Susquehanna River Basin Commission Monitoring and Assessment Strategy

Jennifer L. R. Hoffman
Section Chief, Monitoring and Assessment

Susquehanna River Basin Commission
1721 North Front Street
Harrisburg, PA 17102-2391
Phone: (717) 238-0426
Fax: (717) 238-2436

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INTRODUCTION

The Susquehanna River Basin Commission (Commission)

On December 24, 1970, the Susquehanna River Basin Compact (Compact) (http://www.srbc.net/docs/srbc_compact.pdf) was signed into law by the Congress of the United States, and the state legislatures of New York, Pennsylvania, and Maryland. The Compact authorizes the Commission to coordinate the water resources efforts of its three member states and the federal government and provides a vehicle to enhance conservation, development, and management of the water resources of the Susquehanna River Basin (Basin).

Each jurisdiction is represented by a member. For the federal government, the member, who must by law be an officer of the U.S. Army Corps of Engineers, is appointed by the President of the United States. The governors of the states or their appointees serve as members. The members, or alternates, meet bimonthly to adopt regulations, act on project review dockets, and provide direction for managing the Basin's water resources. Funding for the Commission comes from the three member states and from the federal government through direct allocations, as well as grants.

The essence of the Commission's mission is to enhance public welfare through comprehensive planning and management of the water resources of the Basin. To accomplish this mission, the Commission works to: provide for the reasonable and sustained development and use of surface water and groundwater for municipal, agricultural, recreational, commercial, and industrial purposes; protect and restore fisheries, wetlands, and aquatic habitat; monitor and protect water quality and instream uses; and ensure future availability of flows to the Chesapeake Bay (Bay).

The Commission is uniquely qualified to carry out this mission. As a federal-interstate compact commission, its focus is defined by the natural boundaries of the river basin rather than the political boundaries of the member states. As such, the Commission serves as a forum to provide coordinated management, promote communication among the members, and resolve water resource issues and controversies within the Basin.

The goals of the Commission are:

- To be responsive to water resource management needs of the Commission's signatory members (New York, Pennsylvania, Maryland, and the federal government);
- To provide excellent service to the public;
- To coordinate management of interstate water resources and serve as an effective forum for resolution of water resource issues and controversies within the Basin;
- To be a leader in issues concerning the conservation, utilization, allocation, development, and management of water resources within the Basin;
- To encourage excellence in Commission staff by affording opportunities for professional growth and development and by providing a stimulating work environment for all Commission employees; and
- To provide public information and education about the water resources of the Basin.

Susquehanna River Basin Description

The Susquehanna River is the nation's 16th largest river and is the largest river lying entirely in the United States that flows into the Atlantic Ocean. The Susquehanna and its hundreds of tributaries drain 27,510 square miles, encompassing parts of New York, Pennsylvania, and Maryland.

Meandering 444 miles from its origin at Otsego Lake near Cooperstown, N.Y., the river empties into the Bay at Havre de Grace, Md. The Susquehanna contributes one-half of the freshwater flow to the Bay. As such, most improvements in the Basin would contribute greatly to the cleanup of the Bay. The Basin includes six subbasins, based on divisions of the mainstem and the large tributaries of the Susquehanna: the Chemung, the Upper Susquehanna, the West Branch Susquehanna, the Middle Susquehanna, the Juniata, and the Lower Susquehanna subbasins (Figure 1).

The Chemung River is formed by the confluence of the Tioga River, flowing northward from Pennsylvania, and the Cohocton River, flowing southeast in New York. The Chemung joins the Susquehanna River at Sayre, Pa. The terrain in this subbasin is typical of glaciated watersheds, and is comprised of rolling to flat-topped uplands with steep-sided alluvial valleys in which the main rivers flow. Forests occupy the steeper hillsides bordering stream valleys, while the flatter hilltops and stream valleys are used for agriculture. The population of the Chemung Subbasin is approximately 250,300 (six percent of the total Basin population), with major population centers at Elmira, Corning, and Hornell, N.Y. Abandoned mine drainage (AMD) and municipal waste are the largest sources of stream impairment in this watershed.

The Susquehanna River originates at Otsego Lake in Cooperstown, N.Y. From Cooperstown, the river flows southward into Pennsylvania and back into New York at Great Bend, Pa. The Susquehanna River then flows westward to its confluence with the Chemung River at Sayre, Pa. Most of the subbasin is characterized by steeply sloped hills and ridges and is dominated by forested land. Agriculture can be found in the valleys. The population of the Upper Susquehanna Subbasin is approximately 477,900 (11 percent of the total Basin population), with the major city at Binghamton, N.Y., and smaller population centers at Sayre, Pa., and Johnson City, Endicott, Cortland and Oneonta, N.Y. Agricultural runoff and other nonpoint pollution are the largest sources of stream impairment in this watershed.

Originating in the Allegheny Mountains of Cambria and Clearfield Counties, Pa., the West Branch Susquehanna River flows northeast past the steep hillsides of the Allegheny High Plateau. At Renovo, Pa., the West Branch turns southeast and cuts through the Allegheny Front, entering a region of broad valleys separated by long, high ridges. At Muncy, Pa., the West Branch turns south to its confluence with the Susquehanna River near Sunbury, Pa. The subbasin is covered predominantly by forested lands, although some agricultural lands are congregated in the valleys of the eastern and southern parts of the Basin. Extensive strip mining for coal is the major land use activity in the western parts of the subbasin. The total population of the watershed is approximately 583,200 (13 percent of the total Basin population), with the largest urban centers at State College, Lock Haven, Williamsport, Clearfield, and Lewisburg, Pa. In the West Branch Subbasin, AMD is by far the largest source of stream impairment.

In the Middle Susquehanna Subbasin, the river flows southeast through high, flat-topped plateaus separated by steep-sided valleys. At the midway point, the Susquehanna River joins the Lackawanna River before turning and flowing southwest towards Sunbury, Pa. The major population center in the subbasin is the Wyoming Valley area, from Carbondale, Pa., in the north along the Lackawanna River to Nanticoke, Pa., in the south along the Susquehanna River. Scranton and Wilkes-Barre, Pa., are located in this highly urbanized coal mining region. The population of this subbasin is approximately 733,400 (16 percent of the total Basin population), and the major sources of stream impairment are AMD and urban runoff.

The Juniata River is formed by the confluence of the Little Juniata River and the Frankstown Branch Juniata River and lies entirely within the Ridge and Valley Physiographic Province, which is characterized by a series of tightly-folded parallel mountains and long, narrow valleys. Agriculture, which is the predominant economic activity, is scattered throughout the valleys, while the steep mountain ridges are extensively forested. The subbasin population is largely rural, with a population of

Figure 1. Subbasins within the Susquehanna River Basin

approximately 337,700 (seven percent of the total Basin population). Major population centers include Altoona, Hollidaysburg, Bedford, Lewistown, Huntingdon, and Mount Union, Pa. Agricultural runoff is the largest source of impairment in this watershed.

The Lower Susquehanna Subbasin includes very diverse landscapes. The Susquehanna River cuts through a series of sharp ridges in the upper part of the subbasin and widens as it flows south through rolling hills and broad valleys of the central portion of the subbasin. The southern portion of the subbasin is characterized by a deep gorge in a narrow river valley. The Susquehanna River flows into the Bay at Havre de Grace, Md., providing over 50 percent of the freshwater inflow. Of the six subbasins in the Susquehanna River Basin, the Lower Susquehanna Subbasin is the most developed. The steep river slope and narrow valley of the lower Susquehanna gorge provide areas for hydropower development. This part of the subbasin is a major production area for electricity. Some of the most productive agricultural lands and largest population centers of the Basin also are located in the Lower Susquehanna Subbasin. A significant population is employed in government-related activities around Harrisburg, Pa., the state capital. The population of the Lower Susquehanna Subbasin is approximately 2,165,500 (47 percent of the total Basin population), with major population centers at Harrisburg, Lancaster, York, Lebanon, and Carlisle, Pa. Major sources of impairment in the lower Susquehanna include AMD and agricultural runoff. Additionally, urban and residential runoff is an important issue due to increasing development pressure.

Goals of the Commission

Commission staff develops and implements programs as directed by the commissioners and as found in the Commission's "Comprehensive Plan for the Management and Development of the Water Resources of the Susquehanna Basin." This comprehensive plan provides a strategy to manage the water resources of the basin. The following are goals of the Comprehensive Plan that are pertinent to the Watershed Assessment and Protection (WAP) Division's activities:

- Water Quality Goals
  - Compliance with the water quality standards and criteria of the Basin's waters as established by the member jurisdictions;
  - Abatement of acid mine drainage pollution, along with efforts to correct abandoned mine land problems;
  - Increased monitoring of the effectiveness and enforcement of established water quality control regulations and programs;
  - Maintenance of a coordinated, basinwide water quality and biological data collection and monitoring system;
  - Upgrading and developing needed public and private waste treatment facilities;
  - Increasing control of stormwater runoff and nonpoint source pollution; and
  - Fulfillment of the objectives of the Chesapeake Bay Program (CBP) relating to monitoring and research recommendations, and Bay-wide nutrient and toxicant recommendations.

- Recreation, Fish and Wildlife Goals
  - Utilization of existing water resources for purposes including recreation, and fish and wildlife pursuits;
  - Inclusion of appropriate public recreation, and fish and wildlife programs at existing and proposed water resources projects, as compatible with the project purpose;
  - Delineation of water and adjoining land areas to be retained in a natural state;
  - General improvement of fish and wildlife habitat;
  - Increased public access to streams, reservoirs, lakes, and ponds; and

- Restoration of migratory fishery resources.

- Watershed Protection and Management Goals
  - Protection and enhancement of the water resources of the basin;
  - Development of priorities for uses of land areas critical to water resources interests;
  - Coordination of planning regarding future land development as it relates to water supply, water quality, and wastewater management needs;
  - Use of land in keeping with its conservation and natural resource capabilities; and
  - Establishment and maintenance of programs designed to prevent or reduce erosion and sedimentation.

Additionally, the Commission conducts specialized water resource planning projects, including collecting, compiling, and coordinating surface water and groundwater data.

As part of the overall planning activities initiated by the Commission, the WAP Division has developed a strategic plan that is updated at least once every five years (http://www.srbc.net/docs/WAPStrategicPlan.pdf). The Division's mission is "to coordinate and assist efforts of federal, state, and local governments and private entities to manage and protect the physical, chemical, and biological quality of the water resources of the Basin to meet the needs of present and future generations."

In order to achieve this mission, the WAP Division has set several goals relating to water quality including:

Goal 1. Collect and analyze physical, chemical, and biological data to assess the condition of water resources in the Basin.

- Maintain and improve core Commission monitoring programs to assess interstate consistency and basinwide conditions, and support Bay restoration activities.
- Support and assist federal and state water quality monitoring efforts to meet Commission and member jurisdiction program objectives.
- Provide technical assistance to local entities for projects meeting Commission program objectives and goals.

Goal 2. Encourage and support plans for the remediation and enhancement of the Basin's water resources.

