakes, Ponds, and Impoundments, which sets forth treatment requirements for point source discharges necessary to control eutrophication. Both efforts are important in protecting and restoring the Commonwealth's lakes. Section C ends with an overview of wetlands that describes the types of wetlands found, DEP's jurisdiction and responsibility to protect wetlands, and other wetland related activities.

Finally, Part D provides an overview of the groundwater program including assessment activities and wellhead and source water protection.

PART A: INTRODUCTION

This report is the twenty-second in a series of reports prepared in response to Section 305(b) of the federal Clean Water Act that requires states to provide an assessment of water quality. These reports are prepared on a biennial basis.

DEP uses an integrated format for Clean Water Act Section 305(b) reporting and Section 303(d) listing. The “2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report” satisfies the requirements of both Sections 305(b) and 303(d). The narrative that follows contains summaries of various water quality management programs including water quality standards, point source, and nonpoint source controls. It also includes descriptions of programs to protect lakes, wetlands, and groundwater quality. A summary of the use support status of streams and lakes is also presented in the narrative report.

In addition to this 305(b) narrative, the water quality status of Pennsylvania’s waters is presented using a five-part characterization of use attainment status. The listing categories are:

Category 1: Waters attaining all designated uses.

Category 2: Waters where some, but not all, designated uses are met. Attainment status of the remaining designated uses is may be unknown because data are insufficient to categorize the water or it may be impaired.

Category 3: Waters for which there are insufficient or no data and information to determine if designated uses are met.

Category 4: Waters impaired for one or more designated uses but not needing a total maximum daily load (TMDL). These waters are placed in one of the following three subcategories:

- *Category 4A:* TMDL has been completed.
- *Category 4B:* Expected to meet all designated uses within a reasonable timeframe.
- *Category 4C:* Not impaired by a pollutant and not requiring a TMDL.

Category 5: Waters impaired for one or more designated uses by any pollutant and requiring the development of a TMDL. Category 5 includes waters shown to be impaired as the result of biological assessments used to evaluate aquatic life use. Category 5 constitutes the Section 303(d) list EPA will approve or disapprove under the Clean Water Act.

Each waterbody must be assessed for four different statewide uses as defined in DEP 's rules and regulations at 25 Pennsylvania Code Chapter 93 (Water Quality Standards) in Section 93.3 Protected Water Uses. The four include: Aquatic Life, Water Supply, Fish Consumption, and Recreation. Generally, Aquatic Life pertains to maintaining flora and fauna indigenous to aquatic habitats; Water Supply relates to the protection of ambient water quality for possible use as a potable water supply; Fish Consumption protects the public from consuming tainted fish; and Recreation relates to water contact and boating. Each use may have different water quality criteria for individual chemical constituents and each use requires a different type of stream or lake assessment.

DEP encourages use of the Internet to view the Integrated Report documents electronically on its website at http://www.portal.state.pa.us/portal/server.pt/community/dep_home/5968, search

keyword "Water Quality". Full address is:

http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/draft_integrated_water_quality_report_-_2014/1702856

Because of the size of the five-part list, it will only be available electronically.

PART B: BACKGROUND

Part B1. Total Waters

Table 1

Atlas of Surface Waters in Pennsylvania

The following information is presented to provide a perspective on Pennsylvania's water resources:

State Population	12,763,536 [†]
State Surface Area (square miles)	45,333
Number of Water Basins (major basins)	6
Total Miles of Rivers and Streams	86,000*
Number of Lakes/Reservoirs/Ponds**	3,956
-Number of Significant, Publicly Owned Lakes (subset)	226
Acres of Lakes/Reservoirs/Ponds**	161,445 ^{††}
-Acres of Significant, Publicly Owned Lakes (subset)	104,024
Square Miles of Estuaries/Harbors/Bays	
-Delaware Estuary	17
-Presque Isle Bay	6
Miles of Great Lakes Shore	63 ^{†††}
Acres of Freshwater Wetlands	403,924
Acres of Tidal Wetlands	512

[†] 2013 US Census estimate

^{††} Lakes and ponds greater than two acres

^{†††} Lake Erie - Fourteen miles comprise the Presque Isle Peninsula.

* DEP estimate based on 1:24,000 scale National Hydrography Data (NHD) GIS stream coverage. This 86,000 may change as the NHD is quality assured and corrected.

** "Total Water Estimates for United States Streams and Lakes", EPA, August 1993

Part B2.1. Pollution Prevention and Energy Efficiency Program

DEP clearly recognizes the value of multi-media pollution prevention, resource conservation, and efficiency in providing environmental protection. Not only does preventing pollution create a healthier, more sustainable environment, it also saves money, contributing to a stronger economy. Programs throughout DEP are built upon the premise that not generating waste is preferable to dealing with waste after it is generated.

DEP's pollution prevention programs help government and businesses move beyond compliance-based, end-of-pipe thinking to preventing pollution before it is created -

effectively reducing adverse environmental impacts. The Office of Pollution Prevention and Energy Assistance (OPPEA) manages and administers programs for helping small businesses, industry, government, and schools to better manage their environmental impacts, reduce energy usage, and save money. Some major focus areas of OPPEA are economic development, indigenous energy, market barriers, energy efficient technologies, and green buildings.

The Small Business Pollution Prevention Assistance Account (PPAA) Loan Program provides low interest loans to small businesses undertaking projects (located within the Commonwealth of Pennsylvania) that reduce waste, pollution, or energy use. Loans will be used to fund 75 percent of the total eligible project cost. The maximum loan amount is \$100,000 within any 12-month period. Small businesses with 100 or fewer full-time employees are eligible. The loan has a fixed interest rate of 2 percent and a maximum loan term of 10 years. This funding can help small businesses comply with environmental regulations while receiving the economic benefits of preventing pollution and using energy more efficiently.

The Small Business Advantage Grant Program (SBAGP) provides 50 percent reimbursement grants up to \$9,500 to support eligible projects for eligible businesses. Each eligible business may only receive \$9,500 per fiscal year (FY). The SBAGP provides reimbursement grant funding to promote the pollution prevention and energy efficiency practices of small businesses. Businesses must save 25 percent plus \$500 annually as a direct result of implementing the grant supported project. During 2012-2013 Advantage issued 121 grants worth \$914,452 that leveraged \$3,386,777 of private sector funding.

DEP's contractor, The Pennsylvania Technical Assistance Program (PENNTAP) is working on projects through the Industrial Resource Centers, Manufacturing Extension Partnerships, Department of Energy (DOE) Industrial Assessment Centers, and the Ben Franklin Technology Partners utilizing DOE's Save Energy Now funding. The projects are focused on economic development, improved energy efficiency, and waste reduction. Since the program's inception in July 2011, PENNTAP has provided technical assistance for nearly 350 facilities in the form of on-site support activities. Waste and energy use-reduction assessments were performed at 28 industrial facilities. The assessments included 20 walk-throughs, 4 targeted, and 4 comprehensive. A DOE industrial energy system workshop on Compressed Air was conducted through Penn State's Continuing Education Program. Thirty students and business representatives participated. Additionally, five training events were conducted addressing the new international energy management standard, ISO 50001. PENNTAP is also advancing the ISO 50001 Energy Management Standard and the Superior Energy Performance (SEP) standard through a Demonstration project in which one New Jersey and four Pennsylvania industrial partners have been trained and mentored in the implementation of the requirements of the standards in order to achieve third party certification. For certification to SEP a company must demonstrate improved energy performance using a robust measurement and verification protocol. Minimum improvement required is a 5% reduction over three years or a 15% reduction over 10 years. One company (Mack Trucks, Macungie PA) has satisfied these criteria, demonstrating a 41.9% energy performance improvement over 10 years, and was awarded ISO 50001 and SEP certification in September 2013. The four other participating companies (North America

Hoganas (Hollsopple), Curtiss Wright EMD (Cheswick), Land O'Lakes (Carlisle), and Gerdau (Sayreville, New Jersey)) continue to work on their implementation and plan on certification in 2014.

DEP's Technical Assistance program, in conjunction with EPA Region III, provided the third and final "E2 -Energy Efficiency at Wastewater & Drinking Water Facilities" conference and training for water and wastewater professionals in the fall of 2013; the location was in eastern PA. DEP's Technical Assistance program, in conjunction with EPA Region III and the peer to peer energy team employees, will perform eight detailed energy audits at water/wastewater treatment facilities.

Part B2.2 (a). NPDES

Pennsylvania implements the EPA delegated point source National Pollutant Discharge Elimination System (NPDES) permitting program through DEP's six regional field offices and six district mining operations offices. While program development and evaluation occurs in DEP's central office, the field offices and district mining offices conduct site-specific permitting, monitoring, compliance, and enforcement activities. The central office also provides specialized assistance in the areas of policy, regulatory development, complex permitting, laboratory audits, safety training, treatment plant operations, enforcement, and data management.

The Toxics Management Strategy provides for a consistent statewide approach for addressing EPA priority pollutants and other toxic substances in the NPDES permit program. The strategy, parts of which are codified in Chapter 16, Water Quality Toxics Management – Statement of Policy, is a support document to DEP's toxics regulations, 25 Pa Code Section 93.8a -93.8c of the rules and regulations.

In state fiscal years 2012 and 2013 (July 1, 2011 – June 30, 2013), field office staff issued the following numbers and types of NPDES permits: 980 new, 2,172 renewals, and 146 amendments for municipal or private sewage treatment plants, industrial discharges, and storm water facilities.

Water Quality Management (WQM) permits authorize construction and operation of sewage collection and conveyance systems and sewage and industrial wastewater treatment facilities. The field offices issued 1,159 WQM permits and permit amendments for sewage and industrial waste treatment plants in state fiscal years 2012 and 2013.

Permitting summaries for other programs follow later in the document.

Part B2.2 (b). Compliance and Enforcement

The DEP point source control program regulates approximately 10,500 sewage and industrial dischargers in Pennsylvania. Approximately 408 of these are considered major dischargers based on EPA criteria. DEP field offices maintain a staff of field inspectors, hydrogeologists, biologists, compliance specialists, supervisors, and

managers to conduct activities including inspections of both NPDES and non-NPDES wastewater treatment facilities, emergency response, investigation of pollution incidents and complaints, and routine stream monitoring.

Approximately 9,700 facility inspections were conducted during state fiscal years 2012 and 2013. Generally, if environmental damage or willfulness is not involved in violations, an attempt is made to obtain voluntary compliance. In more serious situations, criminal, civil, or administrative actions may be used. DEP field offices completed approximately 2,000 such actions in state fiscal years 2012 and 2013, resulting in approximately \$5.3 million in penalties.

DEP's Outreach Assistance Provider Program conducted on-site training for wastewater treatment plant operators through 2009. Due to budget cuts, this program was ended in 2009. Permanent funding for the program was included in the fee package for the implementation of the Drinking Water and Wastewater Systems Operator Certification Program. As a result, this program is now in the process of restoring the wage payroll positions that were lost in 2009. The program should be able to provide this service again in the very near future. The priority for this program will be enhanced process control through on-site training of certified operators, resulting in improved compliance with permit requirements.

Tracking of data on effluent quality for major dischargers is accomplished through EPA's Integrated Compliance Information System (ICIS). There has been an ongoing effort to enhance the compliance monitoring program by automating the input of effluent limits data and discharge monitoring data to ICIS. In 2007, DEP implemented an electronic Discharge Monitoring Report (DMR) system to store monitoring data as well as a data system called the NPDES Management System (NMS) to store permit information. These systems have significantly increased the number of data elements that are electronically available.

At this time, DEP is electronically transferring the following data from its Environment, Facility, Application, Compliance Tracking System (eFACTS) enterprise data system, NMS, and eDMR system to EPA's ICIS system:

- Permit action and facility data for all NPDES facilities except concentrated animal feeding operations (CAFOs), as updates occur;
- Permit limits and monitoring requirements for Major NPDES facilities;
- Compliance inspections for all NPDES facilities;
- Discharge Monitoring Report (DMR) data for Major and Significant Chesapeake Bay facilities; and
- Enforcement actions for all NPDES facilities.

There are several checks and balances in place to ensure the quality of self-monitoring data. Since 2006, DEP's Bureau of Laboratories (BOL) has been responsible for oversight of all environmental labs. BOL provides a year-end report to EPA with details and accreditation information. In addition, field inspectors review information and self-monitoring data during surveillance activities and follow up as appropriate.

Part B2.2 (c). Mining

District mining operations offices, under the direction of DEP's Bureau of Mining Programs (BMP), issue NPDES discharge permits for active mining operations. During federal FY 12 and FY 13, the following new permits were issued: 4 Government Financed Construction Contract (GFCC), 1 prep plant, 86 coal surface, 14 coal underground, 3 coal refuse reprocessing, 2 coal refuse disposal, and 36 industrial mineral surface permits.

Part B2.2 (d). Oil and Gas

Revised Erosion and Sediment Control General Permit (ESCGP-2)

In January 2012, PA DEP published in the Pennsylvania Bulletin for a 60-day public comment a revised version of its Erosion and Sediment Control General Permit (ESCGP-2) for earth disturbance associated with oil and gas activities, along with four other supporting documents, including a draft permit application and a policy explaining the permit requirements. DEP considered all public comments and published as final the revised ESCGP-2 permit on 12/29/12. The former ESCGP-1 permit was phased out and expired on April 12, 2013.

The ESCGP-2 permit incorporates regulatory revisions, improves the administration of the program, and implements changes agreed to in a settlement with the Chesapeake Bay Foundation, Talisman Energy USA Inc., and Ultra Resources Inc.

The permit mandates protection of waterways and watersheds from sediment runoff during construction disturbing five acres or more over the life of an oil- or gas-related project.

DEP will no longer offer expedited review of permit applications for projects that have the potential to discharge sediment and runoff to exceptional-value or high-quality watersheds, have well pads that lie within floodplains, or would take place on contaminated lands. The agency may also revoke licensed professionals' ability to request expedited permit reviews if they routinely submit applications for coverage under the general permit that have administrative or technical problems.

For permit applications that do qualify for the expedited review process, DEP will complete its review and return a decision within 14 days from the submission of a complete and accurate application. In other cases, staff will complete the review within 60 days.

Oil and Gas operators are required to implement best management practices for erosion and sediment control, stabilize all areas where earth disturbance is conducted, and manage post construction stormwater rate and volume. When submitting a notice of intent to construct, oil and gas operators must also demonstrate that their post-construction stormwater management plans are consistent with county stormwater

management requirements. Operators must also restore a well site within nine months of completion of drilling of the well.

TENORM Study (Technologically Enhanced Naturally Occurring Radioactive Material)

On January 24, 2013, DEP announced it is undertaking a study to examine naturally occurring levels of radioactivity in natural gas, by-products, and waste streams associated with oil and natural gas development. Although DEP has conducted smaller scale surveys in the past, this represents the most comprehensive study of its kind in Pennsylvania and perhaps the nation.

The Department consulted with independent members of academia to peer review the project's detailed study plan and then published the study plan on its website to make it publicly available.

DEP intends to develop a final report with findings that are scientifically to determine whether any further policy revisions or actions are warranted by the Department and to ensure that public health and the environment will continue to be protected.

The study is scheduled to be completed and a final report published in 2014.

Water Resources and Wastewater Disposal

Recycling of flow back and produced water from unconventional wells for new hydraulic fracturing operations has increased significantly. In 2012, nearly 90% of the flow back and produced water from unconventional wells was recycled. This reduces the amount of water to be withdrawn from fresh water sources in Pennsylvania and reduces the amount of wastewater for disposal or treatment.

In 2013, DEP developed a policy to promote the voluntary use of mine influenced waters by the oil and gas industry and establish a framework by which mine influenced waters can be used for natural gas extraction. The use of these waters by the gas extraction industry helps to protect streams and makes water resources available for other uses.

Part B2.2 (e). Stormwater Discharge Permits

The 1990 Phase 1 federal stormwater regulations require NPDES permits for discharges of stormwater from certain municipalities and sites associated with certain industrial activities. Initially, there were four Pennsylvania cities (Philadelphia, Pittsburgh, Allentown, and Erie) on EPA's list of municipalities needing permits for stormwater discharges from their MS4s. Later, Pittsburgh and Erie were exempted from the stormwater permitting requirements because large areas of those cities were served by combined sewers and the discharges were covered by permits for the wastewater treatment plants. Phase 1 MS4 permits for stormwater discharges were issued to Philadelphia and Allentown.

The Phase II federal stormwater regulations were published by EPA on December 8, 1999. These regulations require all construction activities involving cumulative earth disturbances one acre or greater to obtain permits. In addition, areas within approximately 940 municipalities (including those that were initially exempted) were identified as urbanized and operators of municipal separate storm sewer systems (MS4s) within those urbanized areas were required to apply for permits. The initial permits became effective on March 10, 2003. Including extensions, those initial permits expired on March 15, 2013. Availability of Pennsylvania's MS4 general permit ("PAG-13") renewal package was announced on September 17, 2011 and the deadline for submission of a renewal notice of intent (NOI) and for a renewal individual permit application was September 14, 2012. At the time of this report, DEP has received a total of 946 applications for individual and general MS4 permit coverage, and has reissued approximately 30% of the MS4 NPDES permits.

Part B2.2 (f). Construction and Urban Runoff

This category includes two major subcategories: highway construction and new land development including residential, industrial, commercial, institutional, and recreational construction. Uncontrolled runoff from these sites has the potential to cause significant soil erosion and localized sediment pollution in streams.

The Erosion and Sediment Control (E&S) regulations found at Title 25, Chapter 102 describes the requirements for controlling accelerated erosion and preventing sediment pollution from various earth disturbance activities. The purpose of Chapter 102 is to protect surface waters of the Commonwealth from sediment and stormwater pollution by requiring the use of best management practices (BMPs) that minimize accelerated erosion and sedimentation and manage post construction stormwater runoff, both during and after earth disturbance activities. Revised regulations were implemented on November 19, 2010.

Since 1972, earth disturbance activities related to agricultural plowing and tilling, as well as non-agricultural earth disturbance activities, have been regulated under this Chapter by requiring persons to develop, implement, and maintain BMPs. The revised regulatory requirements also include requirements for animal heavy use areas.

The 2010 Chapter 102 regulation amendments included new requirements for riparian buffers in special protection (HQ and EV) waters. Depending on the attainment status of the stream, a mandatory 150-foot riparian buffer or riparian forest buffer must be established, converted, or protected. In addition, voluntary 100-foot forested buffers can be established or converted.

Standards and criteria for minimizing erosion and preventing sediment pollution, as well as post construction stormwater management (PCSM), are contained in Chapter 102 rules and regulations. The erosion and sediment control requirements apply to any earth disturbance activity, including land development and road, highway, or bridge construction. Requirements for control measures and facilities are written to utilize best management practices, primarily by establishing design and performance standards.

The PCSM requirements are mandatory when permit coverage under Chapter 102 is necessary.

