



Annual Report
2014

SUSQUEHANNA RIVER BASIN COMMISSION





Welcome

EXECUTIVE DIRECTOR'S MESSAGE



Andrew D. Dehoff, P.E.

Data — on water use, water chemistry, aquatic biology — provide the foundation for everything the Commission does. But it is only the first piece of the equation. Assessment of the data, and the science that guides interpretation of the results, are also essential to the process of implementing the Commission's water resource management goals.

This year's Annual Report offers a glimpse of the data collection and analysis efforts currently underway by Commission staff. Some of the efforts

are continuations of decades-long programs, while others represent new investigations. Regardless, they all serve the same purpose — to provide our federal and state commissioners and Commission staff the critical information we need to make policy, planning, regulatory, and restoration decisions.

In the coming years, the pages of future Annual Reports will summarize the projects and policies borne out of rigorous data collection and assessment, aided by top-notch science and productive partnerships. Until that time, the ongoing data collection efforts are already telling interesting stories, and I trust reading about them in these pages will leave you looking forward, as I am, to what's to come.

Commissioners



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Commander
North Atlantic Division
U.S. Army Corps of Engineers



New York: James M. Tierney, Vice Chair

Assistant Commissioner for Water Resources
New York State Department of Environmental Conservation



Pennsylvania: E. Christopher Abruzzo

Secretary
Pennsylvania Department of Environmental Protection



Maryland: Dr. Robert M. Summers

Secretary
Maryland Department of the Environment

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2nd Alternate David J. Leach
3rd Alternate: Amy M. Guise

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3rd Alternate: Randal D. (Duke) Adams

Maryland

1st Alternate: Jay G. Sakai
2nd Alternate: Saeid Kasraei

Coordination, Cooperation & Public Information



Established as a federal-interstate compact commission in 1971, the Susquehanna River Basin Commission (SRBC) is vested with broad responsibilities to manage the water resources of the Susquehanna River Basin.

To accomplish its mission, the Commission works to:

- provide for the reasonable and sustained development and use of ground and surface water for municipal, agricultural, recreational, commercial, and industrial purposes;
- protect and restore fisheries, wetlands, and aquatic habitat;
- reduce damages caused by flooding;
- protect and monitor water quality and instream uses; and
- ensure future availability of flows to the Chesapeake Bay.

The compact requires the Commission to formulate and adopt a Comprehensive Plan for the immediate and long-range development and use of the water resources of the basin.

The current Comprehensive Plan groups management responsibilities into six key Water Resource Needs: Sustainable Water Supply, Water Quality, Flooding, Ecosystems, Chesapeake Bay, and Coordination, Cooperation and Public Information. Each of these



priority management areas covers desired results, goals, ongoing Commission activities, and actions needed to meet these goals.

The Commission adopts an annual Water Resources Program that outlines specific actions needed to meet the goals of the Comprehensive Plan.

Many of these actions are performed in partnership with state and federal agencies and nonprofit organizations. Examples of recent collaborative actions have led to:

- continued research into the use of reservoirs and other sources of water for low flow augmentation;

- a better understanding of water availability versus water use throughout the basin; and

- adoption of a Memorandum of Understanding (MOU) between the Commission and the New York State Department of Environmental Conservation making a strong commitment to the coordination of project review and approval procedures by both parties.

The entire Water Resources Program can be found at <http://www.srbcc.net/planning/water-resources-program.htm>.

Sustainable Water Supply

SUSTAINABLE WATER DEVELOPMENT DEPENDS ON COMPLIANCE WITH PROJECT APPROVALS

SRBC continues to improve enforcement of its regulatory program through the use of improved technology. Commission offices in Harrisburg and Sayre are posed to monitor activities and quickly respond to potential violations.

SRBC now checks protective passby flow requirements (specific flow rate at the point of withdrawal below which the withdrawal must cease) on a daily basis using a gage flow email notification system. The emails help staff effectively identify projects that should cease their withdrawals when trigger gages indicate they should be turned off during critical low flows.