- Conduct studies and encourage initiatives to determine water quality and quantity relationships.
- Support and assist with the development of plans to mitigate the negative impacts associated with AMD, agricultural runoff, and urban/suburban growth.
- Conduct demonstration projects based on priorities identified by Commission programs and member state jurisdictions.
- Use monitoring and assessment data to identify priority areas for implementing restoration activities.

Goal 3. Promote consistent, sound water quality and watershed management practices to protect the water resources of the Basin.

- Develop and enhance protections for source water supplies through technical assistance and education.
- Develop and implement low-flow management plans in rivers and streams to protect instream uses.

- Use monitoring and assessment data to identify areas vulnerable to water quality degradation and to prioritize areas for protection activities.
- Encourage others to incorporate sound water quality practices in county and municipal planning efforts.

Goal 4. Organize, maintain, and distribute data and information for effective water resource management.

- Build and maintain the necessary infrastructure to support an efficient and user-friendly Commission database.
- Develop integrated data and Geographic Information System applications to support water resource programs and projects.

In order to meet the demands of the goals mentioned above, monitoring and assessment are key activities undertaken by the Commission's WAP Division. The Commission has been monitoring the biological, chemical, and physical integrity of the streams of the Basin since the early 1970s. The monitoring and assessment programs are detailed in the following sections.

MONITORING PROGRAM STRATEGY

The Commission is committed to assisting its member jurisdictions with water quality monitoring of the streams, rivers, and other waterbodies of the Basin, both through its own projects and through assisting with various state and federal programs. Commission staff will achieve this goal by continuing work on a number of ongoing projects and assisting with other state and federal projects as funding allows. Ongoing projects currently undertaken by the Commission include:

- Subbasin surveys;
- Large river assessments;
- Sediment and nutrient monitoring;
- Interstate Streams Water Quality Network (ISWQN) monitoring;
- State Assistance with AMD Monitoring and State Surface Water Assessment Program (SSWAP) (Pa.);
- Early Warning System (Pa.); and
- Groundwater monitoring from the Commission's regulatory project review approval function.

Currently, the Commission monitors streams and rivers within the Basin; no lakes or wetlands are being assessed by Commission staff. The Commission has performed lake assessments in Pennsylvania in the past but has not in recent years due to funding limitations. The Commission does collect groundwater quality information from project applicants and compares the results against state and federal water quality standards.

The Commission communicates with its member jurisdictions through a number of avenues, including e-mail, individual meetings on specific topics, and the Commission's Water Quality Advisory Committee (WQAC). This committee holds two meetings per year: one on general programs of interest, particularly the Commission's and member jurisdictions' monitoring projects, and one on a specific topic of focus. In the past, topics have included AMD, stormwater issues, and bacteria monitoring. In addition to Commission staff, members of the WQAC include representatives from the U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers, U.S. Geological Survey (USGS), U.S. Department of Agriculture Natural Resource Conservation Service, New York State Department of Environmental Protection (NYSDEC), Pennsylvania Department of Environmental Protection (PADEP),

Pennsylvania Fish and Boat Commission, Maryland Department of Environment, Maryland Department of Natural Resources, and Upper Susquehanna Coalition. Other organizations are included according to outside interest and depending on the topic of the WQAC meeting.

Subbasin Surveys

Commission staff have been conducting subbasin surveys since the 1970s. Each of the Basin's six subbasins is scheduled to be assessed on a rotating six-year cycle. A subbasin survey entails collecting benthic macroinvertebrate, chemical water quality, and physical habitat data from approximately 100 sites in each subbasin. Each station is sampled once to provide a point-in-time picture of stream characteristics throughout the entire subbasin. Biological samples are collected using a slightly modified version of USEPA's Rapid Bioassessment Protocol (RBP) III. Physical habitat information is collected using RBP parameters, and a water sample is taken to analyze various chemical parameters. The health of the streams is assessed based on this snapshot of information, a report is produced, and the information is included in the Commission's Consolidated Listing (formerly 305(b)) report. Subbasin survey information is used by Commission staff and others to: evaluate the chemical, physical, and biological health of streams in the Basin; identify major sources of pollution and lengths of stream impacted; identify high quality sections of stream that need to be protected; maintain a database that can be used to document changes in stream quality over time; review projects affecting water quality in the basin; and identify areas for more intensive study. Subbasin survey reports can be found on the Commission's website: the 1997 Chemung subbasin report at http://www.srbc.net/docs/Chemung198.pdf; the 1998 Upper Susquehanna subbasin report at http://www.srbc.net/docs/pub203.pdf; the 2001 Middle Susquehanna subbasin report at http://www.srbc.net/docs/srbc_mssreport600.pdf; and the 2002 West Branch Susquehanna subbasin report at http://www.srbc.net/docs/226%20Publication/West%20Branch%20Rept.pdf. During summer 2004, the Commission assessed the Juniata Subbasin; a report will be available in July 2005 and will be placed on the Commission's website by September 2005.

Future activities under this program include subbasin surveys of the Lower Susquehanna Subbasin during summer 2005 and the Chemung Subbasin during summer 2006. The cycle will continue with one subbasin survey each summer, as funding allows. The USEPA-approved Quality Assurance Project Plan (QAPP) for the Juniata Subbasin survey is attached (Appendix A), as is the Lower Susquehanna Subbasin survey QAPP (Appendix B). USEPA approval for the Lower Susquehanna Subbasin survey QAPP is pending. All QAPPs for the subbasin surveys will be placed on the Commission's website by June 2005.

In 2000, the subbasin surveys were modified to add an additional component of a follow-up study in a particular area of each subbasin, based on input from local, regional, and state interests, as well as the information gleaned from the original subbasin survey. To date, follow-up surveys (or Year 2 surveys) have included an assessment of the Snake Creek drainage in Susquehanna County, Pa., and Broome County, N.Y. (http://www.srbc.net/docs/UpperSusRep213.pdf); the Wyalusing Creek watershed in Bradford and Susquehanna Counties, Pa. (http://www.srbc.net/techreport232MiddleSusq.htm); and a current project addressing AMD issues in the Morgan Run watershed in Clearfield County, Pa. A Year 2 survey in the Morrison Cove area of the Juniata Subbasin will be initiated in March 2005. The QAPP for the Year 2 Morgan Run survey is attached (Appendix C); approval for the QAPP is pending. All QAPPs for the Year 2 surveys will be placed on the Commission's website by June 2005.

Large River Assessment

The Commission has been assessing streams biologically throughout the Basin since the late 1970s. When the USEPA introduced the first version of the RBP manual, the Commission adopted those

methods for use in its interstate stream monitoring program and its rotating subbasin surveys. However, neither the previous nor current RBP methods used by the Commission in the aforementioned surveys accurately depict the biological integrity of the Basin's large rivers: the mainstem Susquehanna; Chemung; West Branch Susquehanna; and Juniata Rivers. Thus, in 2002, the Commission initiated a pilot project to determine proper methods of biologically monitoring and assessing the large rivers in the Basin (Figure 2). The information collected during the pilot project will be used in future years to select and calculate metrics for a benthic macroinvertebrate index of biotic integrity to assess the biological conditions in the rivers of the Basin. The data also will be used in the Commission's Consolidated Listing assessments and to complement state assessment efforts.

From this pilot study, performed along the New York-Pennsylvania border on the Susquehanna River, staff determined that rock baskets were appropriate for collecting benthic macroinvertebrates for assessment purposes, due to the ability of the rock baskets to be placed in any water depth and the consistency of the baskets in collecting representative samples. The report can be found on the Commission's website at http://www.srbc.net/docs/228%20Publication/RiverAssmtRept.pdf. In 2003 and 2004, an extended survey at 20 sites on the mainstem of the Susquehanna River and at sites at the mouths of each of the major tributaries in the Basin was planned (Figure 3). However, due to extreme flows throughout the summer and early fall, the effort was postponed until summer 2005. At that time, staff will collect biological, water chemistry, and physical habitat data from designated sites on the large rivers of the Basin. In the future, the Commission is interested in performing a pilot project to determine correct methods for assessing the reservoir system in the downstream portion of the Susquehanna River mainstem. The QAPP for the Large River Assessment Project is attached (Appendix D) and will be placed on the Commission's website by June 2005.

Sediment and Nutrient Monitoring

The Commission implemented a five-year nutrient-monitoring program in October 1984 to establish a database for estimating nutrient and suspended sediment loads in the Basin. This monitoring effort, conducted as part of the Chesapeake Bay Restoration Program, consisted of monthly base flow sampling and periodic sampling throughout the high flow hydrograph for a minimum of five storms per year.

Initially, 12 sampling sites were established. This sampling network included a series of mainstem and major tributary sites, and a series of sites located on smaller watersheds that had significant areas of specific land use, or representative combinations of land uses. Collection of data at stations on the mainstem and major tributaries was necessary to enable accurate allocation of nutrient and suspended sediment loads to the main river reaches and to major subbasins. Data were collected for the Susquehanna River at Danville and Harrisburg, the West Branch Susquehanna River at Lewisburg, the Juniata River at Newport, the Swatara Creek near Hershey, the West Conewago Creek near Manchester, and the Conestoga River at Conestoga, Pa., to confirm the CBP watershed model load allocations and provide the basis for refining the model outputs for these areas. Each site represented large areas having significant differences and levels of complexity in terms of geological setting and combinations of land uses.

The stations located on relatively small watersheds of varying geologic settings provided a range of land uses or representative combinations of land uses. The sites represent: (1) a total wilderness area--Stony Creek at Water Tank Trail near Dauphin, Pa.; (2) a sparsely populated forest/cropland watershed with no areas of concentrated residential development--Sherman Creek at Shermans Dale, Pa.; (3) a small watershed of intense suburban development throughout its headwaters area--Paxton Creek near Penbrook, Pa.; (4) a complex area that drains extensive cropland with a number of fairly large reservoirs--Codorus Creek near York, Pa.; and (5) a suburban and urban development--Codorus Creek at Pleasureville. These