Pennsylvania's program is administered by DEP and county conservation districts through a delegation of DEP authorities to the conservation districts. Joint responsibilities for program implementation include the processing and issuance of permits, complaint investigations, site inspection, compliance, and enforcement. BMPs are reviewed for design and performance effectiveness through permit plan reviews and periodic monitoring at the construction site. Both DEP and the county conservation districts facilitate implementation of BMPs by conducting numerous training seminars and workshops for individuals, municipalities, and other parties engaged in undertaking earth disturbance activities.

DEP's inclusion of post construction stormwater management into the Chapter 102 regulations emphasizes the mimicking of natural runoff conditions from stormwater runoff generated by development and other activities requiring permit coverage by minimization of impervious cover, use of low impact development designs, and use of innovative stormwater BMPs that provide infiltration, water quality treatment, and otherwise more effectively manage the volume and rate of stormwater discharges. Because of increased need and emphasis on improving water quality and protecting water resources through improved stormwater runoff management, DEP finalized the Pennsylvania Stormwater Management Best Management Practices (BMP) Manual in December of 2006 to support the implementation of stormwater management requirements and water quality antidegradation requirements. The BMP Manual provides the design standards and planning concepts to guide local authorities, planners, land developers, contractors, and others involved with planning, designing, reviewing, approving, and constructing land development projects. Currently, the Pennsylvania Stormwater Technical workgroup, an independent partnership, are identifying potential BMP Manual revisions and recommendations to DEP.

DEP finalized revisions to the Erosion and Sediment Pollution Control Program Manual; DEP Document No. 363-2134-008, March 2012 (Manual). The Manual includes specific guidance, performance requirements, and design criteria to support the implementation of the Department's water quality regulatory requirements for erosion and sediment control as provided in Title 25, Chapter 102, Section 102.11(a)(1), including antidegradation provisions.

Part B2.2 (g). Stormwater Permits Conservation Districts

DEP and county conservation districts jointly administer issuance of NPDES permits for stormwater discharges associated with construction activities. During calendar year 2013, conservation districts received, reviewed, and acknowledged 1,828 Notices of Intent (NOI) for coverage under the statewide general permit. Conservation districts also received, reviewed, and made recommendations to DEP for the authorization of 274 individual NPDES permits for stormwater discharges from construction activities. For oil and gas transmission lines, conservation districts authorized 61 Notices of Intent for ESCGP permits. In addition, conservation districts conducted 11,983 compliance-

monitoring inspections at permitted and non-permitted sites. Conservation districts also conducted 1,578 complaint investigations, in addition to routine compliance inspections.

Part B2.2 (h). Combined Sewer Overflows

Combined sewer overflows (CSOs) to waters of the Commonwealth are considered point sources subject to NPDES permitting, compliance, and enforcement requirements. EPA has been regulating CSOs through the 1989 and 1994 national CSO policies that require each NPDES delegated state to develop and implement a state CSO control policy. DEP revised its CSO policy in February 2010. Under the revised policy, DEP conducts or provides for appropriate follow-up actions, including compliance monitoring, compliance actions, permit renewal, plan reviews, field inspections, water quality monitoring, and enforcement as necessary to promote the development and implementation of Nine Minimum Controls (NMCs) and the Long Term Control Plan (LTCP) at each CSO facility. LTCP milestones are placed in NPDES permits with dates for completing them. DEP has continued to place a high priority on the permitting and inspection program to deal with requirements for implementation of NMCs and LTCP.

Part B2.3 (a). Non-point Source Control Program

Pennsylvania's Non-point Source (NPS) Program was developed in response to Section 319 of the federal Clean Water Act to address problems caused by non-point sources, such as the overland flow of stormwater or infiltration of pollutants into the groundwater. The three main sources of non-point runoff resulting in degraded water quality in Pennsylvania are agriculture, abandoned mine drainage, and urban runoff. Other sources include abandoned oil and gas wells, construction activities, land disposal, habitat modification, hydromodification, and silviculture (logging practices).

The Clean Water Act requires each state to prepare a Management Plan for its non-point source program. This Management Plan outlines the program components to be used to address non-point source problems including a variety of non-regulatory, financial, and technical assistance programs needed to improve and maintain surface and groundwater quality. Pennsylvania last updated its NPS Management Plan in 2008.

Pennsylvania has received more than \$103 million from the federal Section 319 Grant Program (FY 1990 - 2013). This money has been used to institutionalize a non-point source program, implement various innovative technologies to treat non-point source pollution problems, develop an educational program, and complete a large number of watershed initiatives. Other funding sources for non-point source pollution management include: Pennsylvania's Chesapeake Bay Program, the Nutrient Management Act, the County Conservation District Assistance Funding Program, the Stormwater Management Act Fund, the Coastal Zone Resources Program, USDA's Environmental Quality Incentives and Conservation Reserve Enhancement Programs, and the Environmental Stewardship and Watershed Protection Grant, also known as Growing Greener.

Growing Greener has provided \$339.5 million in watershed grants since 1999. The funding is being made possible through a \$4.25-per ton tipping fee on solid waste disposed in Pennsylvania's municipal waste landfills. The tremendous value of the program became clear to legislators, and Growing Greener funding was extended under Act 24 of 2010 through 2020. Passage of Act 13 of 2012 added drilling impact fees as an additional revenue source for the Environmental Stewardship Fund.

Monitoring of both land treatment and water quality for a five- to ten-year period is the best way to document the effectiveness of non-point source pollution control efforts. Pennsylvania has hosted 4 of the 24 EPA Section 319 National Monitoring Projects (NMP) across the country. Pennsylvania NMPs include: the Swatara Creek NMP, monitoring the effect of passive treatment on abandoned mine drainage; the Stroud Water Research Center NMP, monitoring a riparian buffer project in an agricultural watershed; the Pequea and Mill Creek NMP, using a paired watershed approach to monitor the effectiveness of agricultural best management practices (BMPs); and the Villanova Urban Stormwater BMP demonstration site, monitoring a suite of innovative stormwater management practices.

Four watersheds in Pennsylvania have been awarded EPA Targeted Watershed Grants: the Dunkard Creek Watershed, Christina River Basin Initiative, Upper Susquehanna River Basin Restoration, and Schuylkill River Watershed Initiative. The Targeted Watershed Grant is an EPA program designed to encourage successful community-based approaches and management techniques to protect and restore the nation's waters.

The Conewago Creek watershed in Dauphin, Lebanon, and Lancaster Counties has been identified by the USDA Natural Resources Conservation Service as one of the three selected Showcase Watersheds within the Chesapeake Bay drainage area. Showcase Watersheds are designed to show what can be accomplished by bringing people and groups together to solve natural resource problems in a targeted area. With this designation, the watershed receives priority consideration when allocating funding for BMP implementation and technical assistance.

Part B2.3 (b). Highlights of Pennsylvania's Current NPS Program

Education and Outreach

One element of the Section 319 Grant Program involves projects fully or partially directed towards NPS education and outreach. Two initiatives funded through the Section 319 Grant Program that are directed entirely at education and outreach at the grassroots level include the Pennsylvania League of Women Voters (LWV) and the Pennsylvania Association of Conservation Districts (PACD). Using funds from the Section 319 Grant Program, the LWV Water Resources Education Network (WREN) supports 10 to 12 grants a year of up to \$5,000 each to enable groups of local citizens and officials to build community support for water resource protection. PACD's NPS Pollution Prevention Educational Mini-Grant program provides funding of up to \$2,500 each for approximately 30 projects a year. These projects include the development of audio-visual products, exhibits or models, production of special events, marketing tools,

publications, actual stream reclamation projects, hands-on water studies, and educational workshops. Since 1999, the Growing Greener Program has provided over \$12 million in grant funds to support the implementation of more than 200 education/outreach projects.

Building Capacity

DEP is working to establish a network of technical assistance providers to help watershed organizations effectively and efficiently achieve their watershed protection goals. These providers offer technical services to groups embarking on projects aimed at protecting and enhancing their local watersheds. Growing Greener, along with the 319 program, currently supports four technical providers.

Conservation district watershed specialists help local groups protect and improve their watersheds, provide expert advice to farmers and landowners for conservation practices, work with DEP regional staff, and help support local grant-funded restoration projects. There are now 67 Growing Greener-funded watershed specialists working in 66 of the state's 67 counties.

Pennsylvania's Watershed Approach

Pennsylvania is committed to a watershed approach for water resource management. Locally managed and monitored watershed improvement projects are essential to enhancing, maintaining, and reclaiming the Commonwealth's water resources.

More and more people are working to improve and protect Pennsylvania's watersheds by learning about their watersheds and sharing that information with their neighbors, restoring water quality through hands-on projects, and planning for the future through water resources management.

DEP provides assistance to local groups planning to implement restoration measures in watersheds where one or more TMDLs have been identified. The goal is to help such groups develop implementation plans more expeditiously and in a manner that fully complies with EPA requirements for additional funding under the Section 319 Grant program.

Thirty-five watersheds across the state containing water bodies with water quality impairments caused by non-point source pollution have been targeted to have watershed-based implementation plans developed with funding from the Section 319 Grant program. Two more plans are being prepared with other funds. The watershed-based plans identify the type, number, and an estimated cost of best management practices needed to eliminate water quality impairments. This work, in turn, qualifies local sponsors to receive Section 319 Grant program construction funds for restoration projects that implement the TMDLs.

Abandoned Mine Reclamation

Eliminating drainage from abandoned mines and restoring rivers and streams to a healthy state represent significant challenges. The vast majority of impacts result from

mines and mining practices of the past, predating the 1977 federal Surface Mining Control and Reclamation Act (SMCRA).

It's estimated that in Pennsylvania alone, the cost of addressing all of the environmental impacts of mining activities prior to the passage of SMCRA will exceed several billion dollars. Therefore, it's unlikely that public funds alone will ever be sufficient to tackle this monumental set of problems. Considering the scope of the challenge and the resources required to mount a successful clean-up program, it is widely recognized that an active, cooperative partnership between involved citizens, academia, industry, and public agencies is essential to properly address acid mine drainage or abandon mine drainage (AMD).

Growing Greener has contributed significantly toward addressing AMD issues. The projected accomplishments of these grants include over 5,600 acres of abandoned mine reclamation and over 600 miles of stream improvements. In the past two years alone, Growing Greener funds have been used to treat over 3.6 MGD of AMD affected water by constructing 21 treatment systems and reclaiming 900 feet of highwalls. Additionally, the Bureau of Abandoned Mine Reclamation awarded reclamation contracts using Growing Greener, State Capital Budget and Abandoned Mine Land (AML) Program funds aimed at reclaiming 1,209 acres of abandoned mine lands (715 acres in 2011 and 494 acres in 2012).

In late 2011, the Department reorganization resulted in the separation of the AML and AMD programs into two different programs. The Bureau of Abandoned Mine Reclamation (BAMR) continues to award contracts to reclaim abandoned mine sites in order to address health and safety hazards. Many of these projects also facilitate watershed restoration by reclaiming surface mines using alkaline addition techniques. The AMD program was moved to a new bureau, the Bureau of Conservation and Restoration (BCR). The BCR's focus is to restore and remove polluted streams from the impaired streams list (Categories 4 and 5 of the Integrated Report). Funding for the AMD programs comes from the AMD Set-Aside Fund, which receives 30% of PA's federal AML Title IV funds. The BCR is currently operating 7 active treatment plants and approximately 45 passive AMD treatment systems that were constructed by BAMR. BCR is also designing two more active treatment plants and developing and designing projects to rehabilitate four passive systems. BCR's stream restoration work is done in Qualified Hydrologic Units as defined by the federal SMCRA.

The Western Pennsylvania Coalition for Abandoned Mine Reclamation (WPCAMR) was formed in 1982 by six western Pennsylvania conservation districts. Today 24 county conservation districts make up WPCAMR. In 1996, the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR) was formed covering 16 counties in the anthracite coal region and the northern bituminous region. Today EPCAMR represents a coalition of watershed organizations, reclamation partners, co-generation plants, the active anthracite mining industry, and regional non-profit organizations.

The goal of the coalitions is to provide leadership for building local watershed-based support and partnerships with grassroots organizations whose primary focus is abandoned mine drainage abatement and abandoned mine land reclamation.

An important event in the battle to address AMD occurred in December 2006 when the Abandoned Mine Lands (AML) Program was reauthorized in the final hours before Congress adjourned. The AML Reauthorization, which amends the 1977 SMCRA, extends the AML Program for at least 15 years and will triple the AML funding Pennsylvania receives from reclamation fees collected on every ton of coal produced. In the next 15 years Pennsylvania should receive at least \$1.5 billion to clean up Priority 1 and 2 AML sites. States can also set aside up to 30% of this funding to address AMD problems not associated with Priority 1 and 2 sites. This extra funding will increase the number of AML problems that can be remediated, however, it will not be enough money to address all of the problems in Pennsylvania.

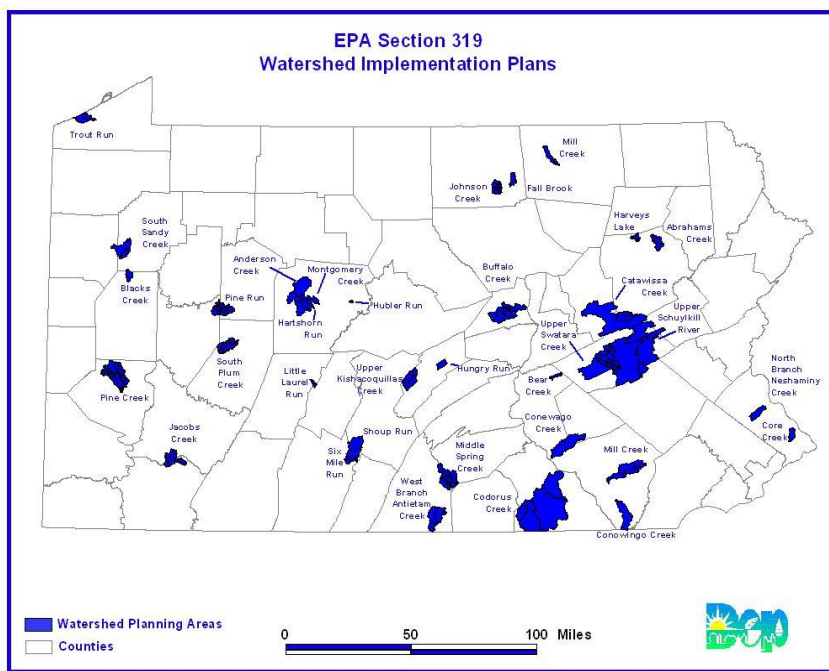
The State's Section 319 Grant program has also made a significant contribution toward correcting abandoned mine drainage (AMD) problems using passive treatment systems. A total of 14 projects costing nearly \$2.5 million to treat AMD through passive treatment were funded through this program in 2012 and 2013.

Organizations supported by Section 319 grants, the EPCAMR, WPCAMR and Stream Restoration, Inc., are cooperating in inventorying and mapping AMD and AML features across the State, including abandoned mine lands, deep mine pools and passive treatment systems.

Agriculture and Nutrient Management

Pennsylvania's Section 319 NPS Management Program provides significant financial and technical assistance resources to help reduce agricultural sources of sediment and nutrients to surface waters. Section 319 grants have provided \$2.17 million in funding for ten agricultural BMP implementation projects in 2012 and 2013.

Section 319 program agricultural projects are targeted to TMDL-approved watersheds with an approved Watershed Implementation Plan (WIP) or watersheds with 303(d) listed streams. Projects continue to be implemented in WIPs for agricultural NPS-impaired watersheds include Core Creek/Lake Luxembourg (Bucks County); Upper Kishacoquillas Creek (Mifflin); Conewago Creek (Dauphin); Mill Creek (Lancaster); Codorus Creek (York); Conowingo Creek (Lancaster); Mill Creek/ Stephen Foster Lake (Bradford); Hungry Run (Mifflin); and Buffalo Creek (Union). The figure below illustrates these agricultural WIP locations.



The NPS Program website provides detailed information on WIPs and Pennsylvania's NPS Program at

<http://www.portal.state.pa.us/portal/server.pt?open=514&objID=554272&mode=2>.

Projects are being implemented in these watersheds to reduce impacts from nutrients, sedimentation/siltation, organic enrichment/low dissolved oxygen, and other causes of agricultural impairment. Program funds are used to develop and implement nutrient management and farm conservation plans and best management practices (BMPs) identified in these plans. Partnerships with the USDA-Natural Resources Conservation Service (NRCS) and county conservation districts assist with both plan and BMP implementation.

Nutrient Management Program

Pennsylvania's Nutrient Management Program (NMP), Act 38 of 2005, was revised as part of the ACRE program initiative unveiled in 2004. Act 38 addresses all farms requiring development of nutrient management plans. The Nutrient Management and CAFO programs coordinate efforts to ensure all farms are covered. The success of these programs is due to the partnership between the State Conservation Commission (SCC), PA DEP, PA Department of Agriculture, county conservation districts, private sector planners, and farm operators. The SCC published major revisions to the NMP regulations in June 2006. These revisions became effective October 1, 2006. Nutrient management planning revisions include the manure export requirements included in the CAFO program, along with additional phosphorus management, manure and soil testing, cover crop and residue minimums for ground cover, and riparian buffer requirements. These revisions were phased-in on farms with existing nutrient management plans (NMPs) over a three-year period ending on October 1, 2009. They are being implemented immediately on new or expanding operations. A total of 1,117 Concentrated Animal Operations (CAOs) were required to have NMPs for 2013, and an additional 1,790 voluntary NMPs were developed.

Concentrated Animal Feeding Operation Program

In October 2005, revisions to Pennsylvania's Concentrated Animal Feeding Operation (CAFO) program regulations became final. This allowed Pennsylvania's program to be consistent with the federal Environmental Protection Agency's CAFO rule. A major change under the revised program is the extension of CAFO permit coverage to a large portion of the state's poultry operations. With the new requirements including dry poultry and newly covered operations, total accepted applications rose from 170 CAFOs in March of 2006 to 370 as of September 30, 2013. DEP has delegated authority from EPA to implement the NPDES CAFO program and in 2008 completed the first update of its permits and forms. DEP is currently pursuing re-approval for its NPDES General Permit. The CAFO and nutrient management website includes a CAFO application review guidance document and is limited to NMP supporting materials. The CAFO website link is:

http://www.portal.state.pa.us/portal/server.pt/community/agricultural_operations/10617/concentrated_animal_feeding_operations_%28cafos%29/554279. DEP maintains an annual CAFO and CAO inspection goal in coordination with county conservation districts and assures all covered operations are following the program requirements.