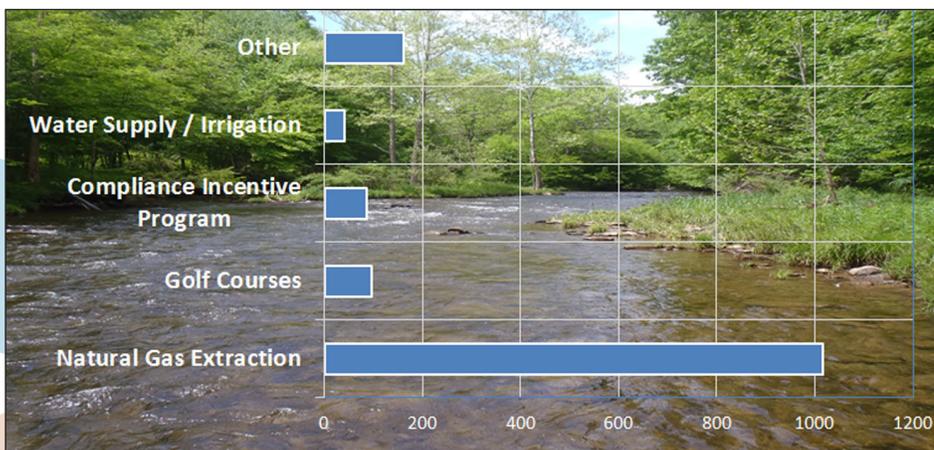
SRBC's inspectors are regularly on patrol ensuring projects operate in compliance with their Commission approvals.

SRBC has the authority to take enforcement action against

companies that fail to gain SRBC approval or violate the terms and conditions of approvals. In 2014, approximately 1,400 inspections and/or audits were conducted to assess compliance with the Commission's regulations. Over that same time period, approximately 100 notices of violations were issued; in most cases, violations were quickly resolved.

Only 15 cases during the year required more involved enforcement actions, such as an assessment of fines/penalties and formulation of a consent order and agreement.

For approved projects, SRBC requires metering to document daily water quantities withdrawn or consumptively used, monitoring of approval conditions such as passby flows, and submission of monitoring data on a quarterly basis. The monitoring data are screened for compliance with docket (permit) conditions upon receipt.



During 2014, roughly 1,400 site inspections were conducted. Nearly 75 percent involved natural gas extraction activities.

WATER AVAILABILITY EXAMINED



SRBC is getting a clearer picture of water availability versus water use across the basin with the progress made on the Commission's Cumulative Water Use and Availability Study, a multi-year effort aimed at quantifying the potential impacts of consumptive water uses on the basin's water resources and aquatic life.

For years, staff has monitored and documented water use. Defining the basis for water availability, however, requires an examination of various approaches.

During 2014, staff compiled information from SRBC approvals and member jurisdiction databases to develop a basin-wide view on water use. For determining water availability, staff compiled and analyzed a variety of data sources to calculate the best measure of water availability; those sources included precipitation and groundwater recharge data, historic streamflows, land cover, geology/soils, ecosystem flow needs, and other factors.

A Geographic Information Systems (GIS)-based analytical tool will automate the assessment and comparison of water availability versus cumulative consumptive water use, either basin-wide or at a user-selected watershed scale. Applications of the GIS-based tool could potentially include screening proposed water use quantities, identifying areas experiencing intensive water uses, informing decisions on possible water availability limits, and prioritizing other water resource management efforts. Wise water use management will be particularly important where the gap between availability and use is narrow.

SRBC PROVIDES GUIDANCE TO PUBLIC WATER SUPPLIERS

The Public Water Supply System Assistance Program (PWSAP) was made possible by a grant through the Pennsylvania Department of Environmental Protection. The PWSAP is intended to help smaller municipal systems renew expiring SRBC groundwater withdrawal approvals or add new groundwater sources to their system.

SRBC staff has worked with approximately a dozen small public water supply systems over the last three years, providing guidance on Commission regulations and the permitting process for renewing and adding groundwater sources, and evaluating potential new groundwater sources with respect to sustainability and SRBC regulations.