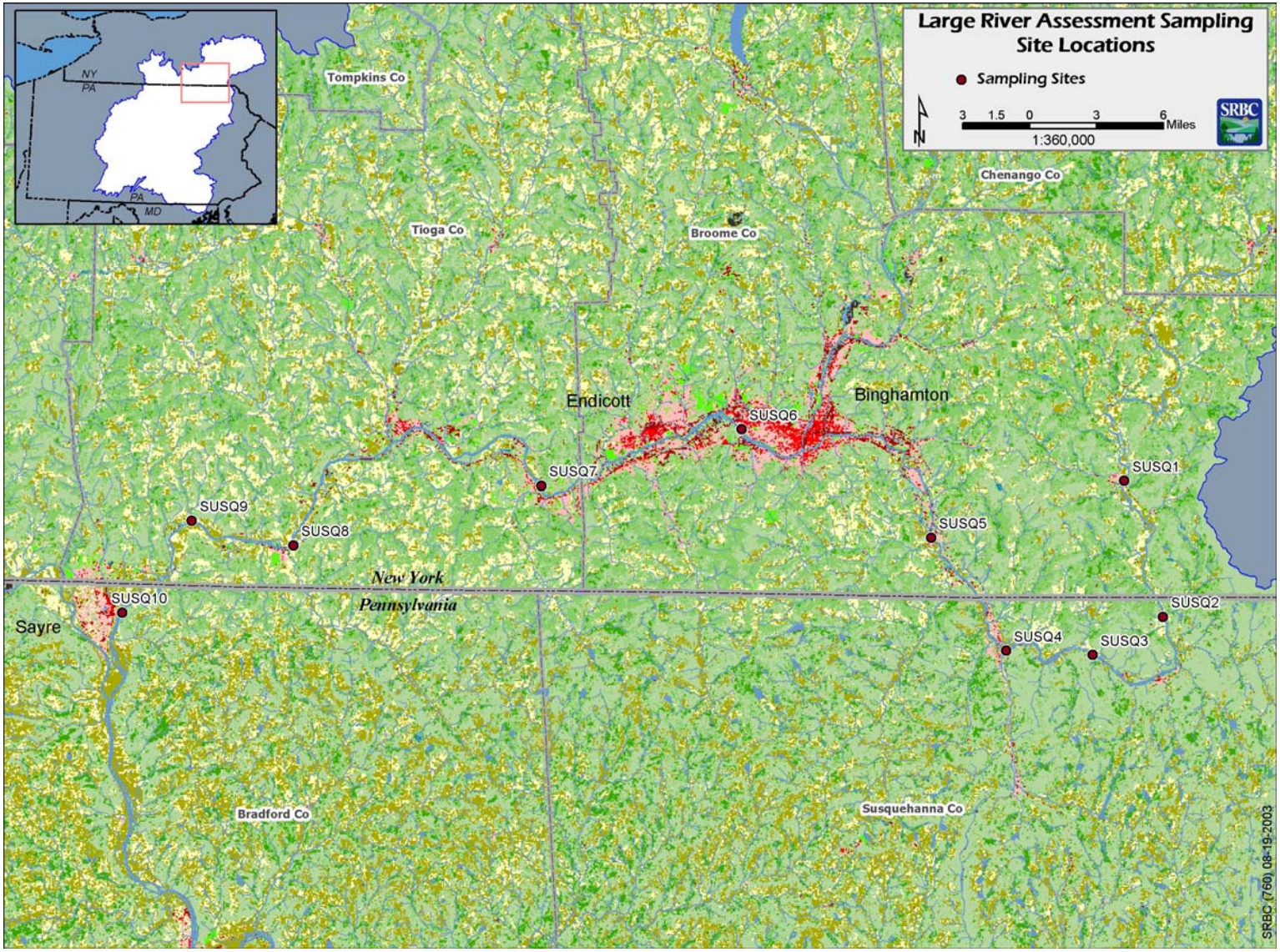

Figure 2. Sampling Locations for the Large River Assessment Pilot Project

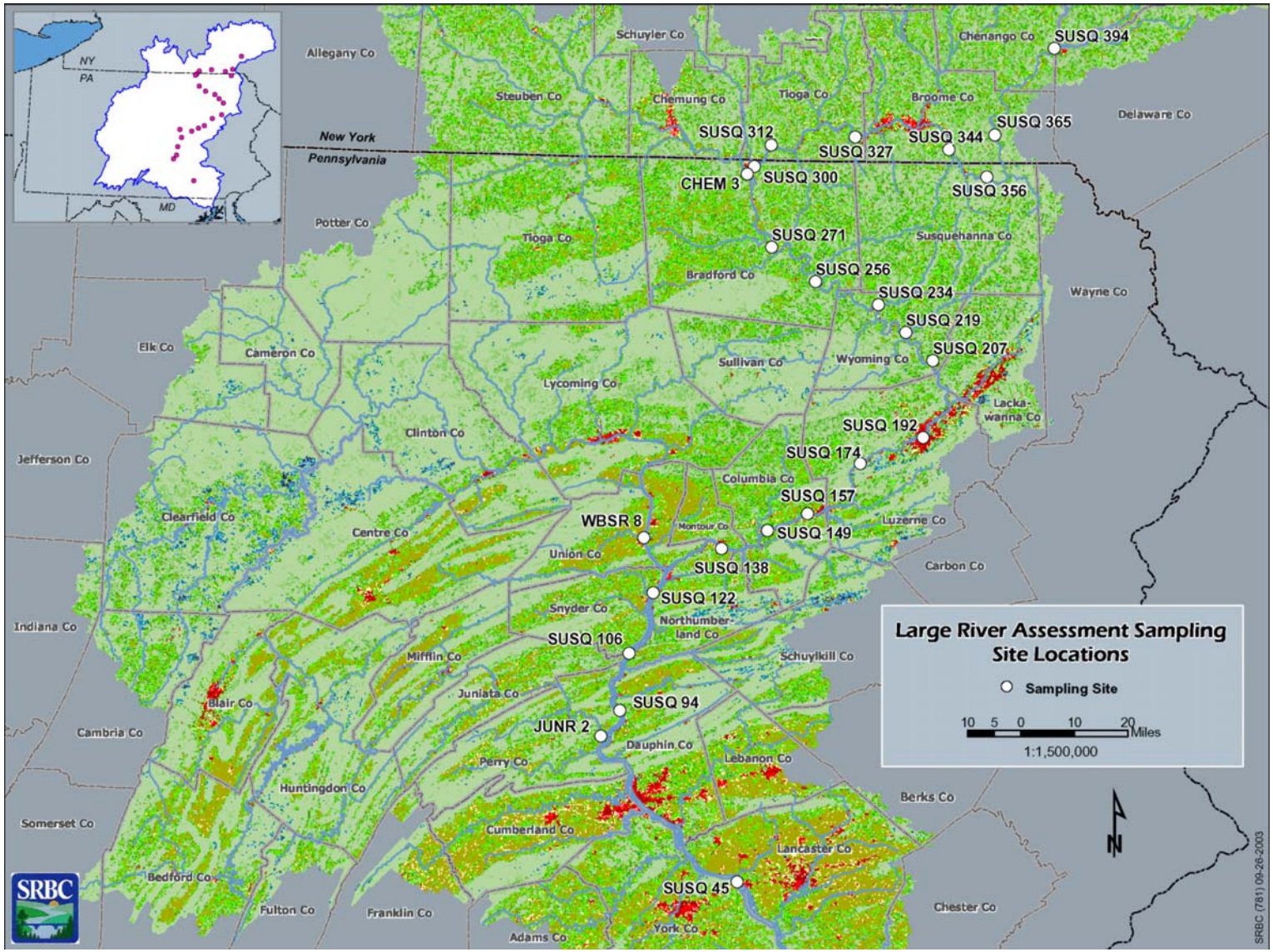

Figure 3. Sampling Locations for the Large River Assessment Project

watersheds were considered to be representative of many areas throughout the Basin and would provide detailed information for: (1) refining the Bay watershed model; (2) identifying problems related to specific land uses and combinations of land uses; and (3) identifying future management actions in the area.

In 1987, an additional site was added on the Susquehanna River at Marietta, Pa., to provide a better estimate of the nutrient and suspended-sediment loads transported by the Susquehanna River prior to entering the hydropower reservoirs in the lower river. In 1989, another sampling site was established on the Susquehanna River at Towanda, Pa., to provide an estimate of nutrient and suspended-sediment loads from New York State.

The initial five-year program was concluded at the end of December 1989, and five of the 12 original sites were selected for continued long-term monitoring. The Susquehanna River at Towanda, Danville, and Marietta, and the West Branch Susquehanna River at Lewisburg were selected to provide long-term data to evaluate trends in nutrient and suspended-sediment transport from the major subbasin. The fifth site, the Conestoga River at Conestoga was selected to provide long-term data from a major tributary watershed with intensive agricultural activity and increasing development. Implementation of best management practices also is being actively pursued. In October 1993, a sixth site, the Juniata River at Newport was reestablished for long-term monitoring.

The data are being used to compute annual loads of nutrients and suspended sediment at each of the sites. The initial five-year intensive sampling program provides baseline data that can be used to evaluate changes in water quality as management practices are installed. Data from the long-term monitoring sites also have been used for statistical trend analysis.

Currently, Commission staff collect sediment and nutrient samples, under a contract with the PADEP, to determine loads, yields, and trends in sediment and selected nutrient parameters on the mainstem of the Susquehanna River (at Towanda, Danville, and Marietta), at Lewisburg on the West Branch Susquehanna River, at Newport on the Juniata River, and at Conestoga on the Conestoga River. Samples are collected monthly during base flow conditions and at a set day each month for a trends data point. Samples also are collected during five seasonal storms each year. The sites included in this effort are data calibration points for the CBP's Watershed Model used for the Bay restoration effort. The most recent report can be found on the Commission's website at http://www.srbc.net/techreport231.htm.

In October 2004, the Commission began an extended sampling project in cooperation with PADEP, NYSDEC, and the CBP. Under this program, Commission staff collect water quality samples monthly and during storm events at the following locations in addition to the stations mentioned above: Chemung River at Chemung, N.Y.; Susquehanna River at Smithboro, N.Y., and near Wilkes-Barre, Pa.; West Branch Susquehanna at Karthaus and Jersey Shore, Pa.; Raystown Branch Juniata River at Saxton, Pa.; Bald Eagle Creek at Castanea, Pa.; Penns Creek at Penns Creek, Pa.; Shermans Creek near Shermans Dale, Pa.; Conodoguinet Creek near Hogestown, Pa.; Swatara Creek at Hershey, Pa.; West Conewago Creek near Manchester, Pa.; and Pequea Creek at Martic Forge, Pa. (Figure 4). The most recent QAPP for the project is attached (Appendix E) and will be placed on the Commission's website by June 2005.