Resources Enhancement and Protection Program

The Pennsylvania Resources Enhancement and Protection Program (REAP) was created through Act 55 of 2007. REAP allows farmers and businesses to earn tax credits in exchange for approved BMP implementation on agricultural operations that will enhance farm production and protect natural resources. Farmers receive tax credits of up to \$150,000 per agricultural operation, covering 50% or 75% of the total cost of a BMP. Farmers also qualify for a 50% tax credit for no-till equipment purchase. REAP funding in 2011-2012 provided \$10 million in tax credits that helped fund 240 BMPs, 176 equipment purchases, and the development of 37 Nutrient Management/Conservation /Manure Management Plans (Plans). The State Conservation Commission administers REAP and tax credits are granted through the PA Department of Revenue.

Conservation Reserve Enhancement Program

Pennsylvania's Conservation Reserve Enhancement Program (CREP) is funded through both the USDA-Farm Services Agency (FSA) and the DEP in both the Susquehanna River and Ohio River basins. This voluntary initiative aids agricultural producers and other landowners in land preservation by decreasing erosion, restoring wildlife habitat, and safeguarding both ground and surface water. CREP continues to lead the nation in the number of acres enrolled in national Conservation Reserve Program. Total enrollment in the 59 counties of the CREP includes 11,288 contracts on 165,923 acres as of September 30, 2013. To date, FSA has provided \$56,825,779 and DEP has provided \$32,479,233 in cost share payments to CREP landowners. The original CREP contracts allowed for a potential maximum enrollment of 200,000 acres in the Chesapeake Bay area of PA and 65,000 acres in the Ohio River area of PA. In 2012 the CREP partners amended the existing contracts to increase the number of acres available in the Chesapeake Bay portion of PA from 200,000 to 219,746 acres. This was achieved by shifting 25,000 acres from the PA Ohio River CREP contract to

the PA Chesapeake contract. This amendment is cost neutral and results in a slight decrease in the total number of acres due to the higher cost to enroll acres in some areas of the Chesapeake Bay drainage. The new total of available acres is 259,746 with 219,746 in the Chesapeake Bay and 40,000 in the Ohio River Basin. An Environmental Assessment for the CREP expansion into 7 counties within the Delaware River was completed in 2013. This expansion- anticipated for 2014 - will include the potential for 20,000 additional acres of conservation practices to bring the statewide total to 279,746 acres.

Natural Resources Conservation Service Programs

The Pennsylvania Office of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) receives substantial funding through the federal Farm Bill for implementing conservation programs statewide and through the Chesapeake Bay Watershed Initiative. The 2010 federal Farm Bill provided increased funding for PA NRCS agricultural conservation program implementation. Obligated funding for FFY2013 totaled over \$47 million. Funding was allocated to several program areas, including the Conservation Stewardship Program (CSP) \$6.9 million, Environmental Quality Incentive Program (EQIP) \$21.1 million, Chesapeake Bay Watershed Initiative (CBWI) \$9.1 million, Agricultural Management Assistance \$0.28 million, Wetlands Reserve Program \$4.75 million, and Wildlife Habitat Incentive Program \$2.28 million. PA NRCS accomplishments are included on the PA NRCS website at www.pa.nrcs.usda.gov/programs/. CBWI priority watersheds and approved practices are included on the website at www.pa.nrcs.usda.gov/.

Environmental Stewardship and Watershed Protection Program

The Environmental Stewardship and Watershed Protection Act of 1999 (Growing Greener I) and the Watershed Stewardship Act 45 of 2005 (Growing Greener II) have funded many agricultural and soil and water conservation related projects. Millions of dollars have also been invested through statewide efforts to implement agricultural BMPs through CREP, Chesapeake Bay Foundation initiatives, the PA Association of Conservation District Technical Assistance grants, and Conservation District Watershed Specialist staff. In 2012 and 2013, agricultural projects were funded in many counties throughout PA. A complete summary of projects and funding provided is available on the DEP Grants Center website at http://www.depweb.state.pa.us/portal/server.pt/community/growing_greener/13958.

Stream Corridor Protection and Restoration

Natural stream channel design addresses the entire stream system. It is based on fluvial geomorphology (FGM), which is the study of a stream's interactions with the local climate, geology, topography, vegetation, and land use - how a river carves its channel within its landscape. All successful natural stream channel designs address sediment transport, habitat enhancement, and bank and channel stabilization. Natural stream channel design (NSCD) is relatively new to Pennsylvania. Our understanding of what works best to restore a channel's natural stability is still evolving, particularly across a state as diverse in geography and land use as Pennsylvania. The Guidelines for Natural Stream Channel Design for Pennsylvania Waterways were developed with

funding through a Section 319 grant by the Keystone Stream Team, an informal group comprised of government and environmental resource agencies, university researchers, sportsmen, citizen-based watershed groups, and private companies. These guidelines are aimed at watershed organizations and professionals involved in stream restoration design, construction, and permitting. The guidelines can be found at <http://www.canaanvi.org/CVI/stream.html> .

The Keystone Stream Team used a Section 319 grant to develop a web-based database for reference reach information collected on NSCD projects. A Section 319 grant also enabled the U.S. Geological Survey to develop Regional Curves. More information on both projects is available on the Keystone Stream Team's website at: <http://www.keystonestreamteam.org/> . In addition, the 319 Grant Program and the Growing Greener program continue to provide funding for the implementation of stream restoration projects using NSCD.

Documenting Restored Waterbodies

Significant funding has been provided over the past several years from non-point source programs such as Growing Greener and Section 319 in support of stream and lake assessment, planning, and restoration activities. Hundreds of projects have been successfully completed. Those activities are beginning to show water quality improvements, but efforts to document them have generally been localized and inconsistent.

During 2007, DEP launched a continuing effort to identify waterbodies across the state in which significant improvements to water quality have been observed. Stream names and locations are solicited from DEP watershed managers, conservation district watershed specialists, and citizen volunteer monitoring groups. DEP biologists then survey these water bodies to determine the extent of their recovery and their potential to be removed from the State's impaired waters lists (Category 4 and 5 of the Integrated Report). Analysis of the survey results is on-going and changes to the Departments stream and lake assessments are made as they become available. DEP has petitioned EPA to remove numerous stream segments from Category 5 of the Integrated Report as the result of this process. As of the 2012 report, these delisted stream segments add up to a total of 39 restored stream miles and 12,445 lake acres.

Many other waterbodies have shown improved water quality, but have not improved enough to be removed from the impaired lists. As more non-point source funding is applied in these watersheds, it is anticipated that water quality will continue to improve and additional stream segments will be removed from impaired status.

Part B2.3(c). Total Maximum Daily Load Development (TMDL)

Section 303(d) waters are those waterbodies that do not or will not meet water quality standards even after the application of all required technology-based treatment and other pollutant control requirements. DEP assesses Commonwealth waters and places waters impaired by pollutants in Category 5 of the Integrated Report. Impaired waters on Category 5 require the development of a TMDL. A TMDL is the amount of pollutant

loading that a waterbody can assimilate and still meet water quality standards. A TMDL is the sum of individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety. DEP uses mathematical models to develop the TMDLs.

TMDLs are planning tools that set water quality objectives for impaired waters. Meeting the water quality objectives of the TMDL will result in the attainment of water quality standards.

TMDLs are developed for the sources and causes of impairment that are identified in Category 5 of the Integrated Report. In the years 2012 and 2013, DEP finalized 25 TMDLs establishing allocations to the appropriate sources of pollutant loading. Individual WLAs are the amounts of the load allocated to point sources. WLAs are the basis for setting limits in NPDES permits, which are the implementation procedures used to correct pollutant problems attributed to point source discharges. The LA portion of the TMDL is the amount of the load that is allocated to categories of non-point sources. The LAs are the basis of future watershed restoration plans, which are the first part of correcting non-point source pollutant problems.

The development of an implementation (or restoration) plan begins with a more detailed assessment of a watershed. The detailed assessment includes an analysis of the known water quality, identification of quantities and locations of pollutant and pollution sources, and selection of priorities for corrective action. It concludes with a description of the management measures needed to restore and maintain water quality, and it provides for public input concerning water quality problems and the restoration measures needed. The result of these activities is a management plan that includes the goals and objectives for improving water quality, an estimate of the technical and financial resources needed to implement the plan, an education program, and monitoring to demonstrate the success of the plan. The document also includes a budget and a timetable for implementation that identifies interim milestones. DEP will encourage local groups, watershed associations, or county conservation districts to take the lead and/or play an active role in completing detailed assessments and developing the implementation plan. Grant monies from the CWA Section 319 Non-point Source Program and the Commonwealth's Growing Greener program can be used to complete these assessments. The final plan should meet the objective set in the TMDL.

Beginning with the 2014 Integrated Report the US EPA and states will be launching a new vision for meeting the goals of CWA Section 303(d). The new vision includes 6 goals: "Engagement", "Integration", "Protection", "Prioritization", "Alternatives" and "Assessment". Detailed information regarding these goals and the new vision can be found on the US EPA website

<http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/programvision.cfm>. The DEP is currently developing strategies to achieve these new goals but in general currently favors prioritizing one or two pollutants (i.e. sediment, metals) statewide for TMDL alternatives or TMDLs and selecting several named watersheds across the Commonwealth where state and local governments and watershed groups are actively engaged in activities to restore waters. The first of these goals to be implemented is "Engagement" and the DEP has begun reaching out to County and local government

officials and watershed groups and other stakeholders in several watersheds in the Commonwealth.

Part C: Surface Water Quality Monitoring and Assessment

Part C1.1. Water Quality Standards Program

Water Quality Standards (WQS) are the combination of water uses to be protected, the criteria (i.e. levels of substances) that need to be maintained or attained to support the uses, and an antidegradation policy. WQS are important elements of Pennsylvania's water quality management program because they set the general and specific goals for the quality of our waters. WQS are instream water quality goals that are achieved by imposing specific regulatory standards, such as treatment requirements, effluent limitations and best management practices.

Pennsylvania's WQS are found in DEP's rules and regulations at 25 Pennsylvania Code Chapter 93 (Water Quality Standards). General or narrative criteria applicable to all waters are designed to control those substances not identified by specific criteria but which may be harmful to protected water uses or to human, animal, plant or aquatic life if present in excessive amounts. Specific water quality criteria are contained in Chapter 93, including criteria for toxic substances identified as EPA priority pollutants, as well as other substances (available electronically at <http://www.pacode.com/>).

Water quality standards implement the provisions of Pennsylvania's Clean Streams Law (35 P.S. Section 691.1 et seq.) and Section 303 of the federal Clean Water Act (33 U.S.C.A. § 1313). The authority of the Environmental Quality Board to promulgate and amend water quality standards is found in Sections 5 and 402 of the Clean Streams Law and in Section 1920-A of the Administrative Code of 1929 (71 P.S. Section 510-20).

Section 303(c) of the Federal Clean Water Act requires that "... the state shall from time to time (but at least once every three year period) hold public hearings for the purpose of reviewing applicable water quality standards and, as appropriate, modifying and adopting standards..." The review and revisions to WQS are part of Pennsylvania's continued planning process and water quality management program. The development and review of WQS and the complementary water quality assessment program consider the fundamental policies that are set forth in state and federal law which includes the national goal to achieve "fishable/swimmable" waters.

Pennsylvania's most recent triennial review (TR13) included amendments to Chapter 93 to incorporate updated and revised water quality criteria for conventional pollutants and toxic substances. Other amendments include clarifications of terms and definitions, drainage list corrections, a review of waterbody segments that do not meet the fishable or swimmable uses, and other corrections of typographic, format, and grammatical errors. In addition, DEP adopted revisions to Chapter 16 for updates to the site-specific aquatic life and human health criteria and updates or corrections to the approved analytical methods. This triennial review of Pennsylvania's WQS was submitted to the US EPA Region 3 Administrator on October 7, 2013 for review and approval following

adoption as final rulemaking at the April 16, 2013 Environmental Quality Board (EQB) meeting, and publication in the Pennsylvania Bulletin on July 20, 2013 (43 Pa.B. 4080). These amendments are based on proposed rulemaking that, with some modification, were approved by the EQB at its April 17, 2012 meeting and were published in the Pennsylvania Bulletin on July 7, 2012 (42 Pa.B. 4367) with provision for a 45-day public comment period, including public meetings and hearings that were held at the Department's Rachel Carson State Office Building in Harrisburg, PA on August 8, 2012. The public comment period concluded on August 21, 2012. The package is currently being reviewed by EPA.

The Department is in the preliminary stages of initiating the next triennial review of Pennsylvania's WQS. The scope of the next triennial review is being developed, but at a minimum will include consideration of updates to aquatic life and human health criteria that have been issued by EPA, and that were not considered during previous triennials. Exclusion of the water contact (swimmable) use in a portion of the Delaware Estuary (RM 108.4 to RM 81.8), and from the outer Erie Harbor/Presque Isle Bay harbor basin and central shipping channel will be evaluated to determine whether conditions still prevail that warrant these exclusions from Pennsylvania's WQS. The Department is also considering the development of new water quality criteria for pollutants not currently regulated, or where water uses may not be adequately protected through existing criteria. Rulemaking associated with the next triennial review is expected to be initiated during winter 2014, for completion as final rulemaking during 2016. Development of the proposed rulemaking phase will be shared with other affected agencies, EPA and appropriate advisory committees. Once proposed, the triennial review will include provision for public participation, with a period (minimum of 45 days) to allow for public review and comments for consideration in the development of final rulemaking.

The Antidegradation Implementation Guidance is designed to apply DEP's antidegradation regulation. The antidegradation policy, which applies to all waters, mandates that existing uses are maintained and protected, and that the existing quality of High Quality and Exceptional Value waters are also maintained and protected.

In Pennsylvania, water uses that are protected statewide, except when otherwise specified in law or regulation, include Warm Water Fishes; Potable, Industrial, Livestock, Wildlife, and Irrigation Water Supply; and Boating, Fishing, Water Contact Sports, and Esthetics. Other uses, such as Cold-Water Fishes, Trout Stocking, High Quality or Exceptional Value waters, navigation, and others, are protected as applicable on a waterbody by waterbody basis.

Part C1.2. Plan for Achieving Comprehensive Assessments

In 1996, DEP developed a strategy for the statewide assessment of wadeable free-flowing streams involving a basic field-level biological screening assessment. After completing the first-ever statewide assessment of the state's wadeable surface waters in April 2007, DEP replaced the original protocol with a new, more intensive assessment protocol for the second statewide assessment. DEP's new plan for achieving

comprehensive, statewide assessment of its surface waters is based on the implementation of the Instream Comprehensive Evaluation (ICE) program.

The ICE program is designed to assess the water quality of previously assessed streams with a more rigorous methodology. It is based on a survey design that includes both probability based and targeted sampling within one major sub-basin in each of six DEP regions. Initial fieldwork began in 2005 in the Delaware drainage and was expanded to include the first set of six regional sub-basins in the rest of the state in 2006. A new set of six sub-basins will be surveyed upon completion of the previous six basins and repeated on a rotating-basin schedule thereafter. In the summer of 2012, almost all of the 25 sub-basins have been completed for the probability based sampling. Results were reported to EPA in the summer of 2013. This is a cooperative effort led by Office of Water Management, with assessments being conducted by Department field and central office staff.

The ICE program uses an intensive biological assessment protocol that is a modification of EPA's Rapid Bioassessment Protocol (RBP) III method, which includes laboratory identification of benthic macroinvertebrates to genus level and an RBP habitat assessment. Each biological assessment results in an Assessment Summary for input to the 305(b) assessment database and GIS that identifies waters with obvious aquatic life use impairment and those with no obvious impairment. In addition to these stream assessment projects, a lake assessment element is also being implemented. Lake sampling efforts are described in the Lakes Water Quality Assessment section.

In 2006, DEP began a potable water supply monitoring program targeting the source waters for community water supplies in the Commonwealth to assess attainment of the potable water supply use (PWS). The monitoring protocol consists of the collection of multiple grab samples upstream of the point of withdrawal during the critical period when criteria violations are expected to occur. Water chemistry analysis is completed for 9 parameters of concern for drinking water. Analysis of collected samples according to the Chemical – Bacteriological Evaluations protocol results in an Assessment Summary for input to the 305(b) assessment database and GIS that identifies waters with obvious aquatic life use impairment and those with no obvious impairment. In 2013, approximately 99% of permanent community PWS surface water sources have been monitored and assessed.

In addition to the Aquatic Life and Potable Water Supply use assessments, DEP employs a Bacteriological Sampling Protocol to assess surface waters for water contact recreational use during the swimming season. Citizen volunteers collect at least two sets of fecal coliform samples from streams throughout the state from May 1st through September 30th. Each set is comprised of a minimum of 5 samples collected within a 30 day period. The samples are analyzed within 6 hours of collection by a DEP accredited laboratory for an exact count of fecal coliform units to determine compliance with standards. Each recreational assessment results in an Assessment Summary for input to the 305(b) assessment database and GIS that identifies waters with obvious recreational use impairment and those with no obvious impairment.

In 2013, DEP conducted a pilot project where locations in the Swatara Watershed and Loyalsock Watershed were monitored for Recreational Use attainment using a

probabilistic sample design. A two stage Generalized Random Tessellation Stratified (GRTS) design for a finite linear resource was employed to randomly select 30 monitoring locations in each watershed. The locations were sampled on 5 dates in late August through September for fecal coliform, *E.coli*, and Enterococcus to determine if the sites were attaining Recreational Use. As a result of the pilot project, approximately 996.7 miles were assessed. This mileage represents approximately 42.5% of the 2,343.5 total miles assessed for Recreational Use in 2014 from targeted citizen volunteer monitoring and probabilistic monitoring combined. For the 2014 reporting cycle, DEP dramatically increased the total miles assessed for recreational use. Due to the success of the pilot probabilistic monitoring project, this method will become DEP's primary approach to assessing surface waters for Recreational Use.

Part C1.3. Intensive Surveys

Intensive surveys have been a key element of DEP's water quality assessment program since their inception in 1965. These chemical and biological stream and lake investigations are conducted to gather background or baseline data on specific streams or lakes to determine the effects of point and/or non-point source discharges on receiving water quality, provide data in support of administrative or enforcement actions, determine the source of spills or releases of pollutants and evaluate their effect on water quality, and assess the distribution and accumulation of trace metals and selected organics in fish tissue or sediments. These surveys can include any combination of chemical sampling of water, effluent, sediment, or fish tissue; flow measurement; qualitative, quantitative, or semi-quantitative EPA RBP macroinvertebrate sampling; qualitative or quantitative (RBP) habitat assessment; or qualitative (and sometimes quantitative) fish sampling. While the current emphasis is on evaluation of waters previously assessed as attaining designated uses (discussed in the previous section), other types of intensive surveys remain important to the Commonwealth's water quality management program.

An important element of DEP's water quality assessment program is the evaluation of candidate waters for Special Protection designation as High Quality (HQ) or Exceptional Value (EV) Waters. These targeted, intensive surveys involve field studies of habitat and the aquatic community, observation of land use and water quality protective measures, historic and other known information to determine if a basin or stream segment qualifies for Special Protection in the Antidegradation program. Streams receiving HQ or EV designation are protected to maintain their existing quality.