Among the goals of the PWSAP is to assist public water supply systems with the addition of new sources, to help ensure redundancy in systems for added reliability of clean and adequate water supplies for drinking, fire suppression, and other important uses.

To accomplish this goal, staff has completed the newly offered pre-drill well site review for five potential well sites for qualifying systems that are exploring the possibility of adding a groundwater source to their public water supply system. When completing the pre-drill well site review in conjunction with the PWSAP, staff provided guidance on regulatory issues regarding the system, groundwater availability issues, potential impacts to surface water features, and potential ecological concerns. More information regarding the program can be found at www.srb.net/programs/PWSAP.htm



NEW STUDY ANALYZES DAMS' IMPACTS ON BAY



Conowingo Dam

The draft Lower Susquehanna River Watershed Assessment's report was released in late 2014, culminating a two-year evaluation of sediment loads, and associated nutrient loads, related to the three hydroelectric dams (Safe Harbor, Holtwood, and Conowingo) on the lower mainstem of the Susquehanna River. Led by the U.S. Army Corps of Engineers and Maryland Department of the Environment, the Lower Susquehanna River Watershed Assessment used monitoring data and computer modeling to better understand sediment movement through the lower portion of the basin. SRBC provided technical support to the study.

The report focused mostly on the influence of the Conowingo dam on the Chesapeake Bay's water quality and how river flows, scouring events, and seasonal factors affect sediment loading to the Bay. Potential management measures were also evaluated using modeling scenarios, including in-reservoir sediment management strategies and upstream best management practices.

The study found that all three dams are no longer trapping sediment and associated nutrients over the

long term; however, episodic floods will scour the reservoirs, increasing their storage capacity and allowing for more deposition over short term cycles. The report revealed that the reservoirs are trapping a smaller amount of incoming sediment and nutrients and scouring more frequently in comparison to historical amounts -- resulting in additional sediment and nutrient loads to the Bay.

Researchers also found that –

- nutrients associated with the scoured sediment were determined to be more harmful to Bay aquatic life than the sediment itself (nutrient pollution has a lingering effect that leads to algae blooms and biological dead zones due to low oxygen), and
- the majority of the sediment load entering the Bay during storm events originates from upstream drainage areas rather than from reservoir scour.

The report suggests that strategies to reduce sediment and nutrients at their sources throughout the Bay drainage area are more effective at addressing impacts to the Bay than dredging or bypassing dams.





Water Quality

IMPROVED WATER QUALITY ANALYSIS APPROACH BETTER REFLECTS BASIN-WIDE CONDITIONS

Since the mid-1980's, SRBC has conducted two-year assessments in each of the six Susquehanna River subbasins on a rotating schedule. Year 1 surveys involve the assessment of water quality, habitat, and benthic communities at widespread sites within a targeted subbasin, followed by a more intensive sampling on a particular region or issue in the same sub-basin during Year 2. The assessments are funded by U.S. EPA - Clean Water Act Section 106 grant funds.