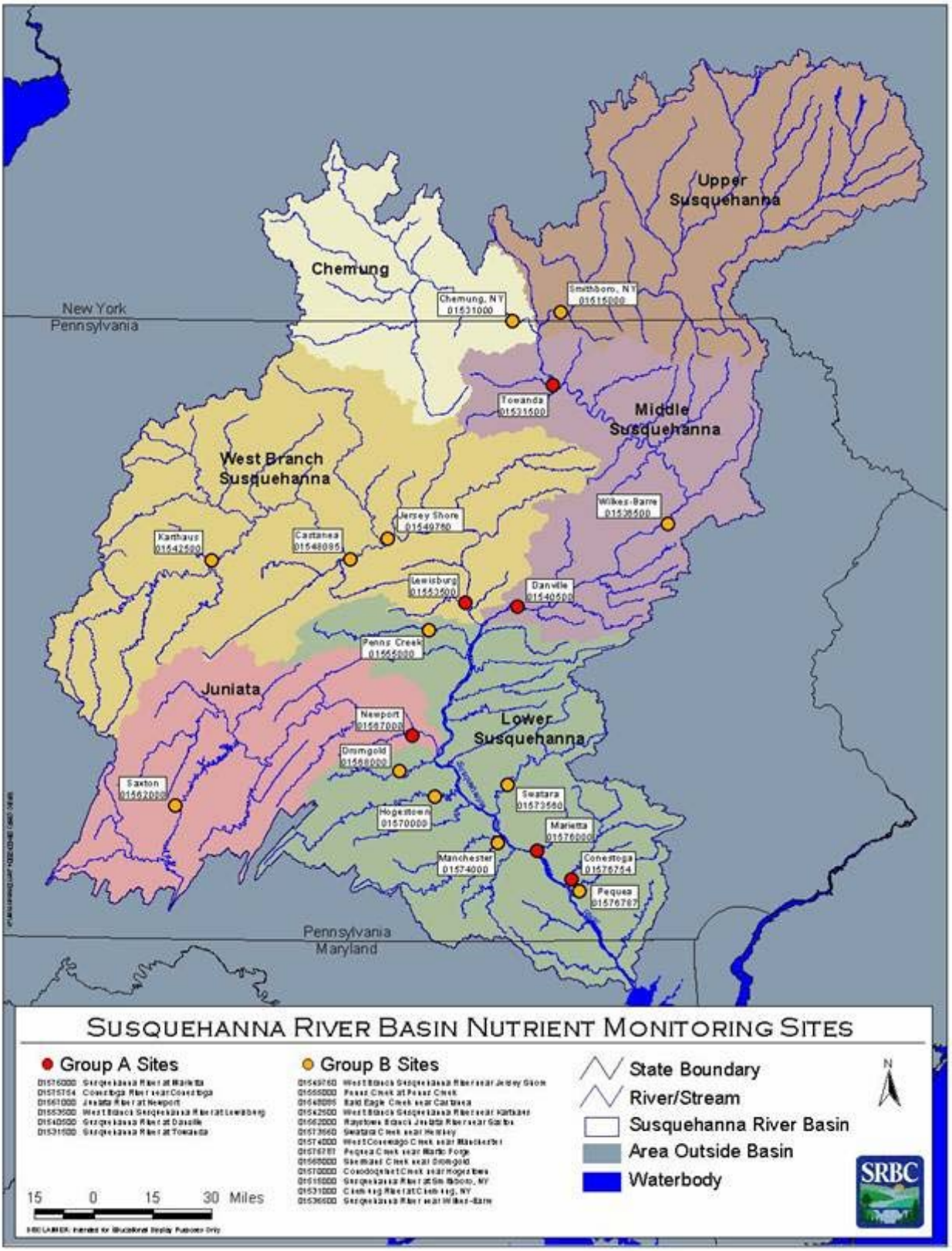

Figure 4. Susquehanna River Basin Nutrient Monitoring Stations

Interstate Streams Water Quality Network

One of the Commission's functions is to review projects that may have interstate impacts on water resources in the Basin. The Commission established a monitoring program in 1986 to collect data that were not available from monitoring programs implemented by state agencies in New York, Pennsylvania, and Maryland. The state agencies do not assess all of the interstate streams and do not produce comparable data needed to determine potential impacts on the water quality of interstate streams. The Commission's ongoing interstate monitoring program is partially funded through a grant from the USEPA. The interstate water quality monitoring program includes periodic collection of water and biological samples from interstate streams, as well as assessments of their physical habitat. Water quality data are used to: (1) assess compliance with water quality standards; (2) characterize stream quality and seasonal variations; (3) build a database for assessment of water quality trends; (4) identify streams for reporting to USEPA under Section 305(b) of the Clean Water Act; (5) provide information to signatory states for 303(d) listing and possible Total Maximum Daily Load (TMDL) development; and (6) identify areas for restoration and protection. Biological conditions are assessed using benthic macroinvertebrate populations, which provide an indication of the biological health of a stream and serve as indicators of water quality. Habitat assessments provide information concerning potential stream impairment from erosion and sedimentation, as well as an indication of the stream's ability to support a healthy biological community.

The Commission's interstate streams monitoring program began in April 1986 and has been changed several times due to both financial and data requirements. Currently, chemical water quality sampling is conducted on selected interstate streams quarterly, while biological, chemical, and physical data are collected annually on the larger streams that cross the N.Y. - Pa., and Pa. - Md. lines (Figures 5 through 8). The most recent report can be found at http://www.srbc.net/techreport233.htm. The most recent QAPP is attached (Appendix F) and will be placed on the Commission's website by June 2005.

Assistance to PADEP

Commission staff assist Pennsylvania with several monitoring efforts. Staff have been assessing the unassessed streams in the Pennsylvania portion of the basin as part of the SSWAP since 1997. More information on PADEP's SSWAP can be found at http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/UnassesWater.htm. Additionally, in 2000, staff began collecting water quality samples in AMD affected areas in order to assist with TMDL development. More information on PADEP's TMDL program can be found at http://www.dep.state.pa.us/watermanagement_apps/tmdl/. The QAPP for the AMD monitoring project is attached (Appendix G) and will be placed on the Commission's website by June 2005.

Early Warning System (EWS)

An EWS was established in the Pennsylvania portion of the Basin as a result of the Commission's involvement in Pennsylvania and Maryland's spill response and source water assessment and protection activities. The network utilizes both traditional communication methods and internet-based technology to provide real-time monitoring of select water quality parameters at drinking water intake locations on the Susquehanna River. Additionally, the network provides emergency information bulletins and updates to water suppliers on reported contamination events. The Commission hopes to expand the EWS into New York and Maryland as funding permits. Currently, the website provided for the water suppliers is not publicly available due to Pennsylvania's security policy on restriction of water supply information. In the future, depending on funding availability, a publicly-accessible web page with a link to the Commission website may be developed.

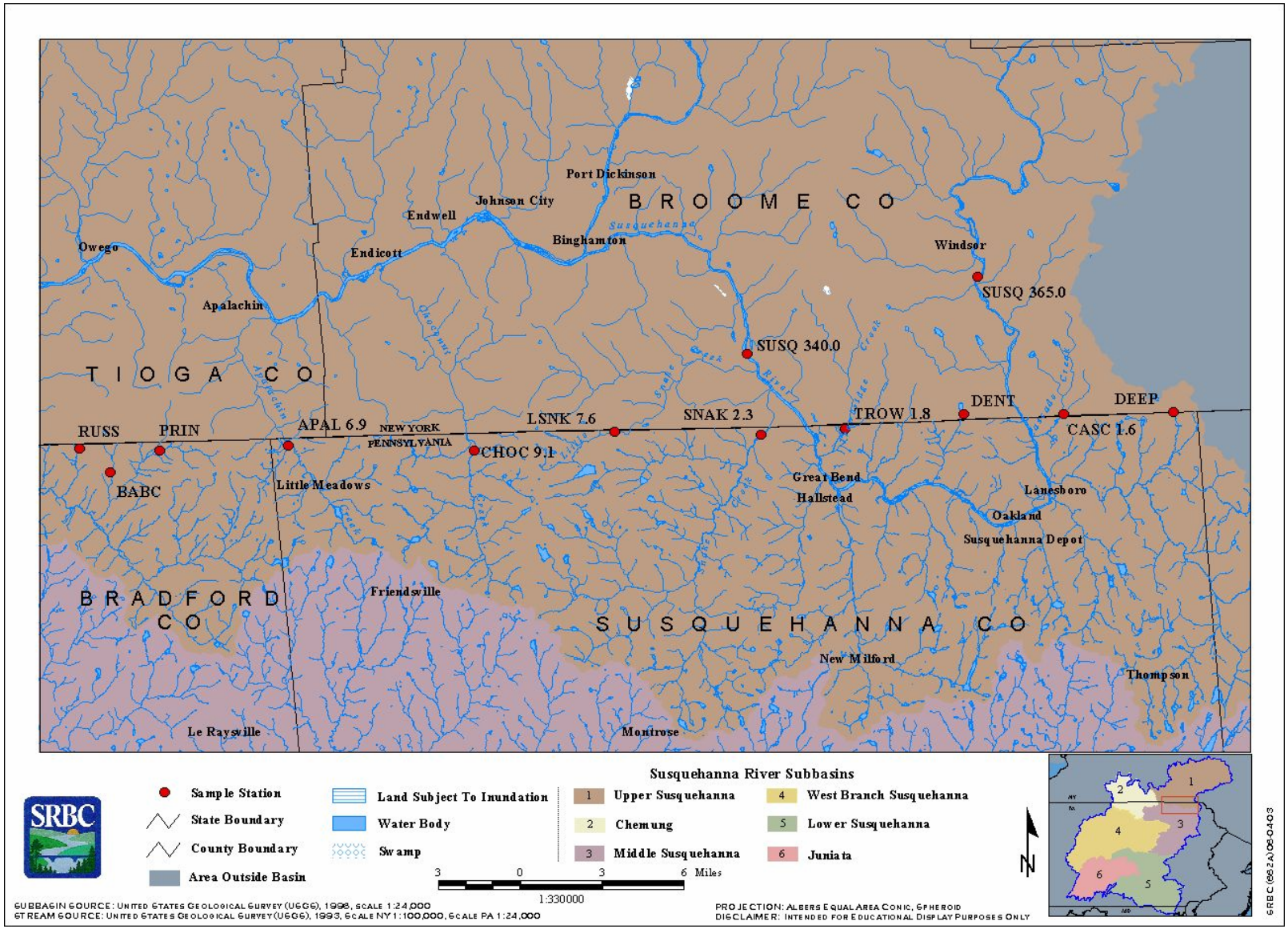

Figure 5. Interstate Streams along the New York-Pennsylvania Border between Russell Run and Deep Hollow Brook