Part C1.4. Ambient Fixed Station Monitoring

The Pennsylvania Water Quality Network (WQN) is a statewide, fixed station water quality sampling program operated by the Bureau of Point and Nonpoint Source Management. It is designed to assess both the quality of the Commonwealth's surface waters and the effectiveness of the water quality management program by accomplishing four basic objectives:

1. Monitor current status and temporal water quality trends in major surface streams (routine stations)
2. Monitor current status and temporal water quality trends in selected reference waters (reference stations)
3. Monitor current status and temporal water quality trends in major tributaries entering the Chesapeake Bay
4. Monitor current status and temporal water quality trends in selected lakes

Major streams are considered to be interstate and intrastate waters with drainage areas of roughly 200 square miles or greater. These waters receive both point and non-point source pollutants and are sampled at or near their mouths to measure overall quality before flows enter the next higher order stream. In this way, current water quality status and trends can be established and the effectiveness of water quality management programs can be assessed by watershed. In addition, reference stations are selected to represent: 1) “ambient” waters of natural quality minimally affected by human activities; and 2) “typical” waters with quality representative of that normally found in the region of the state being sampled.

The WQN consists of 111 routine stations of which ninety are sampled bi-monthly and twenty-one are sampled monthly for stream discharge measurements and physical/chemical analysis. All routine stations are sampled every other year for biological evaluation. Twenty-six reference stations are generally sampled monthly for stream discharge and physical/chemical analysis and annually for biological evaluation. Also, forty-two Chesapeake Bay Nutrient and Sediment loading stations are sampled monthly for stream discharge and physical/chemical analysis and every other year for biological evaluation. In addition, these Chesapeake Bay loading stations are targeted for sampling eight additional times per year during storm events.

Single mid-channel or spatially composited, depth-integrated samples are collected at each site depending on stream size. Stream discharge (flow volume) is measured or calculated each time a water sample is collected. United States Geological Survey (USGS) stream gauging facilities and/or extrapolation equations are utilized whenever possible. Where no USGS facilities/equations exist, stream discharge is measured by U.S. Army Corps of Engineers and private facilities, or calculated according to methods outlined by USGS. At a minimum, macroinvertebrate samples are collected every other year at both routine and Chesapeake Bay load monitoring stations between August 1 and October 31 and annually at reference stations during fall (November 1 – December 30) or spring (March 1 – April 30) utilizing DEP benthic sampling methodology adapted from EPA Rapid Bioassessment Protocols.

Fish tissue is sampled periodically at the rate of about 100 WQN samples per year. Sampling locations are determined annually. Sampling is rotated through the network to provide periodic complete coverage and to maintain surveillance on problem waters. Fillets are sampled for appropriate pollutants in order to assess suitability for human consumption.

Lakes included in the WQN (except for Lake Erie and Presque Isle Bay that are part of the base network) are selected after consideration of size, public access, intensity of use, and availability of existing data. Large lakes with heavy public use and/or historical

data are favored for inclusion because changing trends in the water quality of these resources have the potential for serious impacts on water uses.

In the past, lakes have been scheduled for annual sampling in groups of 15 to 20. Lake groups are sampled once a year for five consecutive years before initiating a new group. The five-year data blocks were then used to assess lake water quality trends. Thirteen lakes are currently being sampled in addition to Lake Erie and Presque Isle Bay. Lake levels for Lake Erie and Presque Isle Bay stations are measured at the U.S. Coast Guard station at the entrance to Erie Harbor.

Lake Erie and Presque Isle Bay samples are collected at mid-depth. The other lake WQN samples are collected at 2 depths per site during mid-summer stratification. These sites correspond to the deepest point in each lake and one uplake station; at each site, one sample is collected one meter below the surface and the second sample one meter above the lake bottom. A temperature/dissolved oxygen profile is recorded through the vertical water column and an aliquot from the shallow sample is filtered for chlorophyll-a analysis. Secchi depth is also recorded.

Qualitative plankton samples and chlorophyll a are collected annually from Lake Erie and Presque Isle Bay. Quantitative invertebrate or plankton sampling and qualitative or quantitative fish sampling is optional at other lakes and may be conducted at the discretion of the collector.

Part C1.5. Susquehanna River Assessment

Wide-scale, disease-related mortality of young-of-year (YOY) smallmouth bass was first documented in 2005 and again annually at varying degrees between 2006 and 2013 on the West Branch Susquehanna, Susquehanna mainstem, and Juniata rivers. Since 2010, bacterial infections resulting in lesions have also been documented in a number of warm-water streams in the Susquehanna River Basin and outside the basin. Fish pathology studies conducted by the United States Geological Survey (USGS) Leetown Science Center, Leetown WV indicate there is a high degree of intersex among the smallmouth bass at one segment in the river that may be caused by endocrine disruption. The intersex has also been found in other warm water tributaries. In addition, the Pennsylvania Fish and Boat Commission (PFBC) and USGS have collected smallmouth bass with external abnormalities, and have isolated both viral and bacterial infections from these fish. The Commonwealth of Virginia had a similar experience with adult diseased fish beginning in 2004. Consequently, the Pennsylvania Department of Environmental Protection has initiated a large scale investigation into the source and cause of this issue and to determine if impairment of portions of the Susquehanna River mainstem is warranted.

Environmental stressors that may predispose smallmouth bass and other fish to viral and bacterial infections include, but are not limited to; low dissolved oxygen, elevated pH, elevated nutrients, and natural stressors associated with low flows and elevated water temperatures. Natural disease sources and population cycles may be factors. Elevated temperatures coupled with excessive nutrients can cause increased algal and aquatic plant growth that result in depressions of dissolved oxygen and increases in pH,

ultimately stressing fish. Accordingly, the 2012 study focused on chemical composition and biological processes associated with nutrient inputs to the Susquehanna River at various locations. Sampling both water column and benthic substrate for analyses of nutrient inputs and responses to those inputs was completed. Results indicate that the Susquehanna River mainstem does not have elevated nutrients when compared to out-of-basin control and other sub-basins within the Susquehanna River basin.

For 2013, an experienced fulltime biologist was assigned to be the Susquehanna River Coordinator. A 2013 sampling plan was developed and disseminated to PFBC and other agencies for comments and ongoing interagency cooperation. In addition, the algae expert analyzing the 2012 collections was kept on contract to study nutrients, algae, and cellular nutrients through 2013. USGS Leetown agreed to continue doing fish pathology, and coordinate Pennsylvania efforts with efforts in Maryland and West Virginia, who are also experiencing fish health problems. This regional approach to the fish pathology should provide a more holistic understanding of the diseases affecting fish. The Department has updated its routine Water Quality Network (WQN) sampling to include additional pesticide sampling for the Lower Susquehanna, Juniata, and Delaware (control site) Rivers. Pesticide samples were collected in the spring of 2013 during base flow and storm events. The analysis includes 54 different pesticides. The Department has also increased continuous instream monitoring for DO, temperature, pH, and specific conductance. Additional nutrient, algal, macroinvertebrate, fish, mussels, polar organic chemical integrative samplers (POCIS), semi-permeable membrane devices (SPMDs), and sediment sampling were also implemented. The primary purpose of this sampling is to test for the presence of emerging contaminants and organic legacy pollutants that could be affecting the health of smallmouth bass as well as the rest of the biological community in the Susquehanna River basin.

Low summer flows and elevated temperatures are limiting factors to life in an aquatic system. In 2012, and especially in 2013, the Susquehanna River basin experienced higher than normal flows. During above normal flow conditions pollutants are diluted and their full effect on aquatic life cannot always be characterized. As a result, 2012 and 2013 were not representative low flow summers and the studies will continue through the summer of 2014.

For the 2014 Integrated Report cycle the Department evaluated the 2012 data collected on the mainstem Susquehanna River for the aquatic life use. The samples collected during 2013 are currently being processed and data results will not be available until later in 2014. The 2012 data did not indicate impairment. In addition the Department has assessed the mainstem from the Maryland State line to Sunbury for the fish consumption use and assessed nearly 5 additional miles for recreational use at the York Haven pool.

The Department has established a webpage to provide up-to-date information regarding the Susquehanna River which can be accessed at this web address:

http://www.depweb.state.pa.us/portal/server.pt/community/water_quality_standards/10556/susquehanna_river_study_updates/1449797. This webpage includes links to various reports and other information related to the Susquehanna study. One such link is to an ongoing report on the state of the Susquehanna River assessment which is updated periodically and can be accessed by using this link <http://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/>

WaterQualityPortalFiles/Water%20Quality%20Standards/2012_SUSQUEHANNA_RIVER_PRELIMINARY_SAMPLING_REPORT.pdf.

Since the inception of the study the Department has spent \$1.9 million to monitor the river and staffs have spent a total of 1,114 work days (187 days in 2012 and 927 days in 2013) on the river.

Part C1.6. Lake Water Quality Assessments (LWQA)

Basic water quality assessments for lakes are achieved mainly through two programs in Pennsylvania – the Lake Water Quality Network sampling, and the TSI or Trophic State Index evaluations, described below.

- LWQN – a statewide set of lakes is sampled once each summer for 5 years to track trends. A new set of 15 lakes was selected for the 2011-2015 sampling round (two were dropped because of dewatering). LWQN sampling is funded mainly through the 106 grant
- Lake TSI studies – all six DEP Regions incorporate TSI lake surveys to determine if phosphorus controls are needed for point source discharges in the watershed or to characterize and determine current trophic status of a lake. Samples are collected three times in one year to cover the spring, summer and fall seasonal variation; each date includes a minimum of two stations, sampled at surface and bottom locations. Approximately 15 to 20 lakes per year are normally sampled using this program. Funding for these studies is through the 319 Program, the State's Clean Water Fund, and through the State's Growing Greener Program.

Pennsylvania's definition of a "significant lake" is a waterbody with public access and a hydraulic residence time of 14 days or more. Pennsylvania currently has 226 significant lakes totaling 104,024 acres. Another 153 public waterways are used as lakes but may not have the 14-day retention time. Lake assessments are done on "significant" lakes and other lakes by DEP and various partners including USGS, SRBC, EPA, other state agencies (Department of Conservation and Natural Resources, DCNR), citizen volunteers, County Conservation Districts, Morris Arboretum, and consultants. Currently 507 lakes have current assessments on at least one of four uses and are the basis of the Integrated Report. Not all uses are assessed for all lakes. Lakes assessed through 2012 are included in this Report.

Lake data from the above efforts are reviewed to evaluate support of designated uses and compliance with water quality criteria. Updated DEP lake assessment methodologies have been publicly reviewed and are posted on DEP's Water Quality webpage at

http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/2009_assessment_methodology/666876.

Lake impairment screening to determine the TSI, identify water quality violations and determine impacts on recreational uses and aquatic life is ongoing statewide. TSI lake survey results, along with other water chemistry parameters, fish and aquatic

macrophyte survey data, lake habitat surveys, and microbiological data (bacteria, algal and cyanotoxin data) are used to determine lake use attainment status. These studies also identify waterbodies in need of more in-depth (Clean Lakes Phase I type) studies that would evaluate existing water quality conditions in the lake and watershed, identify sources and magnitude of pollutants, and recommend lake and watershed management plans to restore or protect water quality. Phase II projects continue to document water quality conditions and also implement lake and watershed BMPs as recommended in the Phase I management plan.

Institutional BMPs, (environmental education efforts, such as workshops and outreach), are integral components of successful projects and can be as important as structural BMPs. Continued water quality studies are recommended to monitor the success of control efforts. Also, TMDL lakes are targeted for monitoring on a continuing basis, post BMP installation, so that water quality improvements may be detected and reported. Several of the TMDL lakes are improving and have been subjects of "Success Stories" on the DEP website:

http://www.portal.state.pa.us/portal/server.pt/community/nonpoint_source_management/10615/success_stories/554277 and EPA's "Success Stories" featured on their website: <http://water.epa.gov/polwaste/nps/success319/>.

Lake acreages herein are standardized to the acres reported in the National Hydrography Data set (NHD) where possible. Some differences in reported acreages will remain until all data are extracted from only the NHD layer and errors in the NHD layer are corrected. Until then lake numbers reported for various statistics and tables will be variable.

Part C1.7. Citizens' Volunteer Monitoring

In July 2009, due to budget constraints, DEP began limiting its direct technical and financial support for volunteer monitors to specific DEP high priority projects. Projects related to DEP's priorities include working with program staff and volunteers to monitor sections of streams to assess impacts from stream restoration projects, best management practices and abandoned mine land remediation projects, which are supported by 319 Non-point Source Program or DEP monies. Conservation Reserve Enhancement Program (CREP) activities are also being monitored to assess the effectiveness of these practices. As priorities change and needs arise, DEP will continue to work with volunteers in monitoring the effectiveness of projects.

DEP recruits citizen volunteers from across the state for bacteria monitoring for the purpose of Recreational Use assessment. Volunteers from Senior Environmental Corps, Watershed Associations, and County Conservation Districts are trained by DEP in adherence to sampling protocol and quality assurance plans. In 2012, 32 volunteer groups collected fecal coliform samples at 263 sites on 61 streams. In 2013, 5 volunteer groups collected fecal coliform samples at 36 sites on 9 streams. All fecal coliform laboratory analysis was completed by either DEP Bureau of Laboratories or DEP certified laboratories. The bacteria data collected by various citizen volunteer groups resulted in the assessment of approximately 1306 stream miles which

accounted for 55.7% of the 2,345 total stream miles that were assessed for Recreational Use in 2012 and 2013.

Requests from volunteer monitors for services previously provided by DEP such as routine technical assistance and training on preparation and implementation of a locally driven monitoring plan are being directed to the Consortium for Scientific Assistance to Watersheds or Nature Abounds. The Consortium, a group of service providers, is funded through a Growing Greener grant administered by DEP while Nature Abounds, a nonprofit organization, has a 319 Non-point Source Management grant to support the Pennsylvania Senior Environment Corps program and monitoring.

Part C1.8. Existing and Readily Available Information

In an effort to utilize all existing and readily available data, DEP contacted about 500 potential outside data sources (federal, state, and local governments; universities; advisory groups; citizen monitoring groups; watershed associations; public interest groups; and sportsmen's groups) to request information regarding water quality. Each group on the mailing list received materials that briefly explained the reasons why DEP was soliciting information from them. Minimum quality assurance standards for the data were made available on DEP's website. Those groups with data and/or information regarding water quality limited segments were requested to fill out a data submission form and return it, along with any pertinent supporting documentation, to DEP.

For any given listing cycle, DEP determines the accuracy and validity of existing and readily available data and information provided by outside groups based on a set of minimum quality assurance requirements. These requirements include the specific location of the reported impairment, identification of the particular water quality standards violation(s), data to substantiate the conclusion of impairment, identification of the source(s) and cause(s) of impairment, and the presence of a quality assurance/quality control plan. Acceptable data from these sources are then included in the assessment database to prepare the use support summary in this narrative report and the five-part list of waterbody-specific use support decisions. More detail on this process is provided in the assessment and listing methodology document associated with the five-part list.

Data from five separate outside data sources were submitted to DEP for consideration in the 2014 Integrated Report.

The Chester Water Authority submitted coliform and nitrate plus nitrite data for the Octoraro Reservoir and nitrate plus nitrite data for the East and West Branches of Octoraro Creek. The East and West Branches of Octoraro Creek were placed on List 5 of the Integrated Report in 2006, with a cause of nutrients. The data submitted this year confirms the continued impairment of the Potable Water Supply use.

The Susquehanna River Basin Commission (SRBC) submitted data and documentation for nine different studies they conducted in the Susquehanna River watershed during 2011 and 2012. Quality Assurance Plans were provided for all nine studies and final reports were provided for four of the studies. Water chemistry data was collected during

the nine studies and over 300 samples were submitted for review. The water chemistry data is valuable information that DEP can use while monitoring and assessing streams in the Susquehanna River watershed. The majority of sites were sampled one-time for water chemistry and therefore not enough samples were available per site to make an assessment for the 2014 Integrated Report. Macroinvertebrate data was collected for all nine studies and over 250 samples were submitted to DEP. Five of the studies used PA DEP's macroinvertebrate sampling protocol. PA DEP's macroinvertebrate Index of Biotic Integrity (IBI) was calculated for all samples (about 180) that used the PA DEP protocol. Single stations do not adequately represent the water quality of large watersheds so in these instances an assessment for the Integrated Report was not done. However, the macroinvertebrate data will help DEP biologists when considering watersheds for reassessment. Where there was adequate data to make assessments fourteen aquatic life use assessments were entered based on the IBI score covering 80.4 river miles throughout the Susquehanna River drainage basin. All of the fourteen assessments were for stream segments attaining their aquatic life use. Fish survey data was collected during five of the studies and was provided. PA DEP is currently developing a Susquehanna/Potomac basins fish IBI (expected to be final in 2015) and has published a semi-quantitative fish sample protocol for wadeable streams in the 2013 Assessment Methods. Stations sampled with methods comparable to PA DEP's protocol will be assessed using the fish IBI when it becomes available and should be include in the 2016 Integrated Report.

A private citizen submitted data and documentation of a trash problem in the Frankford-Tacony Creek watershed located in southeastern Pennsylvania. The documentation was very informative, including many photographs documenting the issue; however, it did not meet the data requirements for quality assurance. The Department is currently working with the private citizen and other interested parties to determine the next steps in addressing the trash issue in this watershed.

The Alliance for the Great Lakes submitted water chemistry, bacteriological, fish, and trash data collected by volunteers for their Adopt-a-Beach program. The data was collected from March through July 2013 at beaches and shoreline property along Lake Erie. The data is useful knowledge for DEP biologists and can help identify any unusual occurrences, however, the Department could not make any assessment decisions for the 2014 Integrated Report based on the data provided.

The Delaware Riverkeeper Network submitted a bacteria dataset for review by the Department. The dataset contained fecal coliform data for three monitoring stations on the Schuylkill River. The stations were sampled according to Department protocols in August and September of 2012. All three stations are attaining Recreational Use. As a result of the data, 31 stream miles of the Schuylkill River were assessed as attaining Recreational Use from the Berks County line downstream to the Valley Forge National Historic Park west of Route 422.

Plainfield Township in Northampton County submitted a bacteria dataset for review by the Department. Fecal coliform data from 23 stations in Little Bushkill Creek was collected by the URS Corporation in July and September, 2013. URS Corporation personnel were trained by Department staff and sampled according to Department protocols and quality assurance plans. As a result of the data, 10 stream miles of the

Little Bushkill Creek that were formerly listed as impaired for Recreational Use will be listed as attaining Recreational Use in 2014.

The Department also sought out sulfate data collected on the Monongahela River to aid in the reassessment of the Potable Water Supply use. Data was received from the West Virginia Water Research Institute and the US Army Corps of Engineers. This data, along with the Department's data, was used to delist the sulfate impairment on the Monongahela River.