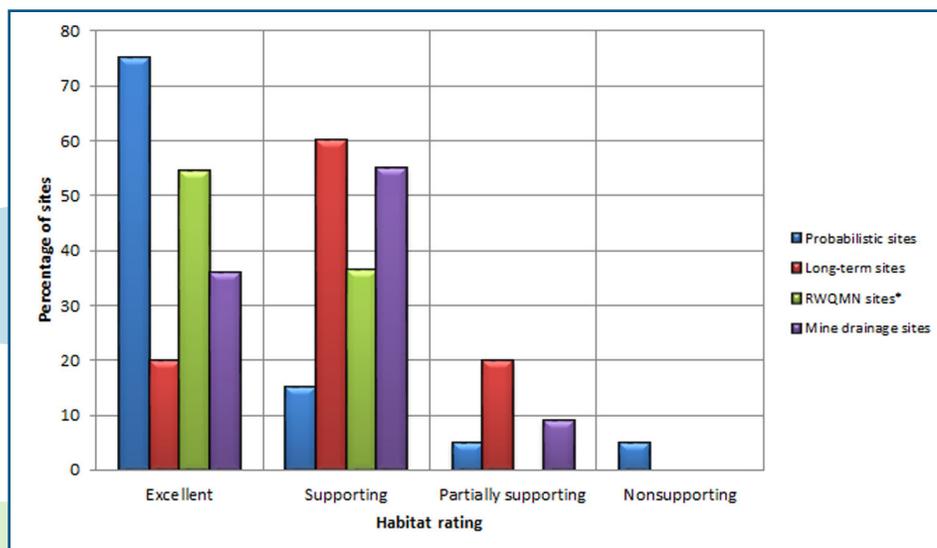
Past Year 1 surveys relied on data collected at sites located at the mouths of watersheds near access points such as road crossings, which can bias data analyses and do not reflect overall stream health. In turn, using these data to characterize water quality of the entire subbasin is not ideal.

For these reasons, SRBC decided to change the survey design for Year 1

surveys beginning with the Middle Susquehanna subbasin rotation in 2014. This new survey design involves collection of data from three categories of sites:

- Long-term sites, which are a subset of the pre-established sites sampled in previous Year 1 surveys;
- Probabilistic sites, which are randomly selected through a computer program; and
- Other sites which are part of other projects collecting data concurrently during the survey year.

Through this new survey design, SRBC will continue to track water quality issues throughout the subbasins, but now will be able to provide more meaningful interpretation of the data using statistical analyses that do not introduce bias and better assess overall subbasin aquatic health.



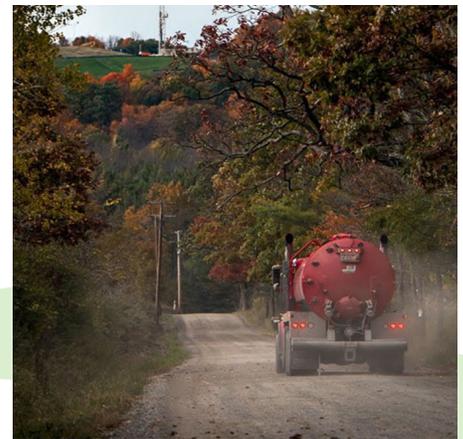
Habitat ratings for sites sampled in the Middle Susquehanna Subbasin in 2014 (*data missing for one RWQMN site). Data indicates majority of sites have good habitat conditions.

ASSESSING SEDIMENT RUNOFF IN SENSITIVE FOREST SETTINGS

What land use factors are most likely to compromise water quality in high-value streams in the Marcellus Shale region? SRBC and its partners will evaluate more than three years of water quality monitoring data and investigate the linkages between this information and land use using GIS and powerful analytical tools that detect subtle changes in large data sets.

Findings will be refined into a catalogue of best management practices (BMPs) most effective at reducing sediment inputs to streams in forested settings.

Following the analysis, staff and project partners — Center for Dirt and Gravel Road Studies, Center for Watershed Protection, and Susquehanna River Heartland Coalition for Environmental Studies — will develop and deliver an outreach program that demonstrates practical and cost-effective ways to lower sediment input to the Marcellus Region's high-value streams. Funding for this study is being provided by the National Fish and Wildlife Foundation and SRBC.



The intent of the study is to use in-stream data and worksite assessments to identify "hot spots" and provide the technical means to improve sediment controls surrounding roads and other land use disturbances in order to minimize pollution to waterways. Target audience for outreach is the operator industry, rural municipal officials, waterway specialists, state foresters, state regulators, and watershed stewardship associations.

IMPROVING RAIN GARDEN DESIGNS FOR THE PREVENTION OF SINKHOLE FORMATION

With grant funding from PA Act 13 (generated by natural gas drilling impact fees), SRBC has partnered with the Alliance for the Chesapeake Bay to develop solutions for treating stormwater with green infrastructure, or in this case rain gardens, while preventing sinkhole formation. The project is located at a municipal park in Hampden Township along Cedar Run, a tributary to Yellow Breeches Creek in Cumberland County, PA.