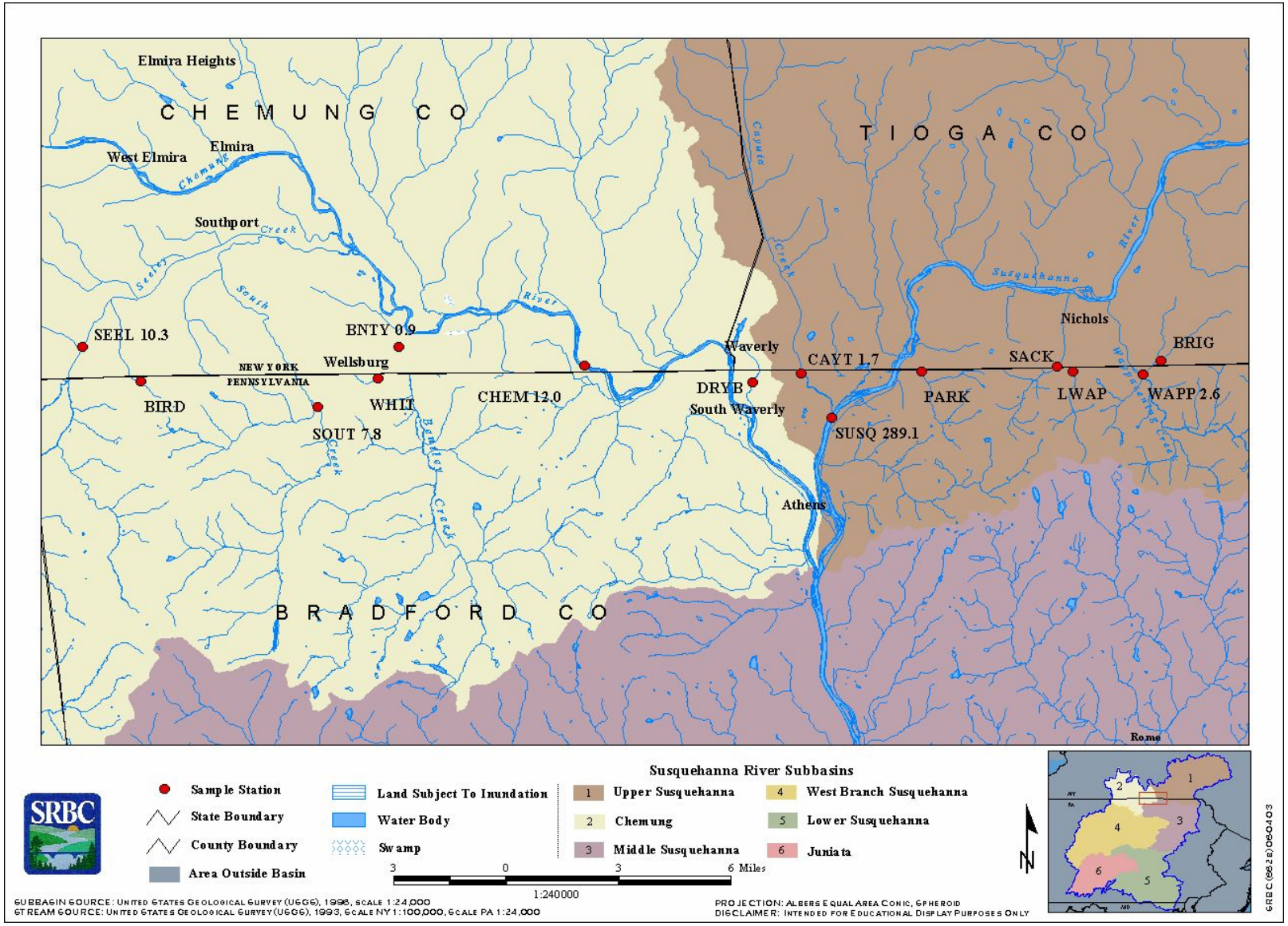

Figure 6. Interstate Streams along the New York-Pennsylvania Border between Seeley Creek and Briggs Hollow

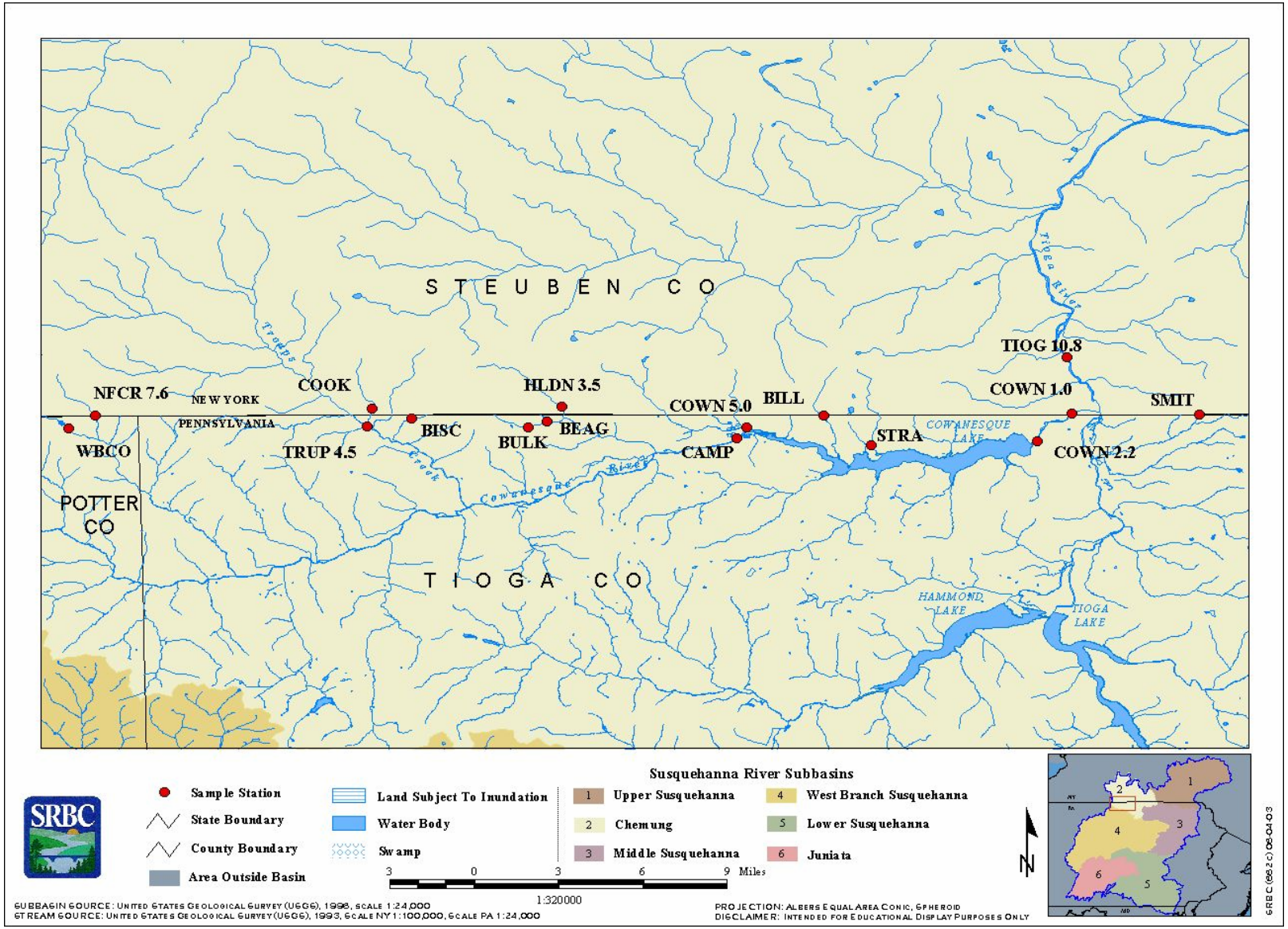

Figure 7. Interstate Streams along the New York-Pennsylvania Border between White Branch Cowanesque River and Smith Creek

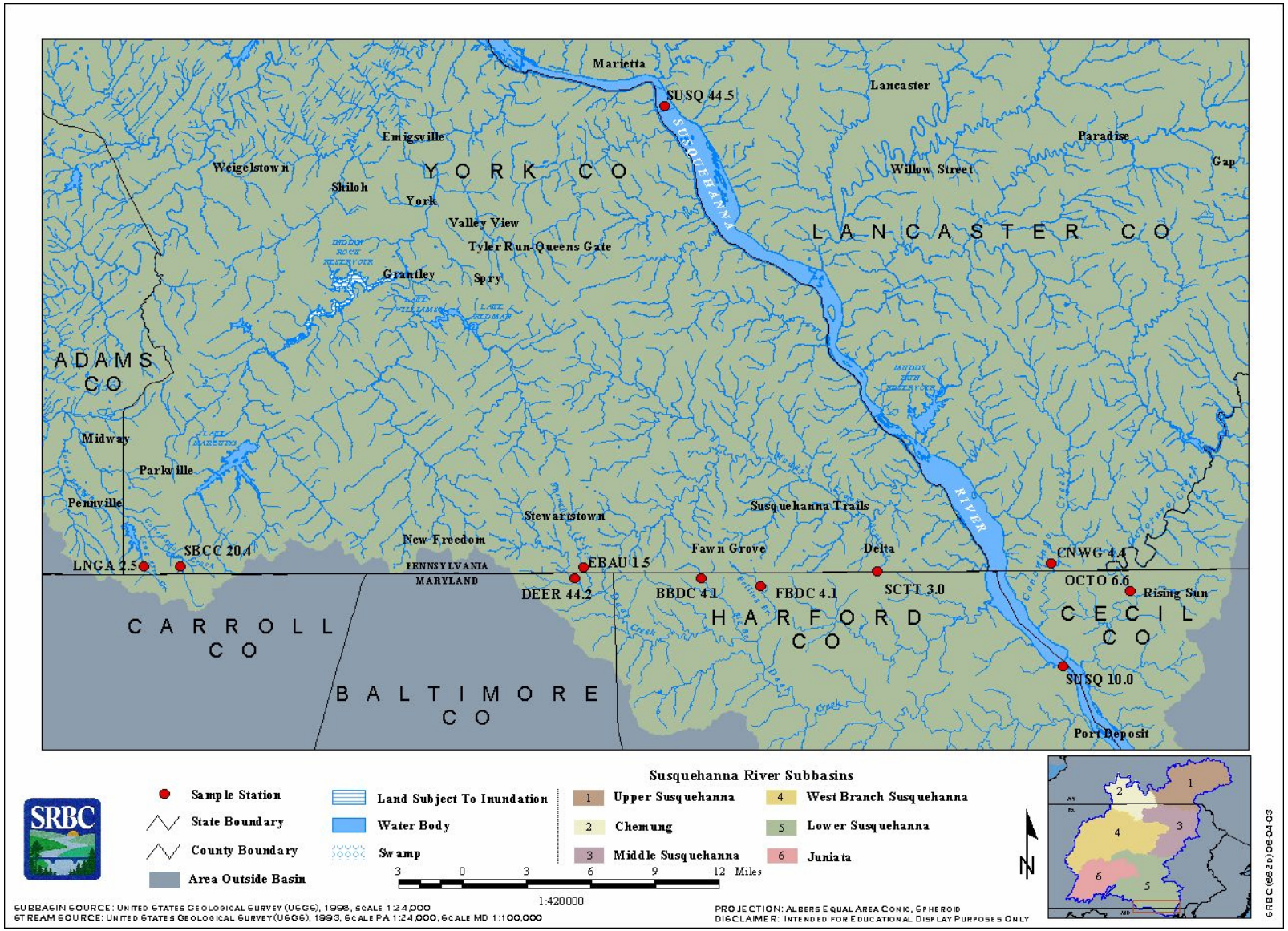

Figure 8. Interstate Streams along the Pennsylvania-Maryland Border

Chemical Groundwater Data

As part of the Commission's project review work, approved groundwater withdrawal projects must provide chemical water quality information every three years. The data are entered into a database by Commission staff and assessed as part of the Commission's Consolidated Listing assessment.