Part C2.1: Assessment and Methodology

On September 28, 2013 the Department public participated several new or revised assessment methods. The public participation period closed on November 27, 2013 and the Department received comment from 4 commenters. The revised protocols included:

- Macroinvertebrate stream protocols
 - Riffle/Run Freestone Streams
- Chemistry and Bacteria
 - Chemistry – Bacteriological Evaluations
- Appendix A – Sources and Cause Definitions

New protocols include:

- Field sampling protocols:
 - Continuous Instream Monitoring
 - Periphyton
 - Streambed Sediment
 - Surface Water Collection
 - Semi-Quantitative Fish Sampling protocol
- Appendix C – Biological Field Methods
 - C1 – Habitat
 - C2 – Benthic Macroinvertebrates
 - C3 – Fish
 - C4 – Taxonomic References

The other methods remain unchanged from the 2009 assessment methods.

Because of its length, the 2013 Assessment Methodology is not included with this report but rather is posted separately on DEP's website. It is available electronically at http://www.portal.state.pa.us/portal/server.pt/community/dep_home/5968 . On the left menu click on Water, then click on Bureau of Point and Non-Point Source Management, then on the right menu select Water Quality Standards, and finally, click on 2013 Assessment Methodology also on the right menu or under the Monitoring heading.

The Methodology describes the collection and analytical methods used to evaluate stream assessment information. The resulting assessments comprise the stream miles, lake acreages, and attained/impaired status reported in the 2014 Integrated Report.

The 2013 Assessment Methodology contains the following protocols:

Watershed Assessment Protocol

 Instream Comprehensive Evaluations (ICE)

Macroinvertebrate Stream Protocols

 Limestone Steams

 Multi-Habitat Pool/Glide Streams

 Riffle/Run Freestone Streams (PDF)

Field Sampling Protocols

 Continuous Instream Monitoring (PDF)

 Periphyton (PDF)

 Streambed Sediment (PDF)

 Surface Water Collection (PDF)

 Semi-Quantitative Fish Sampling protocol (PDF)

Lake Assessment Protocols

 Lake Assessment Protocol

 Aquatic Macrophyte Cover

 Lake Fisheries

 Evaluations of Phosphorus Discharges to Lakes, Ponds, and Impoundments

 Plankton Sampling

 Chlorophyll A Sampling

Chemistry and Bacteria

 Chemistry - Bacteriological Evaluations (PDF)

 Fish Tissue Sampling

Natural Sources

 Natural Pollutant Sources

Outside Agency

 Outside agency Data

Appendices

 Appendix A - Sources and Cause Definitions (PDF)

 Appendix B - Taxa Tolerances

 Appendix C - Biological Field Methods

 Appendix C1 - Habitat (PDF)

 Appendix C2 - Benthic Macroinvertebrates (PDF)

 Appendix C3 - Fish (PDF)

 Appendix C4 - Taxonomic Reference (PDF)

Part C3.1. Stream Use Support

Table 2 is a summary of the four use support categories used in listing. Miles “supporting” are the number of miles not impaired for an assessed water use; “impaired” are not supporting the assessed use and requiring a TMDL; “approved TMDL” refers to impaired segments for which an approved TMDL is in place to address the problem(s), and “compliance” lists stream miles impaired but expected to improve in a reasonable amount of time because formal agreements are in place obligating responsible parties to take corrective action. “Pollution” is a special category of impairment listing problems that cannot be addressed through a TMDL because they are not caused by pollutant loading. “Assessed” represents the total miles surveyed for that use. “Restored” represents waters that were impaired (Category 4 or 5) on previous Integrated Reports but are now attaining one or more uses (Category 1 or 2).

Table 3 summarizes the sources of impairment problems and Table 4 the causes. Note that totaling the sources or causes will not equal the miles summarized in Table 2 because a given waterbody may have multiple sources and/or causes. The tables are statewide summaries. The individual source/cause pairs for each waterbody are found on Categories 4b, 4c and 5. The lists are large and, as a result, are provided on the DEP website at

http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/draft_integrated_water_quality_report_-_2014/1702856. Database corrections to remove stream assessments from many lakes and impoundments resulted in a reduction of the total miles and lake acres assessed for aquatic life use and the minimal increase in miles for potable water supply use.

Table 2

Statewide Assessment Summary

A statewide summary of use support status for four water uses in assessed streams

	Aquatic Life Use	Fish Consumption Use	Recreational Use	Potable Water Supply Use
Streams (miles)				
Assessed*	83,438	8,203	4,994	3,358
Supporting	67,556	6,211	3,109	3,275
Impaired	9,031	1,280	1,784	71
Approved TMDL**	6,851	712	20	12
Compliance	72	---	---	---
Pollution***	2,967	---	---	---
Restored****	72	190	22	49

* Database management to remove assessments from stream lines in lakes and impoundments reduced total miles assessed.

** TMDL miles reported here are only those overlapping impaired segments. A TMDL allocation may include an entire watershed, including streams listed as attained.

*** 2,049 miles have both pollution and pollutant problems.

**** Stream miles now attaining and removed from Category 5 and placed in Category 1 or 2.

Table 3
Statewide Assessment Summary
Sources of Impairment: Streams
Totals Include List 4a, 4b, 4c, and 5
(Mile totals will not equal Table 2 because a waterbody can have multiple impairments)

Source	Designated Use (Miles)				Total
	Aquatic Life	Fish Consumption	Recreation	Water Supply	
Agriculture	5,709		62	31	5,802
Abandoned Mine Drainage	5,572			12	5,584
Source Unknown	599	1,985	1,698	41	4,322
Urban Runoff/Storm Sewers	2,614		41		2,655
Road Runoff	923				923
Habitat Modification	808				808
Small Residential Runoff	747				747
Atmospheric Deposition	505				505
Removal of Vegetation	402				402
Municipal Point Source	388		7	1	396
Channelization	336				336
Other	306		9		315
Bank Modifications	311				311
Land Development	231				231
On site Wastewater	199		6		205
Erosion from Derelict Land	192				192
Subsurface Mining	114			67	181
Construction	161				161
Upstream Impoundment	160				160
Natural Sources	148				148
Hydromodification	143				143
Flow Regulation/Modification	124				124
Subsurface Mining	120				120
Industrial Point Source	110	8			118
Surface Mining	117				117
Combined Sewer Overflow	102	8	12		114
Petroleum Activities	63				63
Golf Courses	55				55
Silviculture	19				19
Highway, Road, Bridge Const.	16				16
Package Plants	15				15
Land Disposal	13				13
Draining or Filling	10				10
Logging Roads	2				2
Recreation and Tourism	2				2
Dredging	1				1

Table 4
Statewide Assessment Summary
Cause of Impairment: Streams
Totals Include List 4a, 4b, 4c, and 5
(Mile totals will not equal Table 2 because a waterbody can have multiple impairments)

Cause	Designated Use (Miles)				Total
	Aquatic Life	Fish Consumption	Recreation	Water Supply	
Siltation	8,920			2	8,922
Metals	5,109			12	5,121
pH	2,855				2,855
Nutrients	2,596			28	2,624
Pathogens			1,804	39	1,843
Water/Flow Variability	1,810				1,810
Cause Unknown	1,462				1,462
Organic Enrichment/Low D.O.	1,304				1,304
PCB		1,234			1,234
Other Habitat Alterations	1,194				1,194
Mercury		955			955
Flow Alterations	717				717
Suspended Solids	529				529
Turbidity	222				222
TDS	170			8	178
Excessive Algal Growth	148				148
Thermal Modifications	76				76
Unknown Toxicity	66				66
Other Inorganics (Sulfates, etc)	51			3	54
Dioxins		46			46
Osmotic Pressure	37				37
Oil and Grease	35				35
Exotic Species	31				31
Pesticides	23				23
Nonpriority Organics	23				23
Chlordane		20			20
DO/BOD temp	19				19
Un-ionized Ammonia	18				18
Priority Organics	18				18
Chlorine	9				9
Filling and Draining	6				6
Chlorides	3				3
Trash	1				1

Monitoring information indicates that 67,556 miles support designated aquatic life use. A total of 9,031 miles are reported as impaired and still requiring a TMDL and 6,851 miles are impaired but already have an approved TMDL. There are 2,967 miles with pollution problems not requiring a TMDL and 72 miles are impaired but expected to improve in a reasonable time pending agreed upon corrective action.

The four largest sources of reported impairment for aquatic life are agriculture, abandoned mine drainage, source unknown and urban runoff/storm sewers. The leading causes are siltation, metals, pH, nutrients and water/flow variability. While it is not possible to link sources to causes at the level of detail presented in Tables 3 and 4, many of the causes other than water/flow variability are known to be associated with the three leading sources of abandoned mine drainage, agriculture, and urban runoff/storm sewers. Agricultural impairments are generally caused by nutrients and siltation associated with surface runoff, groundwater input and unrestricted access of livestock to streams. Low pH, elevated concentrations of metals and siltation are the result of abandoned mine drainage runoff from mine lands and refuse piles. Increased levels of nutrients and siltation, along with flow variability, are associated with urban runoff. The sources associated with water/flow variability are varied, including hydromodification, road runoff, urban runoff/storm sewers, and several others. Any source that alters runoff or stream flow can affect water/flow variability. Water/flow variability is considered pollution not requiring a TMDL but the problem still requires remediation.

There are 6,211 assessed miles supporting the fish consumption use and 1,280 miles impaired and still requiring a TMDL. There are approved TMDLs for 712 miles. The 6,211 miles supporting this use is a conservative estimate. As a rule, when fish tissue samples are clean the results are only extrapolated to represent two miles on small streams and ten on larger waterbodies. To protect the public, larger extrapolations are made when the fish tissue samples are tainted.

The major source of contamination resulting in fish consumption advisories is listed as unknown because it is difficult to trace the sources. The contamination can be in the soil, groundwater, stream sediment, or point sources. The contaminants do not readily break down and can linger for decades. In addition, fish can move considerable distances. Only with careful study can the source of contamination be determined with certainty. The contaminants documented are PCB, mercury, chlordane, and dioxin in decreasing order. Atmospheric deposition is the most likely source of the mercury. There is a statewide advisory limiting consumption of recreationally caught fish to one meal per week. If fish tissue mercury concentrations are greater than the one meal per week level (higher concentrations), they are placed on Category 5 of waters. Conversely, if subsequent samples indicate the concentrations are now less than the one meal per week level they are removed from Category 5.

Recreational use is assessed primarily by measuring bacteria levels. High bacteria densities indicate conditions that might cause sickness from contact with or ingestion of the water. Many of the waters targeted for sampling were suspected of having bacteria problems so the 1,784 miles of impaired miles versus the 3,109 miles attaining is not unexpected. There are 20 miles with an approved pathogen TMDL. The major source of pathogens is listed as source unknown followed by agriculture. If there are several potential sources of bacteria in the watershed the assessor lists the source as unknown until better information becomes available.

Potable water supply use was supported in 3,275 miles of streams assessed, not supported in 71, and 12 had approved TMDLs. This potable water supply use is measured before the water is treated for consumption. The primary assessment

measures are nitrate and nitrite levels and bacteria but additional parameters, both organic and inorganic, are considered.

Part C3.2. Record of changes to the 2012 Integrated List 5 made in the 2014 Integrated List

The Integrated List is part of a biennial report. The previous list included data gathered through 2011. In the two year period leading up to this report, a number of waterbodies listed as impaired on the 2012 Integrated Report were resurveyed. Impaired waters may be resurveyed for a number of reasons including the need for additional data to support TMDL development, or changes in land use, or point source discharge characteristics. Waters are reevaluated on a rotating basis as per the ICE sampling protocol outlined in the 2013 Assessment Methodology. Areas where watershed improvement projects are in place are also targeted to document improvements that may result.

Appendix E tracks changes in the status of waters impaired in 2012 but attaining uses in 2014. Each of these delistings is the result of a detailed chemical or biological survey and subsequent data evaluation. Appendix F tracks changes in the pollutant causes. Entries for waters that were reported as impaired in the 2012 Integrated Report, but subsequent surveys found them to be impaired but by different pollutants, are edited to better reflect the problems. The comments associated with each record describe the changes. Lastly, Appendix G describes records with errors. Some are mapping errors discovered because the GIS coverage has undergone several revisions over the past 16 years and occasionally some legacy mapping errors are uncovered. Other errors relate to an impairment being incorrectly mapped to a pollutant source. Comments in these records describe the error. The 2012 Category 5 erroneously reported approximately 30 miles of the headwaters of French Creek in New York state as impaired for Fish Consumption and that error (reporting miles outside of the Commonwealth) has been corrected for 2014.

Part C3.3. Lakes Use Support

Table 5 is a summary of the four use support categories for lakes. Acres “supporting” is the number of acres not impaired for the assessed use. “Impaired” acres (Category 5) do not support the assessed use and still require a TMDL. “Approved TMDL” includes impaired lake waters where a TMDL has been completed and approved by EPA. “Impaired (Category 4c)” is a special category of use impairment where a problem is documented but it will not be addressed through a TMDL. Pollution is a special category of impairment where there is a problem but it will not be addressed through a TMDL because it does not involve pollutant loadings. “Assessed” refers to the total acres surveyed for that use. “Restored” represents waters that were impaired (Category 4 or 5) on previous Integrated Reports but are now attaining one or more uses Category 1 or 2).

Table 6 summarizes the sources of impairment problems and Table 7 the causes. Note that totaling the sources or causes will not equal the acres summarized in Table 5. This is because a waterbody may have multiple sources and causes. The individual

source/cause pairs for each waterbody are found on Categories 4b, 4c and 5. The lists are large and as a result are provided on the DEP website at http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/draft_integrated_water_quality_report_-_2014/1702856.

Table 5
Statewide Lake Assessment Summary
 A statewide summary of use support status for four water uses in assessed lakes

	Aquatic Life Use	Fish Consumption Use	Recreational Use	Potable Water Supply Use
Lakes (acres)				
Assessed	79,986	68,508	81,390	58,859
Supporting (Lists 1 & 2)	42,225	33,016	76,185	58,225
Impaired (List 5)	6,052	30,246**	5,204**	635
Impaired (List 4c)	20,611	---	---	---
Approved TMDL (List 4a)	11,096*	5,642	---	---
Restored***	853	11,592		

* Harveys Lake TMDL (658 acres) now attaining ALU, is no longer included in TMDL total.

Dutch Fork Lake (87 acres) has a completed TMDL but has been breached so is no longer impaired; however PFBC is reconstructing the impoundment.

** Presque Isle Bay acres are included in the fish consumption and recreation use totals. The remainder of Lake Erie is not included in the pathogen and recreation acre totals. Pennsylvania has 63 miles of Lake Erie shoreline, 14 of which comprise Presque Isle.

*** Lake acres now attaining and removed from Category 5 and placed in Category 1 or 2.

Table 6
Statewide Assessment Summary
Sources of Impairment: Lakes
Totals Include List 4a, 4b, 4c, and 5
(Acre totals will not equal Table 5 because a waterbody can have multiple impairments)

Designated Use (Acres)					
Source	Aquatic Life	Fish Consumption	Recreation	Water Supply	Total
Atmospheric Deposition	219	19,780			19,999
Source Unknown	2,246	15,100	3,718		21,063
Other	19,899				19,899
Agriculture	13,638		1,316	623	15,576
Urban Runoff/Storm Sewers	2,999		82		3,081
On site Wastewater	3,218		87		3,305
Municipal Point Source	2,439				2,439
Natural Sources	1,290				1,290
Habitat Modification	495		72		567
Small Residential Runoff	540				540
Removal of Vegetation	445				445
Abandoned Mine Drainage	365			12	377
Golf Courses	210				210
Bank Modification	192				192
Road Runoff	185		5		190
Recreation and Tourism	185				185
Package Plants	160				160
Hydromodification	121		68		189
Construction	76				76
Draining or Filling			15		15
Land Development	5		5		10

Table 7
Statewide Assessment Summary
Causes of Impairment: Lakes
Totals Include List 4a, 4b, 4c, and 5
(Acre totals will not equal Table 5 because a waterbody can have multiple impairments)

Designated Use (Acres)					
Cause	Aquatic Life	Fish Consumption	Recreation	Water Supply	Total
Mercury (Lakes)		31,461			30,981
pH	15,921				15,921
Nutrients	13,597		137	623	14,357
Suspended Solids	10,347		57		10,404
Organic Enrichment/Low D.O.	8,492				8,492
Pathogens			4,897		4,897
PCB		3,899			3,899
DO/BOD	1,280				1,280
Excessive Algal Growth	471		31		502
Turbidity	445				445
Metals	365			12	377
Exotic Species	235		158		393
Siltation	255		70		325
Noxious Aquatic Plants	291		5		296
Other Habitat Alterations	31				31
Unionized Ammonia	25				25

A total of 79,986 acres of Commonwealth lakes have been assessed for aquatic life use and of these acres, 42,225 acres support that use. There are 6052 assessed lake acres that are impaired and still require a TMDL. Approved TMDLs are in place for 11,096 acres. Pollution problems that do not require TMDLs impair 20,611 acres. The major sources of aquatic life use impairment in lakes are “other” and agriculture. “Other” is the source used for lakes on Category 4c which are impaired but not requiring a TMDL. These lakes show short term fluctuations in DO or pH but support a healthy biotic community. The primary stressors are nutrients, suspended solids, organic enrichment/low DO, and pH. Low DO and high pH problems are associated with summer lake stratification. Low pH problems are associated with natural bog conditions.

Fish consumption assessments covered 68,508 lake acres (excluding Lake Erie but not Presque Isle Bay). Of these, 33,016 acres are assessed as supporting this use, 30,246 acres are reported as requiring a TMDL, and 5,642 acres have approved TMDLs. The reason for the large proportion of impaired acres is the implementation of Pennsylvania’s risk-based mercury fish consumption advisory methodology in 2001. Nearly all of the lake advisories are due to mercury with atmospheric deposition listed as the source.

In addition, fish consumption advisories are in place for a number of species in the Pennsylvania portion of Lake Erie. These advisories are due to PCB and mercury.

There are 63 miles of Lake Erie shoreline in Pennsylvania, fourteen of which comprise the Presque Isle Peninsula.

A total of 81,390 lake acres have been assessed for recreational use support and 5,204 of those acres require TMDLs. Pathogens and exotic species are responsible for the impairments.

All but 635 acres of 58,859 acres assessed for potable water supply use were found to be attaining that use.

Part C3.4. Excluding the Fishable and Swimmable Uses

DEP routinely re-evaluates, as part of its triennial review of water quality standards, the two water bodies where the fishable or swimmable uses specified in Section 101(a) (2) of the federal Clean Water Act are not being met: (1) the Harbor Basin and entrance channel to Outer Erie Harbor/ Presque Isle Bay and (2) several zones in the Delaware Estuary.