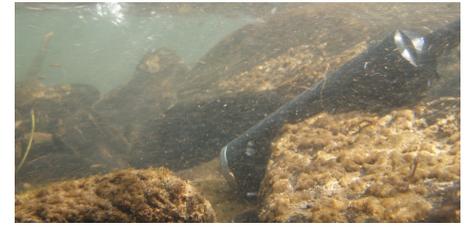
The project involves construction of a series of rain gardens on two sites at Hampden Community Swimming Pool where multiple sinkholes have developed as a result of using a conventional stormwater design approach. Because the site's bedrock is ten feet below the surface, project managers selected an Aquifer Recharge System -- an underground trench that collects excess water treated by the rain gardens and either recharges to groundwater or discharges to the community's storm sewer. This improved design prevents sinkhole formation. Additionally, native plants and grasses are used to treat runoff to improve water quality.

This type of rain garden project stabilizes stormwater flows, reduces localized flooding, and attracts birds, butterflies and other pollinators. These new features are aesthetically pleasing and provide model stormwater practices.



Prior to project implementation, a before-and-after visualization helps park officials envision how native plants will enhance the site aesthetics.

RWQMN DATA BUILDS



An underwater multi-parameter sonde.

In 2010, SRBC established the Remote Water Quality Monitoring Network (RWQMN), a real-time, continuous water quality monitoring network. The purpose of the project was to monitor headwater streams for potential impacts from high volume hydraulic fracturing natural gas activity. To date, the data indicate no major shifts in water quality for any of the monitored watersheds, although staff will continue to closely track conditions for any more subtle shifts in water quality over time. See *RWQMN Data Report of Conditions 2010 – 2013* at www.srbc.net for more information.

Staff has also collected biological data including aquatic macroinvertebrates and, at selected sites, fish as well. No correlation has been found between gas well density and stream biota health. Specific conductance (a good surrogate indicator for hydro fluids entering a waterbody) and turbidity have not changed over the monitored years (2010 – 2013). Analyses also show that climate, precipitation, and streamflow likely influenced the macroinvertebrate communities more so than site-specific activities. Regional annual weather patterns appear to drive stream community structure as well.

Additionally, the scope of the data has opened other opportunities for gaining a better understanding of impacts from other activities in the monitored watersheds, such as road de-icer application, construction, agriculture, and wastewater discharges. For 2015, the network will undergo a 5-year assessment to determine any possible improvements that can be made to better track water quality conditions.

Flooding

THE ISSUE OF FLOODING

With more than 49,000 miles of waterways, the Susquehanna River Basin is one of the country's most flood prone regions. Generally, floods occur each year somewhere in the basin, and major floods can occur in all seasons of the year.

Recent examples include several heavy rain events in 2013 and the more widespread impacts associated with Tropical Storm Lee in 2011.

These events can isolate areas of residential and commercial property during high flows from emergency personnel and create property damage. With multiple flood events in recent years, the affected municipalities, private businesses, county planners, state agencies, and federal agencies have observed a growing need to increase flood protection and public safety in the region.

For this reason, the Commission began a number of initiatives to assist communities with flooding issues. Two such efforts include a deployment of a real-time camera monitoring system called "StageCam," and the development of a smartphone application for enhancing information sharing during and after flood events.



Flood conditions at StageCam test station along Chiques Creek (photo taken before StageCam deployment).