Presently, the Commission has several stream and river monitoring and assessment projects for determining aquatic life use impairment, as listed above. Additionally, staff is or has been involved in several monitoring efforts for AMD-related projects, such as the Tioga River assessment and restoration project (http://www.srbc.net/techreport230.htm) and data collection for the Catawissa Creek restoration project. In the past, Commission staff has been involved with monitoring water quality in Pennsylvania lakes, and has collected chemical water quality information for constructed wetlands (http://www.srbc.net/docs/wetland219_report_may02.pdf and http://www.srbc.net/Conestoga197.pdf). However, due to funding limitations, the Commission has no current plans to expand its assessment of designated uses to bacterial sampling for recreational purposes or fish tissue collection for human health concerns. Likewise, no funding currently is available for monitoring of wetlands or lakes in the basin. Should funding become available, the Commission would be interested in assisting its states in bacteria, fish tissue, wetlands, and lakes monitoring.

Additionally, the Commission is interested in pursuing an instream flow project. This project would provide data and guidance needed to better manage the increases in water withdrawals and consumptive uses occurring in the Basin. This approach would incorporate biology (fish, macroinvertebrates, and wetlands), geomorphology, hydrology, and water quality in an overall basis for managing low flow and consumptive uses in the Basin.

A timeline of monitoring projects for 2004-2014 is presented in Tables 1 and 2.

Table 1. Timeline of Commission Monitoring Projects, 2005-2009

Project Name	2005		2006		2007		2008		2009	
	January	**June**	**January**	**June**	**January**	**June**	**January**	**June**	**January**	**June**
Juniata Subbasin Survey, Year 1	Analysis, Report – June 2005									
Juniata Subbasin Survey, Year 2	Monitoring		Analysis, Report – June 2006							
Lower Subbasin Survey, Year 1		Monitoring	Analysis, Report – June 2006							
Lower Subbasin Survey, Year 2			Monitoring		Analysis, Report – June 2007					
Chemung Subbasin Survey, Year 1				Monitoring	Analysis, Report – June 2007					
Chemung Subbasin Survey, Year 2					Monitoring		Analysis, Report – June 2008			
Upper Subbasin Survey, Year 1						Monitoring	Analysis, Report – June 2008			
Upper Subbasin Survey, Year 2							Monitoring		Analysis, Report – June 2009	
Middle Subbasin Survey, Year 1								Monitoring	Analysis, Report – June 2009	
Middle Subbasin Survey, Year 2									Monitoring	
West Branch Subbasin Survey, Year 1										Monitoring
Large River Assessment		Monitoring	Analysis, Report – June 2006	Monitoring	Analysis, Report – June 2007	Monitoring	Analysis, Report – June 2008	Monitoring	Analysis, Report – June 2009	Monitoring
ISWQN Project	Monitoring, Analysis	Monitoring, Report – July 2005	Monitoring, Analysis	Monitoring, Report – July 2006	Monitoring, Analysis	Monitoring, Report – July 2007	Monitoring, Analysis	Monitoring, Report – July 2008	Monitoring, Analysis	Monitoring, Report – July 2009
Sediment and Nutrient Program	Monitoring	Monitoring, Analysis, Report – December 2005	Monitoring	Monitoring, Analysis, Report – December 2006	Monitoring	Monitoring, Analysis, Report – December 2007	Monitoring	Monitoring, Analysis, Report – December 2008	Monitoring	Monitoring, Analysis, Report – December 2009
AMD Monitoring for PADEP	Monitoring	Monitoring, Analysis, Report – September 2005	Monitoring	Monitoring, Analysis, Report – September 2005						
SSWAP Assistance for PADEP	Monitoring	Monitoring, Reporting – September 2005	Monitoring	Monitoring, Reporting – September 2005	Monitoring	Monitoring, Reporting – September 2005	Monitoring	Monitoring, Reporting – September 2005	Monitoring	Monitoring, Reporting – September 2005

Table 2. Timeline of Commission Monitoring Projects, 2010-2014

Project Name	2010		2011		2012		2013		2014	
	January	**June**	**January**	**June**	**January**	**June**	**January**	**June**	**January**	**June**
Middle Subbasin Survey, Year 2	Analysis, Report – June 2010									
West Branch Subbasin Survey, Year 1	Analysis, Report – June 2010									
West Branch Subbasin Survey, Year 2	Monitoring		Analysis, Report – June 2011							
Juniata Subbasin Survey, Year 1		Monitoring	Analysis, Report – June 2011							
Juniata Subbasin Survey, Year 2			Monitoring		Analysis, Report – June 2012					
Lower Subbasin Survey, Year 1				Monitoring	Analysis, Report – June 2012					
Lower Subbasin Survey, Year 2					Monitoring		Analysis, Report – June 2013			
Chemung Subbasin Survey, Year 1						Monitoring	Analysis, Report – June 2013			
Chemung Subbasin Survey, Year 2							Monitoring		Analysis, Report – June 2014	
Upper Subbasin Survey, Year 1								Monitoring	Analysis, Report – June 2014	
Upper Subbasin Survey, Year 2									Monitoring	
Middle Subbasin Survey, Year 1										Monitoring
Large River Assessment	Analysis, Report – June 2010	Monitoring	Analysis, Report – June 2011	Monitoring	Analysis, Report – June 2012	Monitoring	Analysis, Report – June 2013	Monitoring	Analysis, Report – June 2014	Monitoring
ISWQN Project	Monitoring, Analysis	Monitoring, Report – July 2010	Monitoring, Analysis	Monitoring, Report – July 2011	Monitoring, Analysis	Monitoring, Report – July 2012	Monitoring, Analysis	Monitoring, Report – July 2013	Monitoring, Analysis	Monitoring, Report – July 2014
Sediment and Nutrient Program	Monitoring	Monitoring, Analysis, Report – December 2010	Monitoring	Monitoring, Analysis, Report – December 2011	Monitoring	Monitoring, Analysis, Report – December 2012	Monitoring	Monitoring, Analysis, Report – December 2013	Monitoring	Monitoring, Analysis, Report – December 2014

MONITORING OBJECTIVES

Most of the data collected by Commission staff are used for various purposes including assessing streams for the Consolidated Listing report, identifying impaired waters, providing information for watershed groups, and providing information for project review staff. Additionally, water quality changes over time can be detected due to the long time frame encompassed by most of the collection efforts, particularly the subbasin survey data, the interstate streams project, and the sediment and nutrient monitoring. In fact, trends are calculated for selected parameters yearly for the interstate streams and sediment and nutrient monitoring programs.

Additionally, the subbasin survey data can be used to identify either potential watershed restoration or protection areas, as collection occurs in both waters that may be polluted due to point and nonpoint sources or are more pristine streams. Data are included in the Commission's Consolidated Listing report and yearly electronic updates. Ultimately, member states make the decisions for inclusion of Commission data in state 303(d) listings and for the level of protection needed for each stream, such as water quality standards. Although the Commission does have authority to set water quality standards, this would only be applicable if a member state failed to do so. To date, the Commission has not set any water quality standards. The states also have final decisions in determining the effectiveness of specific projects and overall programs, such as Section 319, Section 314, Section 303(d), TMDLs, water quality standards, and National Pollution Discharge Elimination System permits.

All activities described throughout this Monitoring Strategy support the goals of the Clean Water Act: determining water quality standards attainment; assessing the condition of all waters; determining the effectiveness of nonpoint source programs and projects; determining environmental and public health effectiveness of voluntary and required pollution control programs; identifying and defining the scope of emerging issues and/or threats to the health of waters and the public; establishing, reviewing, and revising water quality standards; identifying causes and sources of water quality impairments; and developing TMDLs. Part of the assessment process for the Commission is determining attainment of water quality standards, as well as identifying causes and sources of water quality impairments. The Commission also performs small projects and assists its member jurisdictions in determining the effectiveness of nonpoint source programs, such as the Conservation Reserve Enhancement Program and the Catawissa Creek/Audenreid Tunnel restoration project. Commission staff reviews all federal and state registers for water quality issues, including water quality standards and provides comments when appropriate. The Commission has been involved with developing TMDLs for Pennsylvania for the past five years. Additionally, a portion of the Commission's Section 106 funding is allocated to TMDL coordination and training.

MONITORING DESIGN

Due to the varied nature of each of the Commission's projects, the monitoring design for each is unique. The subbasin survey program is a rotating intensive basin survey, with sites chosen based on prior sampling points, as well as known problem and potential protection areas. The Commission is committed to performing assessments of each subbasin on a six-year cycle. Additionally, a Year 2 follow-up survey is planned following the initial survey to account for local interests, as well as any problem or protection efforts needed in the watershed.

The ISWQN monitoring project involves the monitoring and assessment of fixed stations at or near the state lines on all interstate streams. Additional projects with a fixed-station design include the sediment and nutrient monitoring project, EWS, and assessment of groundwater information.

Potential future changes to the Commission's monitoring projects would need to be evaluated for cost and efficiency, but could include probabilistic monitoring on the large river systems or in the subbasin survey projects. Additional funding would be required for this change to occur.

Benthic macroinvertebrates, collected using RBP III, are used as the primary avenue for making water quality assessments due to a lower cost and the link with member jurisdiction assessment processes. Chemical water quality and physical habitat information is used as supporting data for assessments. The Commission's assessment methods are described in detail in the Data Analysis/Assessment section on page 22 and in the Commission's Consolidated Listing report.

CORE AND SUPPLEMENTAL WATER QUALITY INDICATORS

As mentioned above, benthic macroinvertebrates are used as the core indicator for water quality assessments. Physical habitat information (based on USEPA's RBP III parameters), field chemistry (pH, specific conductance, dissolved oxygen, alkalinity, acidity, and temperature), flow, and chemical water quality (metals, nutrients, and ions) are used to support assessments and provide information as to sources and causes. Land use data also are collected at the time of sampling. In some cases, information on fish communities and populations is collected, primarily in association with subbasin surveys or special projects. Commission staff does not collect bacteriological, fish tissue, or sediment toxicity data. The Commission is interested in developing a periphyton monitoring protocol for inclusion in the monitoring and assessment process associated with its Large River Assessment Project, as well as the EWS for public water supply.

QUALITY ASSURANCE (QA)

Each project funded by USEPA with Section 106 funds (subbasin surveys, interstate streams monitoring, and large river assessment) has a USEPA-approved QAPP, which is updated annually. Additionally, a QAPP is revised and reviewed annually for the sediment and nutrient assessment project and the AMD monitoring project for PADEP. These QAPPs are attached and will be available electronically on the Commission's website by June 2005. The QAPPs are distributed to all monitoring staff and are maintained in a central location with other project-specific documents. The Commission also has an approved Quality Management Plan (QMP) that is reviewed annually and updated every three years or as needed (Attachment H). Currently, USEPA is reviewing the Commission's updated QMP, and approval is pending. The QAPPs and QMP are peer-reviewed by Commission staff, as well as USEPA staff. Standard Operating Procedures (SOPs) have been developed for field alkalinity and acidity titrations and are reviewed annually. The SOPs can be found in the Appendix of each QAPP. The Commission is committed to collecting high-quality information for its program needs, as well as the needs of its member jurisdictions.

Yearly, Commission staff is audited by the USGS for proficiency in performing certain field chemistry measurements: pH, conductivity, and alkalinity. The WAP Division also has a variety of internal QA procedures, such as a six-month training period for all field personnel, and annual training for benthic macroinvertebrate collection, physical habitat assessment, meter usage, and flow measurement.