The swimmable use designation was deleted from the Harbor Basin and entrance channel demarcated by U.S. Coast Guard buoys and channel markers on Outer Erie Harbor/ Presque Isle Bay because boat and commercial shipping traffic pose a serious safety hazard in this area. This decision was based on a Use Attainability study completed in 1985. Because the same conditions and hazards exist today, no change to the designated use for Outer Erie Harbor/ Presque Isle Bay is proposed.

DEP cooperated with the Delaware River Basin Commission (DRBC), EPA and other DRBC signatory states on a comprehensive Use Attainability study in the lower Delaware River and Delaware Estuary. This study resulted in appropriate restrictions relating to the swimmable use, which DRBC included in water use classifications and water quality criteria for portions of the tidal Delaware River in May 1991. These changes were incorporated into Sections 93.9e and 93.9g (Drainage Lists E and G) of Pennsylvania's Water Quality Standards in 1994. The primary water contact use remains excluded from the designated uses for river miles 108.4 to 81.8 because of continuing significant impacts from combined sewer overflows and other hazards, such as commercial shipping traffic.

Part C3.5. Lakes Trophic Status

Lake trophic status, based on Carlson's Trophic State Index (TSI), is used as a tool to monitor lake status in Pennsylvania. Lakes with a TSI of less than 40 are oligotrophic (nutrient poor); 40-50 is mesotrophic; 50-65 is eutrophic (nutrient rich); and greater than 65 TSI is considered hypereutrophic. TSIs for Pennsylvania lakes are based on seasonal mean values of phosphorus, secchi depth and chlorophyll a. See Methods documents cited above). Trophic category is based on the Total Phosphorus (TP) TSI. Table 8 summarizes lake trophic status. Sums do not include Lake Erie, but do include Presque Isle Bay for pertinent data.

Table 8
Lake Trophic Status: Summary of Lakes Assessed

	Number of Lakes	Acreage of Lakes
Total Assessed (all types)	507	
Assessed for TSI (2002 to 2012)	210	67,026*
Oligotrophic	9	2,341
Mesotrophic	85	14,235
Eutrophic	82	46,079
Hypereutrophic	12	3,020
Unassigned (incomplete data)	22	1,350

* Excel summary table of recent data not from NHD coverage.

Part C3.6. Lake Restoration Efforts

The Commonwealth's lake protection and restoration program is mainly supported by EPA's Nonpoint Source Program (Section 319 of the Clean Water Act) and the state's Environmental Stewardship Program, through Growing Greener grants. Other funding sources include EPA Section 104(b)3 grants, the Natural Resources Conservation Service (NRCS) PL566 program, and other programs such as the Chesapeake Bay Program and PENNVEST (Clean Water State Revolving Funds). DCNR also funds in-lake restoration practices for State Park lakes. Various partners are engaged in lake and lake watershed restorations, and are not limited to the lake owners. Watershed partners include county Conservation Districts which implement many DEP program initiatives and also serve as grant and project managers. Program goals to restore and/or protect lake water quality are based on studies that identify impairments, pollution sources and the course of remediation. Public use and benefit of the lake, and watershed priority based on impairment are important criteria in prioritizing lakes to be funded.

Restoration techniques implemented through Phase II or restoration grants include various watershed and in-lake best management practices (BMPs) such as agricultural BMPs, riparian corridor protection and restoration (buffers and in-stream structures), lake shoreline protection, dredging, stormwater management and control techniques, point source controls, aquatic macrophyte controls, lake and watershed liming, alum treatments, biomanipulation to benefit fisheries, lake drawdowns, septic management, wildlife control, and institutional BMPs such as public education efforts and enacting protective municipal ordinances. Sewage treatment plant upgrades are also an important control technique to improve lake water quality. Invasive species are additionally an important restoration theme, with increasing numbers of lakes impacted by Eurasian watermilfoil, water chestnut, and zebra/quagga mussels. Some limited Growing Greener and Sea Grant funds are available for control of these organisms.

Table 9 provides information on current Phase I (assessments) and Phase II (restoration/implementation) lake work conducted in the Commonwealth. Expenditures on active lake projects or lake watershed projects in Pennsylvania currently amounts to approximately \$5.5- million for projects current through 2013. Table 10 summarizes

known techniques used in lake restoration projects in Pennsylvania's public lakes as of 2013.

Part C3.7. Lake Control Methods

Pennsylvania's lake management regulation is codified in DEP's Rules and Regulations at Section 96.5(b) - Discharges to Lakes, Ponds and Impoundments, which sets forth treatment requirements for point source discharges necessary to control eutrophication. It is a technology- based approach that results in increasingly stringent effluent requirements based on an assessment of the water quality benefits of such controls. The need for and extent of point source controls for a specific lake are determined by field studies conducted during spring overturn, summer stratification and fall overturn. Appropriate nutrient limitations and monitoring requirements are included in NPDES permits based on the trophic conditions found during these studies. In most cases, follow-up monitoring is conducted to evaluate the adequacy of the effluent limitations.

Nonpoint source pollution can also impact lake water quality. Phase I diagnostic studies on Pennsylvania lakes have identified nonpoint source impacts from acid deposition, agricultural runoff, streambank erosion, malfunctioning septic systems, construction, stormwater runoff, and pathogens. Ecosystem impacts from exotic invasive aquatic plants are also increasing. Mitigation of these sources is highlighted in the previous section. Acidity problems, resulting mostly from acid deposition, but also in a few cases mining runoff, may be mitigated with lime treatments, although funding for these types of projects is very limited. Lakes with naturally low pH (swamps and bogs) are not considered for treatment, but may be listed on part 4C of the Integrated List. Liming is the current method to mitigate low pH in lakes, and is used in PA on both public and private lakes. Some lakes (reservoirs) have been identified as impaired by metals from mine drainage, or more commonly by mercury (mainly via fish tissue) and none have been identified as impacted by "high acidity," based on high concentrations of dissolved metals. Restoration efforts and BMPs in the watershed are the best way to reduce mining effects in waterbodies (i.e. treating the source of the problem). In-lake mitigation could be explored by using alum treatments to bind metals into the lake sediments. Some "toxics" can be removed by dredging but, again, funding for dredging is limited. Most efforts have focused on source control (mining BMPs or AMD BMPs) and natural recovery rather than in-lake mitigation.

Table 9

Active Lake Projects in Pennsylvania Public Lakes as of 2013. Does not include water quality assessments done by DEP. Growing Greener and 319 final reports available from DEP, Bureau of Conservation and Restoration.

Lake or Study Name	County	Study Type	Study Period	Federal Funds	Fund Source	State Funds	319 Funds	Match	Sponsor /Project
Antiedam Lake	Berks	Phase II	2010-2012		GG	\$145,000		\$21,750	Berks Co Commissioners; stream BMPs
Bald Eagle Lake	Centre	Phase III	2007-2012		GG	\$150,000		\$39,200	Centre CCD; stream BMPs (partial applied to this watershed)
Blue Marsh Lake	Berks	Phase II	2010-2012		GG	\$51,593		\$74,322	Berks CCD
Conneaut Lake	Crawford	Phase II	2011-2012		GG	\$2,997			Conneaut School District/ EE
Conneaut Lake	Crawford	Phase II	2010-2012		GG	\$43,050		\$6,458	Crawford CCD/ ag BMPs (partial in lake watershed)
C-SAW - Various Small Lake Projects	multi	Mostly Phase I	2010-2012		GG	\$75,000		\$161,114	C-SAW - Consortium of Scientific Assistance to Watersheds
C-SAW - Various Small Lake Projects	multi	Phase I and Phase II	2012-2014		GG	\$75,000		\$125,000	C-SAW - Consortium of Scientific Assistance to Watersheds
Frances Slocum Lake	Luzerne	Phase II	2013		DCNR	\$14,000			Bureau of State Parks, wetland islands

Lake or Study Name	County	Study Type	Study Period	Federal Funds	Fund Source	State Funds	319 Funds	Match	Sponsor /Project
Frances Slocum Lake	Luzerne	Phase II	2013	\$48,900	319		\$48,900		Luzerne CCD, Watershed Implementation Plan
Foster Joseph Sayres	Centre	Phase II	2010-2012		GG	\$37,778		\$61,004	Clearwater Conservancy; watershed BMPs
Glendale Lake	Cambria	Phase II	2012-2014				\$16,580	\$12,544	Cambria Co Conservation District
Greenlick Reservoir	Fayette	Phase II	2010-2012		GG	\$10,000		\$1,500	Jacobs Creek Watershed Assn; shoreline stabilization
Harveys Lake	Luzerne	Phase II and III	2009-2012	\$262,534	319		\$262,534	\$48,315	Harveys Lake Borough;
Harveys Lake	Luzerne	Phase II and III	2010-2012	\$565,700	319		\$565,700	\$100,000	stormwater BMPs and monitoring
Harveys Lake	Luzerne	Phase II and III	2012-2014	\$366,100	319		\$366,100		stormwater BMPs and monitoring
Lake Carey	Wyoming	Phase II	2008-2012		GG	\$308,939		\$67,490	Lake Carey Welfare Association; stormwater BMPs
Lake Carey	Wyoming	Phase II	2012-2014		GG	\$111,610		\$22,240	Lake Carey Welfare Assocn
Lake Erie	Erie	Phase II	2009-2012	\$247,825	319		\$247,825	\$37,000	Erie CCD; stream, Ag, and EE BMPs
Lake Erie	Erie	Phase I	2007-2012		GG	\$20,000		\$117,984	Erie CCD; develop a plan for

Lake or Study Name	County	Study Type	Study Period	Federal Funds	Fund Source	State Funds	319 Funds	Match	Sponsor /Project
									Trout Run
Lake Erie	Erie	Phase II	2008-2012	\$150,000	319		\$150,000	\$32,800	Erie CCD; Trout Run BMPs
Lake Erie	Erie	Phase II	2008-2012		GG	\$35,000		\$65,000	Erie CCD; septic system BMPs
Lake Erie	Erie	Phase II	2008-2012		GG	\$200,000		\$120,926	Erie CCD; Cascade Creek stream BMPs
Lake Erie	Erie	Phase II	2008-2012		GG	\$13,785		\$91,900	Erie PSU; stream projects & monitoring Bear Run
Lake Erie	Erie	Phase II	2012-2014		GG	\$371,843		\$71,282	Penn State University
Lake Galena	Bucks	Phase II	2011-2012		GG, PALMS	(part of PALMS below			Bucks CCD/ lakeshore restoration
Lake Jean	Luzerne, Sullivan	Phase II	1995-yearly		DCNR	\$1,500			Bureau of State Parks/ liming
Lake Luxembourg	Bucks	Phase II	2011-2014	\$293,900	319		\$293,900	\$52,680	Bucks County Conservation District
Lake Pleasant	Erie	Phase II	2011-2012		GG, PALMS	(part of PALMS below)			Western PA Conservancy; invasive control
Lake Wallenpaupack	Pike, Wayne	Phase II	2012-2014		GG	\$76,050		\$2,629,110	Lake Wallenpaupack Watershed Management

Lake or Study Name	County	Study Type	Study Period	Federal Funds	Fund Source	State Funds	319 Funds	Match	Sponsor /Project
Lake Wilhelm	Mercer	Phase II	2011-2012		GG, PALMS	(part of PALMS below)			DCNR, Bur. State Parks
Laurel Hill Lake and Kooser Lake	Somerset	Phase I	2008-2012		GG	\$30,900		\$14,958	Somerset CCD; watershed assessment
Laurel Hill Lake and Kooser Lake	Somerset	Phase I	2008-2012		GG	\$240,240		\$108,097	Somerset CCD; flow and sediment analysis
Leaser Lake	Lehigh	Restoration	2012-2014			(part of PALMS below)			Leaser Lake Foundation
Magnolia Lake	Bucks	Phase II	2009-2012		GG	\$44,341		\$8,770	Bucks CCD; lakeshore stabilization
North Fork Dam	Potter	Phase II	2009-2012		GG	\$23,306		\$33,634	Potter Co. Commissioners
Ontelaunee Lake	Berks	Phase II	2009-2012		GG	\$90,435		\$25,300	Berks CCD; ag BMPs
PA Lake Management Society (PALMS)	multi	Phase I and II	2009-2012		GG	\$250,000		\$37,500	various lake projects statewide
PA Lake Management Society (PALMS)	multi	Phase II and III	2011-2014		GG	\$283,000		\$105,074	various lake projects statewide, mostly buffers
Shenango Res. (watershed)	Mercer	Phase II	2008-2012		GG	\$18,709		\$8,000	Shenango River Watchers; bank stabilization
Shawnee Lake	Bedford	Phase II	2013		DCNR	\$14,000			DCNR, wetland islands
Somerset Lake	Chester	Phase I	2010-2012		GG	\$39,835		\$7,675	New Garden Twp.

Lake or Study Name	County	Study Type	Study Period	Federal Funds	Fund Source	State Funds	319 Funds	Match	Sponsor /Project
Speedwell Forge Lake	Lancaster	Phase II	2012-2014		GG	\$43,509		\$7,603,858	Save Speedwell - dam and lake restoration
Stephen Foster Lake	Bradford	Phase II	2010-2013	\$161,938	319		\$161,938	\$28,390	Mill Creek streambank restoration
Stephen Foster Lake	Bradford	Phase II	2011-2013	\$194,468	319		\$194,468		Bradford CCD/Watershed and In-lake BMPs - wetland pocket, wetland islands, alum tmnt
Stephen Foster Lake	Bradford	Phase III	2012-2013	\$6,000	319		\$6,000		Efficacy monitoring
Tioga Lake	Tioga	Phase II	2009-2012		GG	\$175,000		\$104,000	Tioga CCD; ag BMPs
Tioga Lake	Tioga	Phase II	2008-2012		GG	\$227,107		\$34,066	Tioga CCD; Dirt & Gravel Roads
Total Funds				\$2,297,365		\$3,223,527	\$2,313,945	\$12,078,941	
Total Federal and State Funds									\$5,520,892

319 = Nonpoint Source Program

DCNR = PA Dept. of Conservation & Natural Resources

GG = Growing Greener Program, PA Environmental Stewardship Funds

CCD = County Conservation District

Phase 1 = lake & watershed assessment/monitoring & management plan

Phase II = restoration BMPs, including Educational

Phase III = monitoring for efficacy, post-TMDL

Table 10
Lake Rehabilitation Techniques Used in Public Lakes

Technique	Number of Lakes on which Technique is Used	Acres of Lakes on which Technique is Used
<i>In-Lake Treatment</i>		
Aeration	4	120
Aquatic herbicide treatment	40	428
Aquatic macrophyte harvesting	4	70
Artificial Wetland Islands	4	90
Dredging	1	50
Invasive species controls	5	481
Lake drawdowns	25	7,526
Liming	1	100
<i>Watershed Treatments</i>		
Sediment traps/detention basins	8	8,317
Shoreline erosion controls/bank stabilization	15	14,332
Conservation tillage	5	7,893
Animal waste management practices	8	9,893
Riprap installed	4	7,334
Road or skid trail management	5	14,779
Stream restoration (natural channel design)	4	1821
Created wetlands	5	1794
<i>Other Lake Protection/Restoration Controls</i>		
Local lake management program in place	26	15,941
Public information/education	59	63,739
Local ordinances/regulations to protect lake	3	6,608
Point source controls	18	15,262

Part C4. Wetlands Protection Program

Pennsylvania has 403,924 acres of wetlands and 412,905 acres of deep-water habitats such as ponds and lakes. About 1.4 percent of the Commonwealth's land surface is represented by wetlands, with 97 percent classified as palustrine. Approximately 76 percent of the palustrine wetlands are further classified as forested and scrub/shrub wetlands. Lacustrine wetlands, mainly composed of the shallow zone (less than 6.6 feet deep) of Lake Erie, represent about two percent of the total, while riverine wetlands make up the remaining one percent. Pennsylvania has 512 acres of tidal wetlands in the Delaware Estuary.

Wetlands are most abundant in the glaciated portions of northeastern and northwestern Pennsylvania. Crawford, Mercer, Erie, Monroe, Pike, Wayne and Luzerne counties contain 40 percent of the Commonwealth's wetlands. Pike

and Monroe counties have the highest percentages of land covered by wetlands with 6.7 percent and 6.4 percent, respectively.

DEP's authority for the protection of wetlands is primarily established by the Dam Safety and Encroachments Act of 1978 and The Clean Streams Law. The Environmental Quality Board adopted Chapter 105, Dam Safety and Waterway Management rules and regulations effective September 27, 1980. Amended regulations became effective October 12, 1991. Since March 1, 1995, DEP has been given authority to attach federal Section 404 authorization along with state permit approvals for most projects through the Pennsylvania State Programmatic General Permit (PASPGP-4). This provides “one-stop shopping” for approximately 80-90 percent of the state and federal permit applications received. PASPGP-4 will expire on June 30, 2016. This reissuance of the PASPGP-4 included the Mineral Resource program area for the first time as eligible to include the federal Section 404 authorization along with the state permit approvals.

Thirty two (32) of Pennsylvania's 66 county conservation districts have Chapter 105 Delegation Agreements with DEP to register Bureau of Waterways Engineering and Wetlands General Permits within their counties. The basic duties of each district are to provide information and written materials to the general public on the Dam Safety and Encroachments Act and Chapter 105 regulations, register general permits, and perform on-site investigations as the first step to gain voluntary compliance. In addition to county delegations, program implementation for general and individual permit processing and issuance is also delegated to the several DEP program areas including the Mineral Resources, Abandon Mine Lands, Conservation and Restoration, Oil and Gas, and Flood Protection programs. The Office of Water Management coordinates this program.

An Environmental Review Committee, consisting of representatives of the U.S. Fish and Wildlife Service (USFWS), Pennsylvania Game Commission (PGC), Pennsylvania Fish and Boat Commission (PFBC), EPA, U.S. Army Corps of Engineers (ACOE) and DEP, meets monthly to review selected applications submitted to DEP. A similar committee has been established that meets semi-annually to review ongoing enforcement actions. Through these committees, lead agencies are designated for taking action or providing field support to resolve violations or to provide data for permit reviews. This coordination economically utilizes limited staff of both state and federal agencies.

Part C5. Trend Analysis for Surface Waters

Introduction

Periodically, the Department – assisted greatly by the United States Geological Survey – analyzes long-term trends of chemical water quality using data collected at fixed-site monitoring stations throughout the Commonwealth. Trend analyses were run for two different time frames: from 1992 to 2012 (long term) and from 2003 to 2012 (10 year, short term).

Trend analysis is a statistical technique used to determine if values of a random variable generally increase or decrease over some time period. Lack of a trend is good evidence that none exists, however there is some possibility that more sample collection will reveal a less obvious trend. Conversely, we can be quite confident that changes in water quality are occurring where trends are detected.

Methods

The present analyses utilized a parametric trend test developed and performed by United States Geologic Survey staff. This approach adjusts observed variation in water quality parameters for variation in flow because most water quality parameters exhibit substantial co-variation with stream flow.