STAGECAM TEST DEPLOYMENT

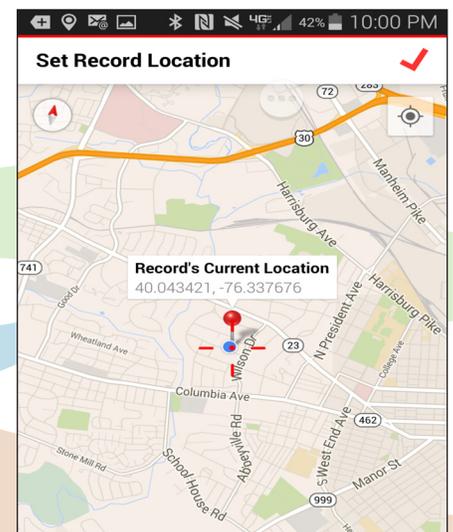
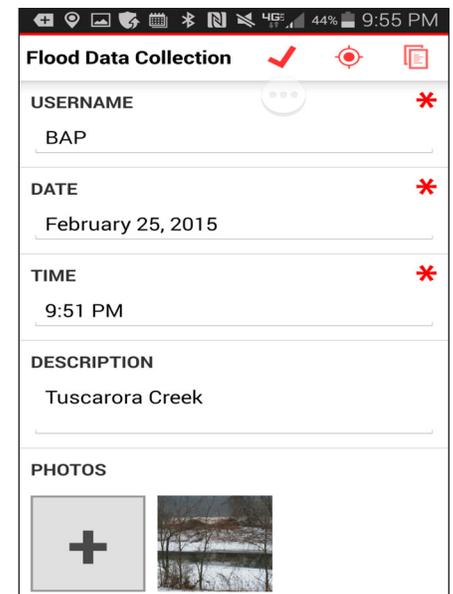
StageCam is a three-year pilot study that began in 2014 to evaluate smart phone-based pictures for enhancing flood warning capabilities and compiling longer-term records for documenting hydrologic conditions. The intent is to demonstrate that this type of observation network can be a cost-effective method for warning a community on impending flood conditions. The simplistic nature of being able to view real-time images with some general stream stage data can be quickly understood by the public. Three camera stations were deployed for testing purposes in the Canisteo, Juniata, and Chiques watersheds in Chemung, Huntingdon, and Lancaster Counties, respectively.



StageCam night image – non-flood stage photo taken at same StageCam station along Chiques Creek.

FLOOD WARNING GOES MOBILE

Commission staff have also developed a smartphone application – currently in the testing phase – to provide a tool for rapid data collection to enhance communication in a community-based flood warning system. The application is inexpensive to operate and maintain and can be used on any Apple or Android-based smartphone. The goal is to utilize crowd-sourced information to maximize the number of observations able to be compiled from the field in order to better inform and communicate the extent and magnitude of flood conditions.



"Screen shots" showing flood condition information that can be entered using a smartphone to assist emergency personnel.