The PADEP, Bureau of Laboratories, in Harrisburg, Pa., processes all water chemistry samples. The lab has its own USEPA-approved QA plan. The PADEP lab is certified by USEPA for drinking water parameters; the laboratory ID number is PA00001. Commission staff works closely with PADEP lab staff when validating results from chemical analyses.

DATA MANAGEMENT

The Commission has made a commitment to enter all of its data collected for projects funded by Section 106 funds into USEPA's STORET (STOrage and RETrieval) system. Currently, staff has entered station header information for approximately 650 stations from data collected during the 1997-2003 time frame. The Commission's organization name for STORET is 42SRBCWQ. Staff also has developed an Access database for chemical data to upload to STORET. Currently, data for the ISWQN project are available on STORET; chemical water quality data for all other Commission projects will be available by July 2005. Data are entered into the Commission's Access database within three weeks of receiving the data. By December 2005, all biological information and physical habitat data will be entered into the STORET system. The Commission does not collect data on fish tissue, toxicity, or sediment chemistry for inclusion in the STORET. Currently, all water quality, biological, and physical habitat data are stored in Excel databases maintained by the Commission. Lab sheets are retained in-house for two years, and then stored in an off-site location indefinitely.

For Consolidated Listing assessments, the Commission is entering information into USEPA's Assessment Database (ADB) for ease of inclusion in future state reporting. Additionally, the Commission plans to use the National Hydrological Database (NHD) to link stream assessments to the proper stream coverage; currently, the estimated start time for the Commission's use of the NHD is December 2006. The Commission also is working with PADEP to enter stream assessment information directly into PADEP's NHD and Access database for Consolidated Listing purposes.

The Commission also is conducting an evaluation of its database needs to complement the above, as well as its regulatory and other planning, management, and public information and education functions. This is an ongoing, dynamic process. The Commission has a draft data management strategy that can be provided to USEPA upon request.

DATA ANALYSIS/ASSESSMENT

Stream assessments performed by the Commission are based largely on benthic macroinvertebrate information. The Commission uses the current USEPA RBP manual as the basis for its assessment and biological metrics. Using this method, staff calculates a series of biological indexes for each stream and compares them to indexes for a nonimpaired reference station in the same region to determine the degree of impairment. Metrics used by the Commission are as follows: (1) taxonomic richness; (2) modified Hilsenhoff Biotic; (3) percent Ephemeroptera; (4) percent contribution of dominant taxon; (5) number of Ephemeroptera/ Plecoptera/Trichoptera taxa; (6) percent Chironomidae; and (7) Shannon-Wiener Diversity Index. Each metric score is then converted to a biological score, based on the percent similarity of the metric score, relative to the metric score for the reference site. The sum of the biological condition scores constitutes the overall biological score of the sampling station and is used to assign each site to a condition category. A score of 54 percent or greater constitutes a fully supporting condition, a 54 to 18 percent score represents partially supporting, and 17 percent or less describes a nonsupporting condition. The Commission's biological monitoring methods are very similar to those used by the member jurisdictions: the Commission, New York, Pennsylvania, Maryland, and the federal government use RBP methods for data collection. However, the assessment methods differ slightly, due to differences in metrics used to determine attainment versus nonattainment. The Commission is investigating the use of PADEP's assessment methodology for use in Commission listing guidance's.

Physical habitat conditions are assessed using a slightly modified version of the habitat assessment procedure outlined in the RBP manual. Eleven habitat parameters were field-evaluated at

each site and used to calculate a site-specific habitat assessment score. Habitat parameters were evaluated on a scale of 0 to 20 and were based on instream composition, channel morphology, and riparian zone and bank conditions. Some of the parameters to be evaluated varied based on whether the streams were characterized by riffles and runs or by glides and pools.

Chemical water quality information is compared to water quality standards of member states. When a parameter is not listed in the standards of the states, additional references from peer-reviewed literature are used.

The Commission's water quality assessment program is designed to determine if the waters of the Basin meet the water quality standards of the state through which the stream flows. The program also coordinates standards between states to avoid conflicts on interstate streams. The standards are based on protected uses and water quality criteria to prevent stream degradation, as determined by each of the Commission's member states (New York, Pennsylvania, and Maryland).

All surface waters in the Basin have multiple use designations for aquatic life, water supply and recreation. Water quality criteria for a specific waterbody are set to protect the most sensitive use, which is generally aquatic life.

Maryland classifies all of its waters for basic water uses that include swimming, supporting a balanced population of fish and other aquatic life, supporting wildlife, and providing for water supply (agricultural, industrial). In Pennsylvania, all surface waters must meet protected uses for aquatic life (warm water fishes), water supply (potable, industrial, livestock, and wildlife), and recreation (boating, fishing, water contact sports, and aesthetics). New York State has a minimum use requirement that stipulates water quality shall be suitable for primary (swimming) and secondary (fishing) contact recreation. These waters must be suitable for fish survival, but not necessarily for fish propagation.

The Commission focuses on determining the degree to which the waters of the Basin support aquatic life, because aquatic life use support can be easily and economically assessed using biological sampling techniques and because aquatic life is one of the most sensitive of the national use support categories. The Commission does not sample for bacteria (to determine if the contact recreation use is being met) or collect fish tissue (for fish consumption impairments). A limited number of parameters, such as chloride, iron, manganese, nitrite + nitrate, sulfate, and total dissolved solids, are examined for the ISWQN program with regard to drinking water. However, as samples are collected only quarterly and not in targeted water supply areas, the Commission considers the aquatic life use support as the best indicator of the health of the Basin's waters.

The Commission's water quality assessment program involves the collection of physical habitat, chemical water quality, and biological (macroinvertebrate) data primarily obtained through the subbasin surveys, ISWQN, and large river assessment project. These data are analyzed relative to the designated use and associated criteria of the waterbody being assessed. Other information such as land use, location of point sources, and habitat characteristics are incorporated into the assessment as a guide to the possible causes and sources of impairment of a waterbody. An overall use-support classification for a waterbody is based on an integrated assessment of the available biological data and, when available, the professional judgment of scientists who planned and conducted the field investigations.

The degree of use support of designated uses is fully supporting, not supporting, and insufficient information. Assessments are based on biological data collected from Commission's monitoring programs. The biological conditions of a stream segment are assessed using procedures described in the USEPA RBP manual. Using this method, staff calculates a series of biological indexes for each stream and compares them to indexes for a nonimpaired reference station in the same region to determine the

degree of impairment. The metrics used in Commission projects are: Taxonomic Richness, Shannon Diversity Index, Hilsenhoff Biotic Index, Ephemeroptera/ Plecoptera/Trichoptera (EPT) Index, percent Ephemeroptera, percent contribution of dominant taxon, ratio of EPT to Chironomidae, and percent Chironomidae.

The 200-organism subsample data were used to generate scores for each of the metrics. Each metric score was then converted to a biological score, based on the percent similarity of the metric score, relative to the metric score for the reference site. The sum of the biological condition scores constituted the total biological score for the sample site, and total biological scores were used to assign each site to a biological condition category. A score of 54 percent or greater constitutes full support while 53 percent or less characterizes nonsupporting conditions. For the 2004 reporting cycle, due to the slight differences in the Commission's assessments and the assessments of its member states, the Commission, New York, Pennsylvania, and Maryland jointly decided that all of the Commission's nonsupporting assessments would be characterized as "Category 3 - insufficient information." This will allow the member states to address the possible issues concerning these streams without the streams automatically requiring a TMDL.

Biological

Fully Supporting = 54 percent or greater of the reference condition
Not Supporting = 53 percent or less of the reference condition

Chemical data are compared to state standards or to aquatic life limits. These limits are project-specific, as differing water chemistry parameters are collected for different projects. For example, the West Branch Subbasin Survey used the parameters and limits located in Table 3, while the ISWQN project utilizes the parameters and limits in Table 4.

Data gathered to assess the status of the Basin's streams are stored in the Commission's water quality database. Assessment decisions are stored in USEPA's ADB. Sources and causes are determined for each impaired reach. More detailed information on the assessment protocols and methods can be found in the QAPPs for each project (see Appendixes) or the Commission's Consolidated Listing report.

REPORTING

The Commission releases reports on all of its internal monitoring projects. Full technical reports are completed yearly for the interstate streams and sediment and nutrient monitoring projects and can be found on the Commission's website (www.srbc.net). These reports also are sent to interested parties and the member jurisdictions. Glossy, public-oriented publications are produced in conjunction with subbasin surveys and also can be found on the Commission's website.

Yearly, a Consolidated Listing report or electronic update of all data is completed as a part of Section 106 requirements for USEPA. These reports are sent to the member jurisdictions, as well as USEPA, and can be found on the Commission's website. The Commission does not produce its own 303(d) report. The 2002 305(b) report can be found at http://www.srbc.net/docs/305b_report_may02.pdf. The 2004 Consolidated Listing report will be placed on the website by June 2005.

Table 3. Water Quality Limits for West Branch Subbasin Survey

Parameter	Limit	Parameter	Limit
Temperature	> 25 degrees Celsius	Total Sodium	> 20 mg/l
Dissolved Oxygen	< 4 mg/l	Total Potassium	> 30 mg/l
Conductivity	> 800 μmhos/cm	Total Chloride	> 150 mg/l
pH	< 5 standard units	Total Sulfate	> 250 mg/l
Alkalinity	< 20 mg/l	Total Fluoride	> 2.0 μg/l
Total Suspended Solids	> 15 mg/l	Total Copper	> 12 μg/l
Total Nitrogen	> 1.0 mg/l	Total Iron	> 1.5 mg/l
Total Ammonia	> 0.2 mg/l	Total Lead	> 1.0 μg/l
Total Nitrite	> 1.0 mg/l	Total Manganese	> 1 mg/l
Total Phosphorus	> 0.1 mg/l	Total Nickel	> 158 μg/l
Total Organic Carbon	> 10 mg/l	Total Aluminum	> 200 μg/l
Total Hardness	> 300 mg/l	Total Orthophosphate	> 0.05 mg/l
Total Magnesium	> 35 mg/l		

Table 4. Water Quality Standards used in the Interstate Streams Water Quality Network