Trend tests were run for 17 water quality parameters (Table 11) at a set of 14 water quality network (WQN) monitoring stations (Figure 1). Most samples in the datasets were collected on a monthly or a bi-monthly basis at each station. Trend tests were not run for datasets that had: (1) more than half of the data recorded as non-detects; (2) a lot of missing data; or (3) validation issues. Nitrite data were considered, but most nitrite concentrations were reported as below detection limits.

Table 11

List of 17 selected nutrient, major ion, sediment, and metal parameters with estimated loads and trends.

Group	Parameter Name	Parameter Abbreviation
Nutrient	Total Nitrogen	TN
	Total Ammonia	NH4
	Total Nitrate	NO3
	Total Phosphorus	TP
	Dissolved Inorganic Phosphorus	DIP
Sediment	Total Suspended Solids	TSS
	Total Dissolved Solids	TDS
Major Ion	Hardness	Hard
	Alkalinity	Alk
	Calcium	Ca
	Magnesium	Mg
	Sulfate	SO4
Metals	Aluminum	Al
	Copper	Cu
	Iron	Fe
	Lead	Pb
	Zinc	Zn

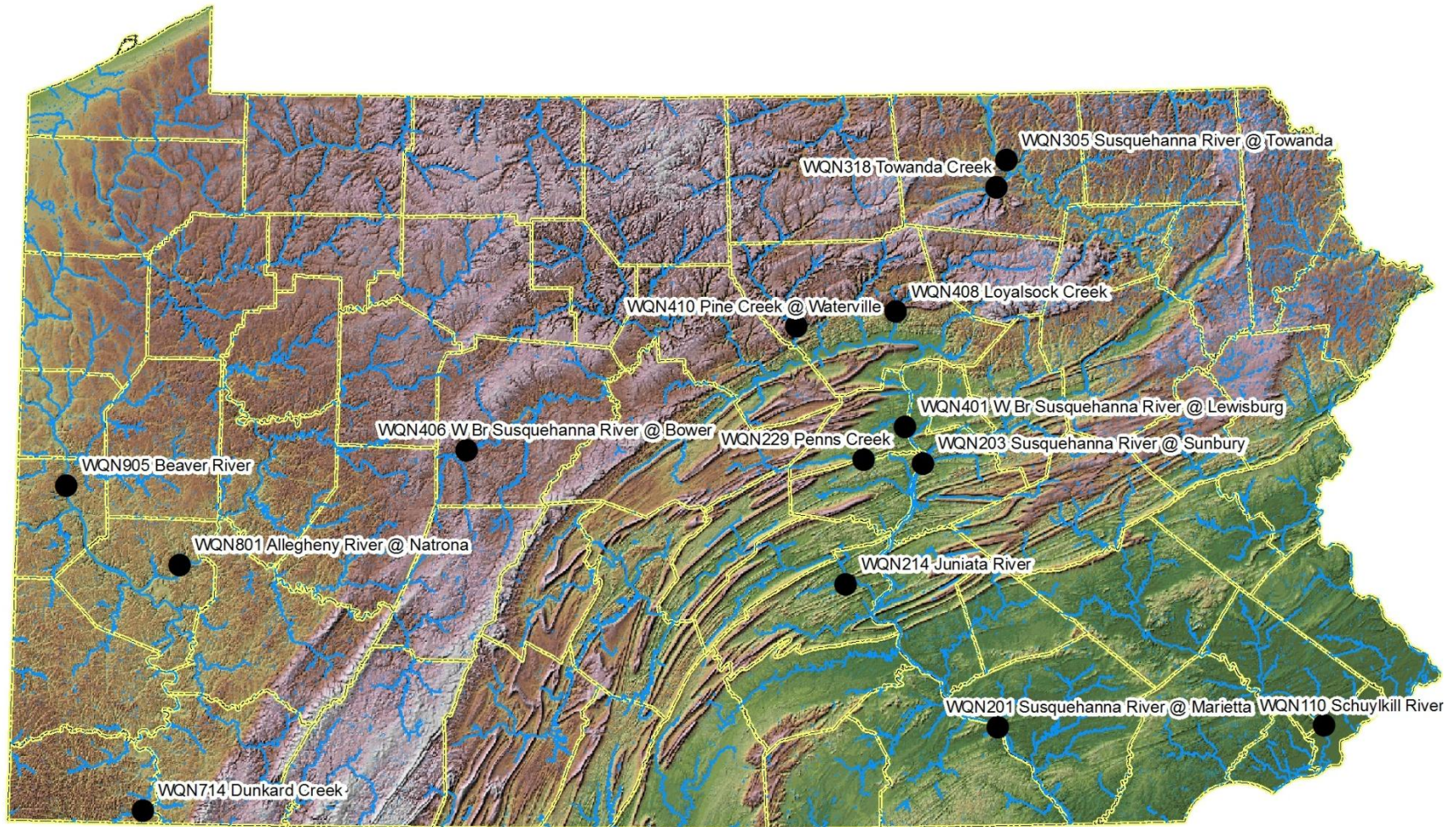


Figure 1. Locations of the 14 fixed-site, long-term water quality network (WQN) monitoring stations used in the 2014 trend analysis. Major waterways (blue) and county boundaries (yellow) are also shown.

Results

Trends for the suite of transition metals (Cu, Zn, Fe) and poor metals (Al, Pb) indicated decreasing concentrations for datasets where the trends were statistically significant, with the exception of Pine Creek where there was a long term increase of Zn by 190%. (Table 12, Table 13). Statistically significant decreasing trends were more commonly seen for Al and Fe and ranged between 24% and 66%. However, larger negative trends were observed for Pb at the Allegheny River and the Beaver River (93% and 90%, respectively) and for Cu at the Allegheny River (91%).

Trends for ALK, Hard, and the two alkali earth metals tested (Ca, Mg) were variable (Table 12, Table 13). Most statistically significant long term ALK and Hard trends indicated increases between about 10% and 50%. However, short term trends tended to be more frequently negative between 10% and 24%. The Dunkard Creek ALK trends were more pronounced, and the Dunkard Creek Hard trend was large relative to other Hard trends. Most sites had significant Ca and Mg decreases between approximately 7% and 40%. The exception to this was Pine Creek where there were increases of 6% and 14%, respectively. The Juniata River also had a significant Ca increase of 24%.

Trends for SO₄ and TDS were mostly decreasing, except for Dunkard Creek and Loyalsock Creek (Table 12, Table 13). There were substantial increasing trends for SO₄ observed at Dunkard Creek in both time frames. At Loyalsock Creek, statistically significant increasing trends were observed for TDS in the long term period.

Trends for tested nitrogen species (NO₃, NH₄, TN) were mostly decreasing, but variable across stations (Table 12, Table 13). The statistically significant decreasing nitrogen species trends mostly ranged between 10% and 60% with a few exceptions of more dramatic trends. Long term NO₃ trends were increasing for the Schuylkill River and West Branch Susquehanna River at Lewisburg. However, the short term trend indicates a decreasing trend. All statistically significant trends for nitrogen species at Dunkard Creek show moderate to substantial increases. Another exception to the overall nitrogen species trend was observed at Penns Creek where NH₄ increased 79% in the long term period.

Results for tested phosphorus species (DIP, TP) indicate variable trends (Table 12, Table 13). Statistically significant trends for TP were all negative with the exception of Dunkard Creek. For long term DIP trends, statistically significant increases were observed at Schuylkill River, Susquehanna River at Marietta, Juniata River, Susquehanna River at Towanda, and West Branch Susquehanna River at Lewisburg. Statistically significant short term trends for all these stations indicate decreasing trends. Over the long-term there is an increasing trend but in more recent years that trend is reversed.

There were only two stations that have statistically significant trends for TSS, which were the Susquehanna River at Marietta and Susquehanna River at Sunbury (Table 12, Table 13). Trends for the Susquehanna River at Marietta show substantial increases for long term and short term periods (108% and 201%, respectively). The only significant result for the Susquehanna River at Sunbury indicates a decreasing long term trend of 86%.

Overall, there were 112 statistically significant instances of decreasing trends and 55 instances of increasing trends (Table 12). The number of stations with increasing trends was more pronounced for long term ALK and Hard. There were no statistically significant increasing trends for Cu, Fe, or Pb. The number of stations with decreasing trends was fairly uniform for all constituents analyzed. However, 50% or more stations had decreasing trends in Al, TN, TP, DIP, and SO₄ for either time period. Additionally, there were no statistically significant decreasing trends for ALK.

Table 12

Approximate percent change in flow-adjusted trends over the tested time periods. Highlighted values indicate statistically significant trends (p-values < 0.05) --- indicates datasets without enough data to run the trend test, where residuals were not normal, or with > 50% non-detects.

WQN Station	Stream Name	Trend Period	Al	Cu	Fe	Pb	Zn	TN	NH4	NO3	TP	DIP	TDS	TSS	Alk	Hard	Ca	Mg	SO4
WQN 110	Schuylkill River at Philadelphia	Long Term	-66	---	-44	---	---	-57	4	65	7	1359	---	---	13	17	4	-3	---
		Short Term	---	---	-5	---	---	-24	-36	-26	-15	-23	---	---	-4	-14	-11	-17	---
WQN 201	Susquehanna River at Marietta	Long Term	-24	---	-34	---	---	-9	-12	150	-31	208	---	108	12	29	15	14	-25
		Short Term	13	---	22	---	---	-20	-40	---	-43	-54	---	201	-3	-6	-7	-9	-15
WQN 203	Susquehanna River at Sunbury	Long Term	-58	---	-5	---	---	-87	17	-69	-36	54	---	-86	33	9	-10	-10	-41
		Short Term	-33	---	2	---	---	-25	58	-25	15	-61	---	---	6	-5	-4	-7	-25
WQN 214	Juniata River at Newport	Long Term	-45	---	-4	---	---	-2	21	181	-15	207	---	-25	20	36	24	15	---
		Short Term	-44	---	-29	-64	---	-22	-34	---	-49	-65	---	80	0	-8	-3	-8	-5
WQN 229	Penns Creek at Penns Creek	Long Term	12	---	-19	---	---	-55	79	332	15	7693	---	299	---	17	-10	-3	---
		Short Term	-21	---	10	---	---	-4	42	---	-47	-75	---	---	1	2	2	0	-1
WQN 305	Susquehanna River at Towanda	Long Term	-23	---	18	---	---	-36	-47	-27	-8	529	5	-13	11	22	-7	-6	-64
		Short Term	-33	---	44	---	---	-23	-30	---	-21	-39	-18	24	-5	-10	-10	-12	-30
WQN 318	Towanda Creek at Monroeton	Long Term	-8	---	2	---	-18	---	-51	-76	-12	---	-6	5	4	-7	-37	-43	-65
		Short Term	---	---	40	---	---	-25	-27	-63	-28	-61	-5	-9	-5	-24	-10	-14	-18
WQN 401	West Branch Susquehanna River at Lewisburg	Long Term	-22	---	-25	---	---	-36	-21	830	-48	186	---	-34	58	6	36	-3	-31
		Short Term	-26	---	9	---	---	-26	-22	---	-48	-78	---	136	5	-1	2	-5	-14
WQN 406	West Branch Susquehanna River at Bower	Long Term	---	---	-19	---	---	-86	-48	-48	---	---	---	-70	52	8	-7	-19	-16
		Short Term	---	---	8	---	---	-13	---	-24	59	---	---	---	15	-7	-8	-5	-7
WQN 408	Loyalsock Creek at Loyalsockville	Long Term	-29	---	-20	---	---	-89	---	-69	-56	---	68	---	17	12	-2	-8	---
		Short Term	-9	---	33	---	---	-23	---	-44	---	---	-38	---	7	-1	0	-5	---
WQN 410	Pine Creek at Waterville	Long Term	---	---	22	---	190	-95	---	-74	-55	---	30	198	29	34	6	14	-15
		Short Term	77	---	16	---	---	-25	---	-79	-27	---	-41	550	0	-5	-5	-2	-8
WQN 714	Dunkard Creek at Shannopin	Long Term	-38	-39	-49	-39	-43	20074	437	197	64	-72	---	29	63	115	---	---	209
		Short Term	-40	---	-42	---	-43	65	283	53	356	-21	---	126	31	100	---	---	167
WQN 801	Allegheny River at Natrona	Long Term	-48	---	-44	-93	-28	-71	-22	-27	-57	88	-3	-24	36	2	-28	-34	-38
		Short Term	-43	-91	-35	---	-48	-20	60	-26	9	-36	-15	1302	9	-14	-14	-15	-31
WQN 905	Beaver River at Beaver Falls	Long Term	-57	---	-16	-90	-65	-73	-13	-43	-30	-95	-8	35	17	5	-23	-20	-34
		Short Term	-55	---	-43	-53	-62	-5	-30	-1	-3	-26	-25	70	6	-9	-9	-12	-24

Table 13

Summary of the number of stations with significant trends by time period.

Constituent	Trend Period	# of stations with statistically significant trend tests	
		Increasing	Decreasing
Al	Long term	1	7
	Short term	0	3
Cu	Long term	0	0
	Short term	0	1
Fe	Long term	0	4
	Short term	0	3
Pb	Long term	0	2
	Short term	0	2
Zn	Long term	1	2
	Short term	0	0
TN	Long term	1	7
	Short term	1	8
NH4	Long term	2	4
	Short term	2	5
NO3	Long term	3	6
	Short term	0	5
TP	Long term	1	7
	Short term	1	5
DIP	Long term	6	1
	Short term	0	10
TDS	Long term	5	1
	Short term	0	1
TSS	Long term	1	1
	Short term	1	0
Alk	Long term	12	0
	Short term	1	0
Hard	Long term	9	0
	Short term	1	6
Ca	Long term	2	1
	Short term	0	3
Mg	Long term	2	1
	Short term	0	5
SO4	Long term	1	9
	Short term	1	2

Discussion

The generally decreasing trends in transition metals, poor metals, SO₄, nitrogen species, and phosphorus species, combined with increasing trends in ALK and Hard suggest improving chemical water quality conditions based on the sampling conducted

in the tested time periods at all the stations analyzed except the Dunkard Creek station. Increasing trends in ALK can often be considered water quality improvements because increased ALK means increased acid neutralizing capacity, but elevation of alkalinity much beyond natural levels can have detrimental consequences to water quality, so assessment of the ALK trends depends on the specific context of conditions at each station.

Trends for many constituents exhibited particularly dramatic increasing trends at the Dunkard Creek station. Increasing trends at this station were well over 100% for Hard, SO₄, NO₃, NH₄, TN, and TP in one or both time frames. The Dunkard Creek station also was the only station to show increasing SO₄, TP, and TN trends. It's interesting to note that DIP at 5 stations shows increasing long term trends, but decreasing short term trends. This suggests that although there was significant increase in DIP, improving conditions are apparent over the last 10 years. A similar inverse temporal relationship exists with NO₃ at the Schuylkill River.

Part D: Groundwater

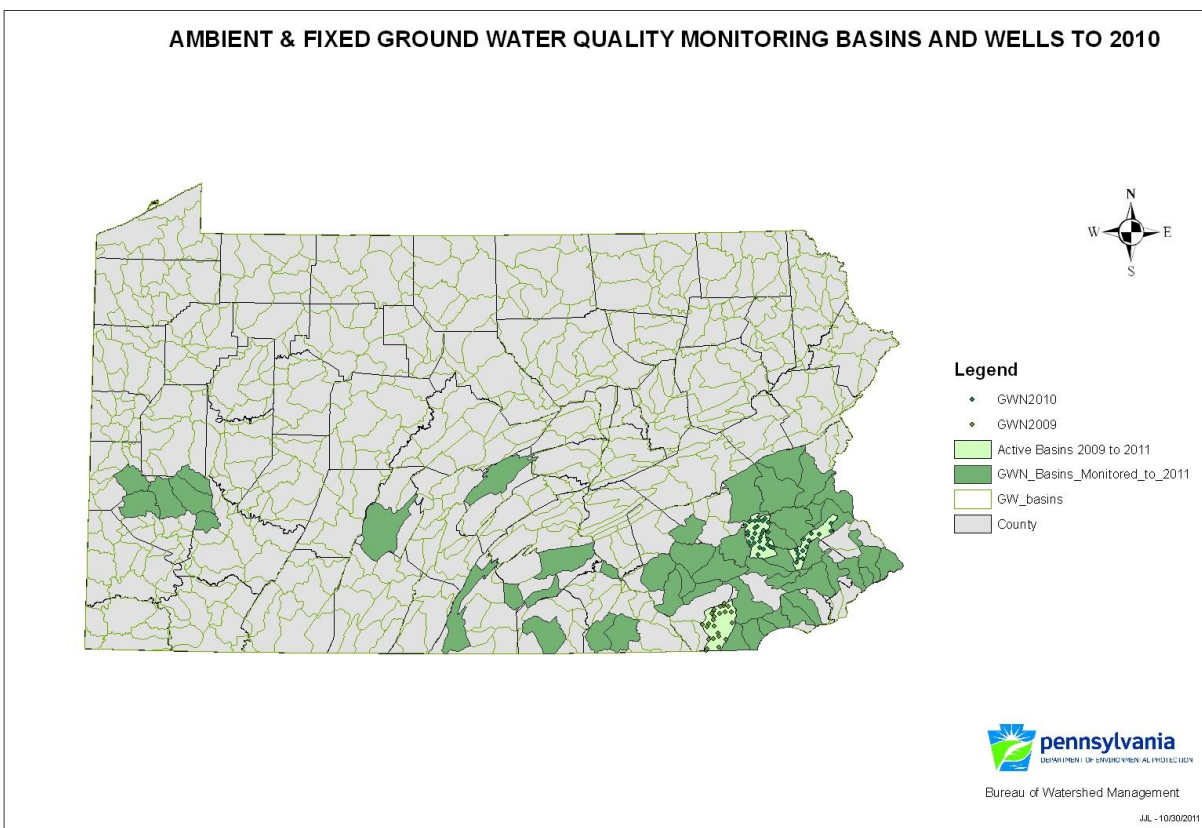
Part D1. Groundwater Assessment

Ambient/Fixed Station Ground Water Quality Monitoring Network (GWMN)

Resources available to operate the Ambient Fixed Ground Water Monitoring Program continue to be limited. Ground water quality monitoring has been active from 2011 to 2013 in two GWMN basins in the Southeast Region: Pottstown Basin (58) and Telford Basin (61) (the two northernmost light-green colored basins in Figure 2). The basins have been sampled for over 10 years at over 40 stations depending on access. The most common contaminant is nitrate-nitrogen but the trend has been for improving water quality for this contaminant. Approximately two locations in the Pottstown Basin regularly do not meet drinking water standards but even they show a trend toward lower nitrate-nitrogen concentrations. The most likely source of elevated nitrate-nitrogen in groundwater is agricultural land use as both sampling points are located adjacent to agricultural fields. Septic systems are also a possibility since both properties and the surrounding area is served by on-lot sewage disposal. One sampling point in the Telford Basin also had nitrate-nitrogen which did not meet drinking water standards but conditions have improved markedly and the well no longer shows nitrate-nitrogen contamination. Concentrations are elevated, but only rarely do not meet drinking water standards. As agriculture is not present in proximity to this location, contamination is presumed to be from septic systems or possibly prior agricultural activity. Some locations in the Telford Basin show detectable concentrations of arsenic and lead that are less than drinking water standards. It is rare to see detectable levels of these metals in these basins but the concentrations appear to be consistent and suggest that the likely sources would be the local geology.