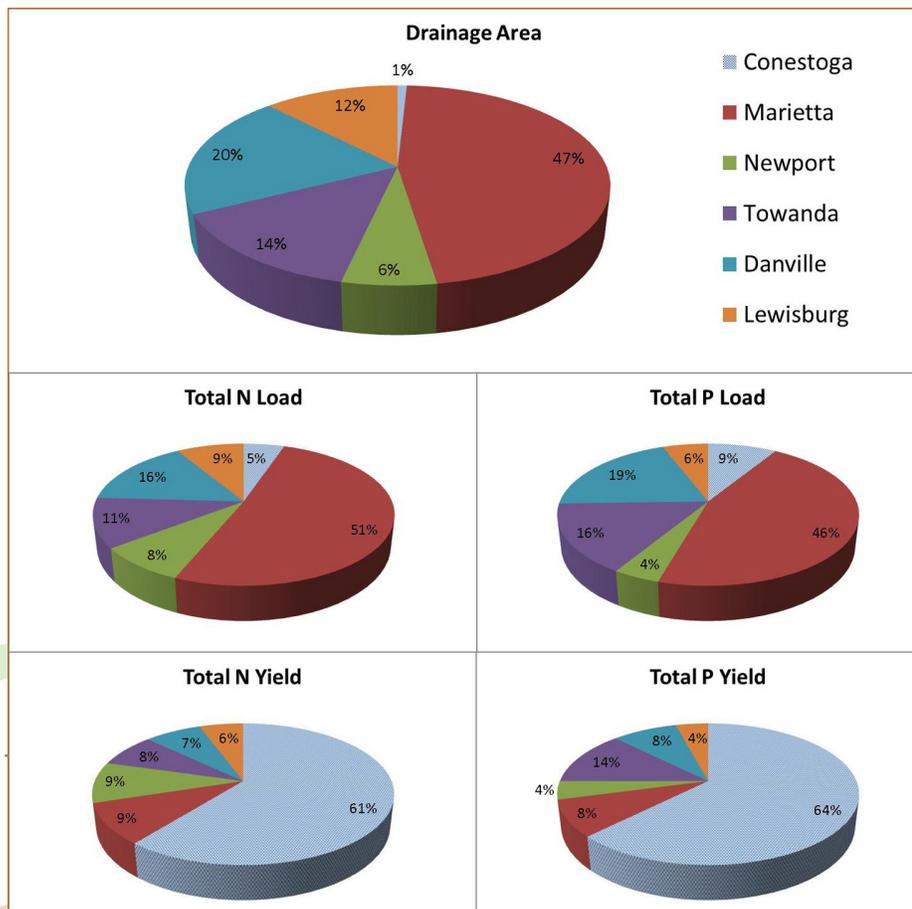
Chesapeake Bay

THIRTY YEARS OF NUTRIENT & SEDIMENT MONITORING

In 2014, SRBC collected and analyzed nutrient and sediment data from 26 sites in the basin, marking the 30th anniversary of SRBC's involvement in the Chesapeake Bay's Non-tidal Monitoring Network. The long-term monitoring at these sites has allowed SRBC to evaluate changing trends over the years for nitrogen, phosphorus, and suspended sediment loads.

In addition to presenting key findings on regional loadings and trends, the latest report (2013 data) presents information for a new approach to data analysis using the runoff ratio, which is the percent of watershed precipitation that becomes streamflow.

The initial analysis emphasizes the impact that single outlier events — such as Tropical Storm Lee in 2011 — exert on nutrient and sediment loadings and dramatically illustrates the influence of “stored” sediment within the system, or sediment built up in stream channels and in stream banks that is scoured during high flow events.



Conestoga River is the smallest drainage area in the network, yet the total nitrogen (TN), total phosphorus (TP), and suspended sediment (SS) yields are disproportionately the highest. Conestoga lies in the highly fertile Lancaster County region. The Marietta station, the largest watershed in the network, observed the highest overall pollutant loads in 2013.

DAM RELICENSING DELAYED

Unanswered questions about the downstream effects of sediment stored behind the Conowingo Dam led to its federal application for re-licensing being temporarily withdrawn by Exelon Corporation, the operator of the dam. Exelon agreed to provide up to \$3.5 million to study the effects of sediment related to the dam on water quality in the Susquehanna River and the Chesapeake Bay.

As per the U.S. Army Corps of Engineer's draft Lower Susquehanna River Watershed Assessment detailed on page 5, the Conowingo Pond has reached a state of equilibrium in which it no longer provides a net reduction of phosphorus and sediment loadings to the Chesapeake Bay. Removing the sediment is considered cost prohibitive. Therefore, strategies must look upstream to reduce nutrient and sediment loadings to the pond.

EEL RESTORATION PLAN ADOPTED

The Commission took action to adopt the American Eel Restoration Plan as an addendum to the Migratory Fish Management and Restoration Plan for the Susquehanna River Basin. Both plans were prepared by the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRFC), with the eel restoration plan having been issued by SRAFRFC on December 5, 2013.

An important objective of the plan is to insure that American Eel that approach the Conowingo Dam can ultimately move upstream into the Susquehanna Basin.



SRBC staff measures eel along Susquehanna River near Halifax, Pa.

Ecosystems

A RECORD-SETTING YEAR IN FISH DATA COLLECTION

2014 was a record-setting year for staff who collected and identified fish under SRBC's Monitoring and Protection Program as part of the ultimate goal of compiling a comprehensive dataset for tracking fish community health basin-wide.

Staff collected data from 148 sites during the year. Over 83,000 fish were captured and identified. Since 2012, a total of 250,158 fish from 418 sites have been catalogued.