A total maximum daily load has been proposed for the Upper Octoraro Creek (Kirkwood Basin – 196, the southernmost light-green colored basin in Figure 2). The Ground water quality monitoring data for the previously sampled Kirkwood Basin has been made available for this effort.

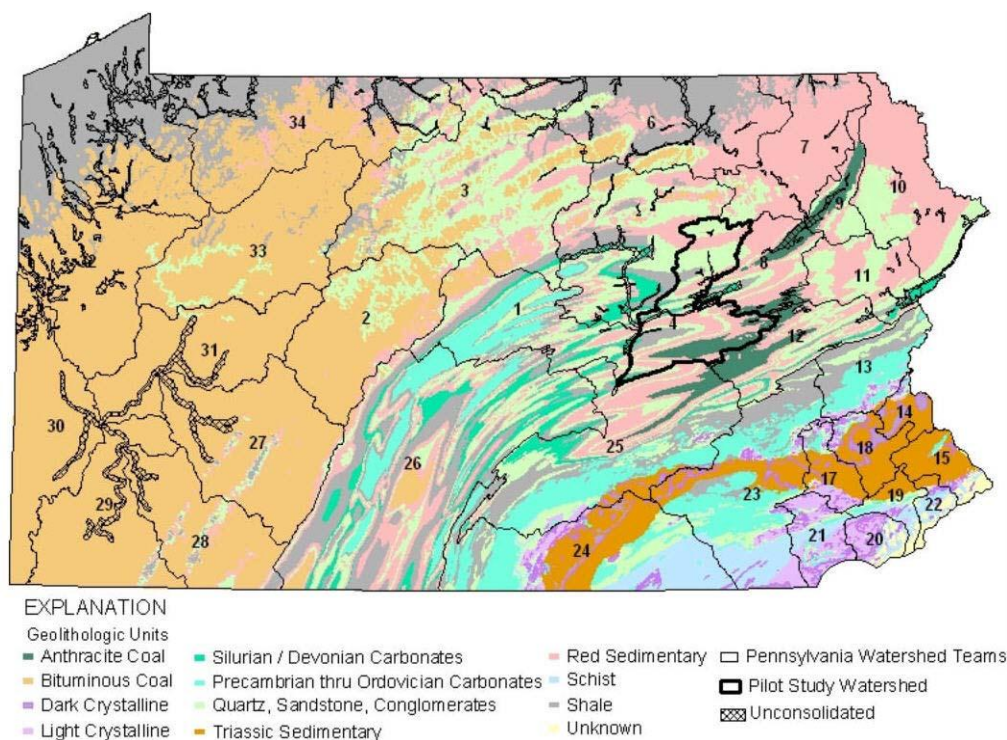
Figure 2



Statewide Monitoring Networks:

To address the need for increased groundwater quality monitoring coverage of the state to meet program goals, DEP has worked with the USGS to design a statewide, watershed-based groundwater quality network using the stratified approach applied in the USGS National Water Quality Assessment project for the lower Susquehanna River. There have been 13 major aquifer categories (geolithologic units) identified for the network based on dominant rock type. The distribution of these geolithologic units (except for the glacial outwash) are shown on Figure 3.

Figure 3



To develop the groundwater network, 30 groundwater monitoring points are needed within each geolithologic unit. This network can be reconfigured to be analyzed based upon various delineated watersheds.

Part D2. USGS Groundwater Quality Data Compilation for Pennsylvania

Under a joint funding agreement with DEP, the U.S. Geological Survey has updated a digital Data Series report that provides a compilation of electronically available groundwater quality data for a 28-year period based on water samples from wells throughout Pennsylvania (Figure 4). Twelve data sources from local, state, and federal agencies were used in the updated compilation, which covers 11 different analyte groups. The data are presented both in terms of 35 former water planning watersheds used by DEP as well as the 13 major geolithologic units representing the major aquifers in the state. Over 24,000 wells were included in the project and the number of analyses ranged from several thousand for nutrients and other inorganic compounds to two dozen for antibiotics. The number of wells sampled varies considerably across the state with most being concentrated near major urban centers. Minimal data exists for about a fourth of the state. When compared to maximum contaminant levels (MCL), the analyte group with the highest MCL exceedance was microorganisms (50% of 4,674 samples), followed by volatile organic compounds (24% of 4,528 samples). The lowest MCL exceedances were for insecticides (<1% of 1,424 samples) and wastewater compounds (<1% of 328 samples). With limited monitoring of ambient groundwater in only a handful of basins in the Ambient/Fixed Station Monitoring Networks, this compilation will help fill in data gaps and shed light on how to establish a more complete statewide groundwater monitoring network. This data compilation in addition to capturing

compliance ground water quality data will help address ground water data needs in the area of unconventional hydrocarbon development in the state. The report (Low, D.J., Chichester, D.C. and Zarr, L.F. 2008. Selected groundwater quality data in Pennsylvania – 1979-2006: USGS Data Series 314, 22 p.) is available on-line at <http://pubs.usgs.gov/ds/314/>

Figure 4

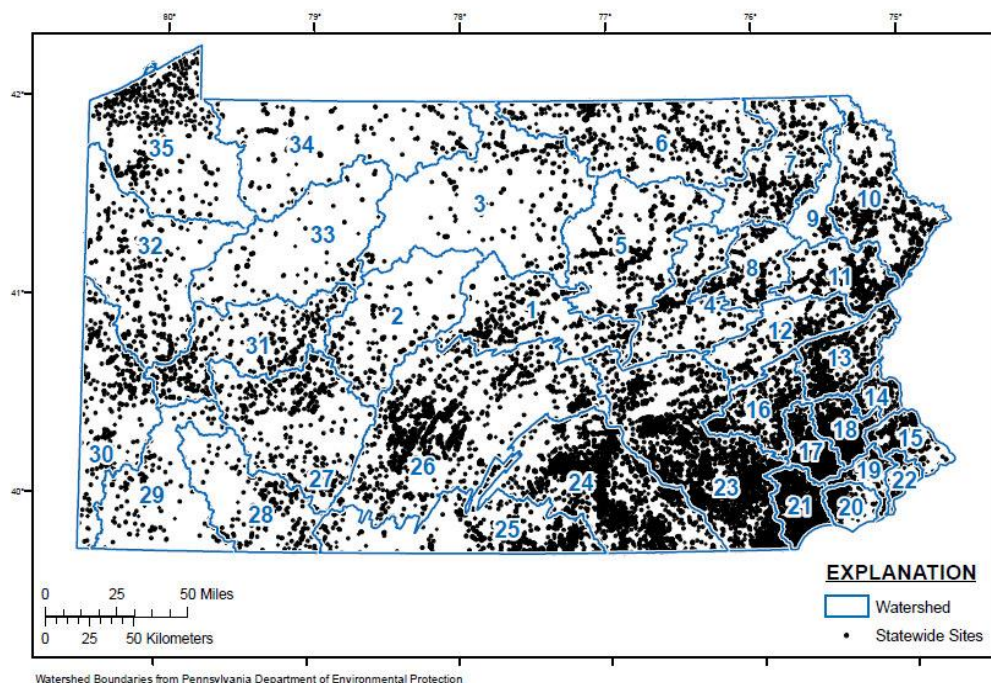


Figure 4. Well and spring locations with ground-water data compiled from 14 source agencies or programs representing the period 1979-2006 for Pennsylvania.

Part D3. Sources of Groundwater Contamination

Each DEP regional office previously defined its highest priority sources of groundwater contamination and a preliminary attempt to revisit the information was undertaken in 2013. These concerns are generally consistent from the 2008 report and are shown below in Table 14. The priorities include industrial facilities, underground storage tanks, hazardous waste sites, abandoned landfills, aboveground storage tanks, manure/fertilizer applications, chemical facilities, septic systems, acid mine drainage, and abandoned oil and gas wells. The contaminants associated with these sources are also shown. Multiple regional studies have indicated 30% to 90% of private water wells have total coliform contamination. In addition, one study showed up to 30% *E. coli* contamination. The USGS study, Relation Between Selected Well Construction Characteristics And Occurrence Of Bacteria In Private Household Supply Wells, South-Central And Southeastern Pennsylvania, WRIR 01-4206, stated that either or both well construction and aquifer contamination could be responsible for the results but problems were more likely to occur where the well was poorly constructed.

Table 14
Major Sources of Groundwater Contamination

Contaminant Source	High Priority Sources (✓)	Factors Considered in Selecting Contaminant Sources (1)	Contaminants (2)
Agricultural Activities			
Animal feedlots			
Chemical facilities	✓	ADCEFG	ABCDE
Drainage wells			
Manure/fertilizer applications	✓	ABCDEFGH	DEIK
On site pesticide mixing & loading			
Pesticide applications			
Storage/Treatment Activities			
Land application of biosolids			
Lawn maintenance/pest treatment			
Material stockpiles			
Storage tanks (above ground)	✓	ABCDEFGF	ABC
Storage tanks (underground)	✓	ABCDEFGH	ABCDEGIJK
Surface impoundments			
Waste piles or tailings			
Disposal Activities			
Abandoned landfills	✓	ABCDE	ADGJ
Landfills (current)			
Septic systems	✓	ABCDEFGH	EIK
Underground injections			
Resource Extraction			
Abandoned oil/gas wells	✓	DHI	BFGL (CH ₄)
Existing oil/gas wells			
Abandoned/poorly built water wells			
Coal mining/acid mine drainage	✓	BCDEFH	JKL (pH)
Quarries (noncoal)/borrow pits			
Other			
Atmospheric deposition			
Industrial facilities	✓	ABCDEFGF	ABCG
Hazardous waste			
Hazardous waste sites	✓	ABCDEFGF	ABCDEGHIJK
Natural groundwater conditions (3)			
Petroleum/fuel pipelines			
Sewer lines			
Salt storage and road deicing			
Urban runoff			

Table 14. (Continued)**(1) Factors in Selecting a Contaminant Source**

- A. Human health and/or environmental risk (toxicity)
- B. Size of the population at risk
- C. Location of the source relative to drinking water sources
- D. Number and/or size of contaminant sources
- E. Hydrogeologic sensitivity
- F. State findings, other findings
- G. Documented from mandatory reporting
- H. Geographic distribution/occurrence
- I. Other criteria (please describe)

(2) Contaminants

- A. Volatile organic chemicals
- B. Petroleum compounds
- C. MTBE/TBA
- D. Pesticides
- E. Nitrates
- F. Salinity/brine
- G. Metals
- H. Radionuclides
- I. Microbiological
- J. Sulfates, manganese and/or iron
- K. Total dissolved solids
- L. Other contaminant (please describe)

(3) This could include natural occurring contaminants such as radium, radon, sulfate, iron, manganese, salt, etc.

Part D4. Statewide Groundwater Protection Programs

A summary of state groundwater protection programs is presented in Table 15. Important groundwater protection programs are summarized following the table. Pennsylvania does not have statewide, private water well construction standards.

Table 15
Summary of State Groundwater Protection Programs

Programs or Activities	Implementation Status	Responsible State Agency
Active SARA Title III Program	Fully established	BLRWM
Ambient groundwater monitoring system	Continuing efforts	BSDW
Aquifer vulnerability assessment (pesticides)	Continuing efforts	PDA
Aquifer mapping	Continuing efforts	BTGS
Aquifer characterization	Continuing efforts	BTGS
Comprehensive data management system	Continuing efforts	BSDW*
EPA-endorsed Core Comprehensive State Groundwater Protection Program (CSGWPP)	Partially established	BSDW*
Groundwater discharge permits	Continuing efforts	RWM
Groundwater Best Management Practices	Continuing efforts	BSDW*
Groundwater legislation (remediation)	Fully established	BLRWM
Groundwater classification (remediation)	Continuing efforts	BLRWM
Groundwater quality standards (remediation)	Fully established	BLRWM

Programs or Activities	Implementation Status	Responsible State Agency
Interagency coordination for groundwater protection initiatives	Continuing efforts	BSDW*
Non-point source controls	Continuing efforts	BPNP*
Pesticide State Management Plan	Continuing efforts	PDA
Pollution Prevention Plan	Continuing efforts	OPPCA
Resource Conservation and Recovery Act (RCRA) Primacy	Fully established	BLRWM
Source Water Assessment Program (EPA approved 2000)	Fully established	BSDW
State Superfund	Fully established	BLRWM
State RCRA Program incorporating more stringent requirements than RCRA primacy	Not applicable	
State septic system regulations	Fully established	BPNP
Underground storage tank installation	Fully established	BLRWM
Underground storage tank remediation fund	Fully established	BLRWM
Underground storage tank permit program	Fully established	BLRWM
Underground injection control program	Not applicable; EPA direct implementation	
Vulnerability assessment for drinking water/wellhead protection	Partially established	BSDW*
Well abandonment guidelines	Fully established	BTGS*
Wellhead Protection Program (EPA approved 1999)	Continuing effort	BSDW
Well installation regulations (Public Water Supplies)	Fully established	BSDW
Others:		
Monitoring well installation guidance	Fully established	BSDW*
Nutrient management program	Continuing efforts	BCR
Private well installation guidance	Continuing efforts	BSDW
Voluntary site remediation program	Fully established	BLRWM

BECB DEP Bureau of Environmental Cleanup and Brownfields
 BTGS Bureau of Topographic and Geologic Survey, Department of Conservation and Natural Resources
 BCR DEP Bureau of Conservation and Restoration
 BPNSM DEP Bureau of Point and Nonpoint Source Management
 BSDW DEP Bureau of Safe Drinking Water
 OPPEA DEP Office of Pollution Prevention and Energy Assistance
 PDA Bureau of Plant Industry, Department of Agriculture
 RWM DEP Regional Water Management Program
 * Indicates lead agency

Part D5. Groundwater Protection Program

DEP's Principles for Groundwater Pollution Prevention and Remediation (DEP ID: 383-0800-001), is available on DEP's website at http://www.portal.state.pa.us/portal/server.pt/community/dep_home/5968

and has been in place since 1996. This document sets forth the principles for a consistent statewide program for prevention of groundwater pollution and remediation of contaminated groundwater. The ultimate goal for groundwater protection, as set forth in the Principles, is prevention of groundwater contamination whenever possible.

Part D6. Wellhead Protection and Source Water Protection Program

Pennsylvania's Wellhead Protection (WHP) Program is the cornerstone of the Source Water Assessment and Protection (SWAP) Program for groundwater resources serving public water systems. Pennsylvania's Wellhead Protection Program was developed in 1989 and subsequently approved by EPA in 1999. The Pennsylvania safe drinking water regulations direct public water suppliers to find and utilize the best sources available and take measures necessary to protect those sources. These regulations define wellhead protection, set permitting requirements for groundwater resources, and set forth requirements for state approval of local WHP programs.

Over 630 municipalities or water suppliers have substantially implemented local WHP programs and/or watershed protection programs to protect surface-water intakes and over one hundred municipalities or water systems are developing strategies for protecting drinking water sources used by public water systems. DEP provides direct technical assistance, and supports partnerships to assist communities and water systems to protect community drinking water sources from contamination. These efforts and previous grants support the voluntary development of local Source Water Protection (SWP) programs that meet DEP's minimum requirements. Since 2007, direct technical assistance has been provided to community water systems and municipalities through the Source Water Protection Technical Assistance Program. Over 110 Community Water Systems (CWS) have developed local SWP programs and over 40 water systems are participating in the program at this time. In addition to protecting public health and infrastructure investment by avoiding costly contamination, local SWP efforts complement water resource protection and management through sound land-use planning and pollution prevention activities. Source water protection is an integral part of a sustainable infrastructure for public water supply.

Part D7. Source Water Assessment and Protection (SWAP) Program

The 1996 Safe Drinking Water Act reauthorization requires that states develop a Source Water Assessment and Protection (SWAP) Program. The SWAP program assesses the drinking water sources that serve public water systems for their susceptibility to pollution. This information is used as a basis for building voluntary, community-based barriers to drinking water contamination. States are required to assess all sources (both

groundwater and surface water) serving public water systems. In Pennsylvania, this represents about 14,000 permanent drinking water sources. EPA approved Pennsylvania's SWAP program in March 2000. Pennsylvania has completed the source water assessments for 98% of systems in the state. Under the plan, Pennsylvania will continue to conduct assessments for new sources and update completed assessments as needed.

For the assessments that have been completed, the SWAP program has delineated the boundaries of the areas providing source waters for all public water systems and has identified (to the extent practicable) the origins of regulated and certain unregulated contaminants in the delineated area to determine the susceptibility of the water sources to such contaminants.

The SWAP program provides prioritized information on the potential sources of contamination that will be the basis for coordination of restoration efforts and development of local source water protection programs. These efforts will lead to improvements in raw water quality and may also result in reduced treatment costs for the public water system. The following table provides a summary of the results of the source water assessments for the most common and the most threatening potential sources of contamination to sources of public drinking water conducted under the EPA Program. More detail on how the source water assessments were conducted can be found in the Source Water Assessment and Protection Program guidance.

Table 16
Most Prevalent and Threatening Sources of Contamination

GW RANK	EPA Most Threatening	EPA Most Prevalent
1	Underground Storage Tanks	Transportation Corridors
2	Transportation Corridors	Agriculture
3	Agriculture	Underground Storage Tanks
4	Automobile Related Activities	Septic
5	Mining	Mining
SW RANK	EPA Most Threatening	EPA Most Prevalent
1	Transportation Corridors	Transportation Corridors
2	Agriculture	Municipal Sanitary Waste Disposal
3	Fertilizer and Pesticide Applications	Septic Systems
4	Storm water	Mining
5	Mining	Animal Feeding Operations

Source water assessments support emergency response, improved land use planning and municipal decisions. They also prioritize and help coordinate actions by federal and state agencies to better protect public health and safety. Spill detection and emergency

response networks for public water systems in Pennsylvania have been established on the Allegheny, Monongahela, Susquehanna, Schuylkill, and Delaware Rivers. They include a variety of on-line detectors to alert operators to imminent changes in raw water quality at surface water intakes. Long-term trends in raw water conditions based on data provided by these monitors may be the basis for restoration and protection efforts or changes in water treatment schedules. The core of these programs is the Internet based communication network that shares raw water data, incident information, and response efforts in real-time.