Fish data provide critical information to SRBC's water quality and biological monitoring studies that include:

- **Subbasin Surveys** - document fish populations in the targeted Year 2 subbasin survey to assess overall aquatic community health;
- **Aquatic Resource Surveys** - monitor impacts to fish populations associated with specific water withdrawals;
- **Reservoir Studies** - monitor fish assemblages in free flowing and impounded portions of the Susquehanna River;
- **Watershed Restoration Projects** - document the impact of restoration work (e.g., acid mine drainage restoration, agricultural conservation practices, urban stormwater practices) on fish populations;
- **Flow Monitoring Study** - monitors the relationship between fish community health and the natural flow regime; and
- **Interstate Stream Studies** - fish populations are analyzed at interstate stream sites to provide monitoring data not collected by state agency monitoring programs; more than 80 streams cross state lines in the Basin.



INVESTIGATING DIDYMO



In 2013, *Didymosphenia geminata* (or didymo also known as rock snot), an aquatic invasive species of diatom (algae), was discovered by Commission scientists in the Pine Creek Watershed of the Susquehanna River Basin. Didymo has gained world-wide notoriety in recent years due to nuisance blooms that have the potential to choke aquatic life in premier trout and salmon rivers.

Since the discovery, Commission staff has continued to survey streams in Pine Creek Watershed for didymo, as well as to compile and review water quality conditions using historic monitoring data. In 2014, PA Sea Grant funded further research on the current and historic distribution of didymo in Pine Creek and surrounding watersheds.

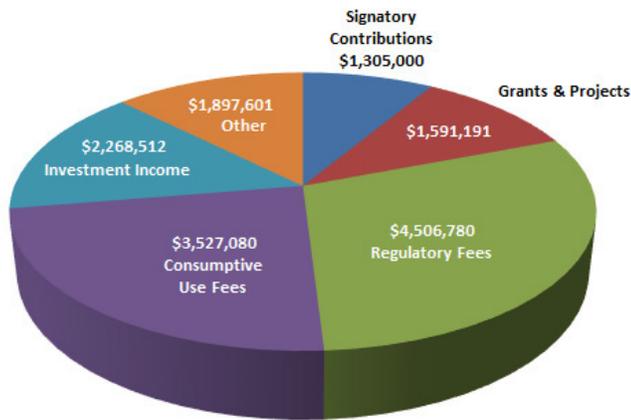
SRBC will analyze data, develop a didymo habitat suitability index, and investigate the nutritional content of the didymo collected. These efforts are designed to increase the understanding of didymo occurrence, to enhance predicting where it will spread, and preventing its spread.



Didymo on underwater pipe in West Pine Creek, Lycoming County, Pa.

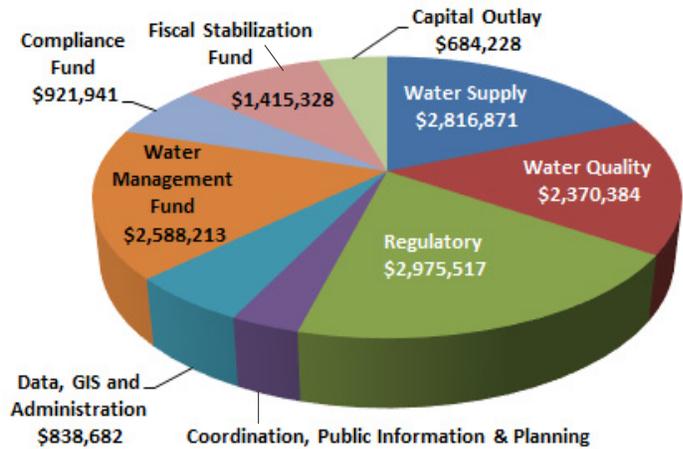
Fiscal Year 2014 Summary

Revenues



Total Revenue
\$15,096,164

Expenditures & Designations



Total Expenditures & Designations
\$15,096,164

SRBC Staff

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