Parameter	State	Criteria	Critical Use
Alkalinity	PA	Minimum 20 mg/l as CaCO3, except where natural conditions are less	Aquatic Life
Aluminum	NY	100 ug/l	Aquatic Life (chronic)
Chlorine	PA	1-hour average = 0.019 mg/l	Aquatic Life
	NY	0.019 mg/l	Aquatic Life (acute)
	MD	0.019 mg/l	Aquatic Life
Dissolved Oxygen	PA	5.0 mg/l (Cold Water Fishery); 4.0 mg/l (Warm Water Fishery); 5.0 mg/l February 15 – July 31, otherwise 4.0 mg/l (Trout Stocked Fishery)	Aquatic Life
	NY	5.0 mg/l (trout); 4.0 mg/l (non-trout)	Trout Waters
	MD	5.0 mg/l	Aquatic Life
Dissolved Solids	PA	750 mg/l	Public Water Supply
	NY	500 mg/l	General
Iron	PA	30-day average – 1.5 mg/l as total recoverable	Aquatic Life
	NY	300 ug/l	Aquatic Life (chronic)
Magnesium	NY	35,000 ug/l (Class A)	Health (water source)
Manganese	PA	Maximum 1.0 mg/l, as total recoverable	Aquatic Life/Public Water Supply
Nitrate + Nitrite	PA	10 mg/l	Public Water Supply
	NY	10,000 ug/l (Class A)	Health (water source)
Nitrate	NY	10,000 ug/l (Class A)	Health (water source)
Nitrite	NY	1,000 ug/l (Class A)	Health (water source)
		100 ug/l (warm water fishery); 20 ug/l cold water fishery	Aquatic (chronic)
pH	PA	From 6.0 to 9.0 inclusive	Aquatic Life
	NY	From 6.5 to 8.5 inclusive	General
	MD	From 6.5 to 8.5 inclusive	Aquatic Life
Sulfate	PA	Maximum 250 mg/l	Public Water Supply
	NY	250,000 ug/l (Class A)	Health (water source)
Turbidity	MD	Maximum 150 NTU	Aquatic Life

The Commission routinely provides information to NYSDEC for the Priority Waterbodies List and responds to requests for water quality information from its member states for consolidated listing and stream redesignation purposes. Currently, the Commission is investigating using PADEP's listing guidance for its assessments and entering data directly into PADEP's assessment database and NHD stream layer. Commission staff will continue to work with its member jurisdictions to ensure inclusion of the Commission's assessment information into the states' Consolidated Listing reports.

In addition to written reports, presentations regarding monitoring projects often are given to watershed groups, to state and federal agencies, at Commission meetings, and in conjunction with the WAP Division's WQAC meetings. Summary report announcements for each project are distributed widely to persons and organizations on the Commission's mailing list.

PROGRAMMATIC EVALUATION

The Commission evaluates its monitoring programs in various ways. Yearly, USEPA reviews and comments on the Section 106 workplan submitted by the Commission, which contains descriptions of the various monitoring activities, planned using Section 106 funds. USEPA staff also review the Commission's overall QMP and the QAPPs for each project. The WQAC members offer constructive reviews of Commission activities during the biannual meetings. An additional source of internal evaluation includes revisions to the WAP Division's Strategic Plan, which is available on the Commission's website at http://www.srbc.net/docs/WAPStrategicPlan.pdf. The current "Elements of a Monitoring and Assessment Program" was distributed to the WQAC for review and comment. This document will be evaluated and updated every two years.

In considering whether to pursue new grant opportunities, the potential grant is evaluated according to a standard set of criteria including whether the grant would support the Commission's mission statement, strategic plan, comprehensive plan, and division-specific strategic plans. The Commission also considers the mission statement, comprehensive plan, and strategic plans in developing the annual budget.

Annual Milestones

The following annual milestones are based on activities supported by current funding levels. Annual reviews of appropriate QAPPs are implied for each project. If additional funding is secured, the Commission would like to assist its member jurisdictions with additions to the respective monitoring programs, as well as develop a basinwide lakes and wetlands assessment program.

2005:

- Complete report for Juniata Subbasin survey, Year 1 – June 2005.
- Complete report for West Branch Subbasin survey, Year 2 – June 2005.
- Initiate monitoring in the Lower Susquehanna Subbasin for the subbasin survey, Year 1 – June 2005.
- Begin sampling for the Juniata Subbasin survey, Year 2 – April 2005.
- Continue monitoring for the ISWQN project – quarterly throughout the Year; report due July 2005.
- Initiate monitoring for expanded large river assessment project – June 2005.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2005.

- Continue to assist PADEP with AMD monitoring – bimonthly throughout the year; report due September 30, 2005.
- Continue to assist PADEP with SSWAP – reporting due September 30, 2005.
- Provide electronic update for Consolidated Listing report to member jurisdictions and USEPA – April 1, 2005.
- Place all QAPPs and QMP on the Commission's website – June 2005.
- Enter all chemical water quality data into STORET – July 2005.
- Enter all biological and habitat data into STORET – December 2005.

2006

- Complete report for Lower Susquehanna Subbasin survey, Year 1 – June 2006.
- Complete report for Juniata Subbasin survey, Year 2 – June 2006.
- Begin monitoring for Lower Susquehanna Subbasin survey, Year 2 – January 2006.
- Begin monitoring for Chemung Subbasin survey, Year 1 – June 2006.
- Continue monitoring for the ISWQN project – quarterly throughout the year; report due July 2006.
- Continue monitoring for expanded large river assessment project – June 2006.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2006.
- Continue to assist PADEP with AMD monitoring – bimonthly throughout the year; report due September 30, 2006.
- Continue to assist PADEP with SSWAP – reporting due September 30, 2006.
- Provide Consolidated Listing report to member jurisdictions and USEPA – April 1, 2006.
- Link the Commission's ADB to the NHD – December 2006.
- Update Elements document – December 2006.

2007

- Complete report for Lower Susquehanna Subbasin survey, Year 2 – June 2007.
- Complete report for Chemung Subbasin survey, Year 1 – June 2007.
- Begin monitoring for Chemung Subbasin survey, Year 2 - January 2007.
- Begin monitoring for Upper Susquehanna Subbasin survey, Year 1 – June 2007.
- Continue monitoring for the ISWQN project – quarterly throughout the year; report due July 2007.
- Continue monitoring for expanded large river assessment project – June 2007.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2007.
- Continue to assist PADEP with SSWAP – reporting due September 30, 2007.
- Provide electronic update for Consolidated Listing report to member jurisdictions and USEPA – April 1, 2007.
- Prepare periphyton monitoring and assessment protocol – December 2007.
- Update QMP – April 2007.

2008

- Complete report for Chemung Subbasin survey, Year 2 – June 2008.
- Complete report for Upper Subbasin survey, Year 1 – June 2008.
- Begin monitoring for Upper Subbasin survey, Year 2 – January 2008.
- Begin monitoring for Middle Subbasin survey, Year 1 – June 2008.
- Continue monitoring for the ISWQN project – quarterly throughout the year; report due July 2008.

- Continue monitoring for expanded large river assessment project – June 2008.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2008.
- Continue to assist PADEP with SSWAP – reporting due September 30, 2008.
- Provide Consolidated Listing report to member jurisdictions and USEPA – April 1, 2008.
- Begin utilizing periphyton protocol in large river assessment – June 2008.
- Update Elements document – December 2008.

2009

- Complete report for Upper Subbasin survey, Year 2 – June 2009.
- Complete report for Middle Subbasin survey, Year 1 – June 2009.
- Begin monitoring for Middle Subbasin survey, Year 2 – January 2009.
- Begin monitoring for West Branch Subbasin survey, Year 1 – June 2009.
- Continue monitoring for the ISWQN project – quarterly throughout the year; report due July 2009.
- Continue monitoring for expanded large river assessment project – June 2009.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2009.
- Continue to assist PADEP with SSWAP – reporting due September 30, 2009.
- Provide electronic update for Consolidated Listing report to member jurisdictions and USEPA – April 1, 2009.
- Revise WAP Division Strategic Plan – June 2009.

2010

- Complete report for Middle Subbasin survey, Year 2 – June 2010.
- Complete report for West Branch Subbasin survey, Year 1 – June 2010
- Begin monitoring for West Branch Subbasin survey, Year 2 – January 2010.
- Begin monitoring for Juniata Subbasin survey, Year 1 – June 2010.
- Continue monitoring for the ISWQN project – quarterly throughout the year; report due July 2010.
- Continue monitoring for expanded large river assessment project – June 2010.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2010.
- Provide Consolidated Listing report to member jurisdictions and USEPA – April 1, 2010.
- Update QMP – April 2010.
- Update Elements document – December 2010.

2011

- Complete report for West Branch Subbasin survey, Year 2 – June 2011.
- Complete report for Juniata Subbasin survey, Year 1 – June 2011.
- Begin monitoring for Juniata Subbasin survey, Year 2 – January 2011.
- Begin monitoring for Lower Subbasin survey, Year 1 – June 2011.
- Continue monitoring for the ISWQN project – quarterly throughout the year; report due July 2011.
- Continue monitoring for expanded large river assessment project – June 2011.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2011.
- Provide electronic update for Consolidated Listing report to member jurisdictions and USEPA – April 1, 2011.

2012

- Complete report for Juniata Subbasin survey, Year 2 – June 2012.
- Complete report for Lower Subbasin survey, Year 1 – June 2012.
- Begin monitoring for Lower Subbasin survey, Year 2 – January 2012.
- Begin monitoring for Chemung Subbasin survey, Year 1 – June 2012.
- Continue monitoring for the ISWQN project – quarterly throughout the year; report due July 2012.
- Continue monitoring for expanded large river assessment project – June 2012.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2012.
- Provide Consolidated Listing report to member jurisdictions and USEPA – April 1, 2012.
- Update Elements document – December 2012.

2013

- Complete report for Lower Subbasin survey, Year 2 – June 2013.
- Complete report for Chemung Subbasin survey, Year 1 – June 2013.
- Begin monitoring for Chemung Subbasin survey, Year 2 – January 2013.
- Begin monitoring for Upper Subbasin survey, Year 1 – June 2013.
- Continue monitoring for the ISWQN project – quarterly throughout the year; report due July 2013.
- Continue monitoring for expanded large river assessment project – June 2013.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2013.
- Provide electronic update for Consolidated Listing report to member jurisdictions and USEPA – April 1, 2013.
- Update QMP – April 2013.

2014

- Complete report for Chemung Subbasin survey, Year 2 – June 2014.
- Complete report for Upper Subbasin survey, Year 1 – June 2014.
- Begin monitoring for Upper Subbasin survey, Year 2 – June 2014.
- Begin monitoring for Middle Subbasin survey, Year 1 – June 2014.
- Continue monitoring for the ISWQN project – quarterly throughout the year; report due July 2014.
- Continue monitoring for expanded large river assessment project – June 2014.
- Continue to monitor for sediment and nutrient assessment program – monthly throughout the year and during storm events; report due December 2014.
- Provide electronic update for Consolidated Listing report to member jurisdictions and USEPA – April 1, 2014.
- Update Elements document – December 2014.
- Revise WAP Division Strategic Plan – June 2014.

GENERAL SUPPORT & INFRASTRUCTURE PLANNING

Staff and Training: The monitoring and assessment section of the WAP Division includes four permanent and one temporary staff. Additional temporary staff members are employed as needed, largely as summer interns. These numbers constitute the bare minimum necessary to maintain the high quality of the current monitoring program. Current training needs include: clean technology; Index of Biotic

Integrity development; periphyton identification, monitoring, and assessment methods; instream flow assessment techniques; lakes monitoring; wetlands monitoring; advanced statistics; and bacterial monitoring.

Laboratory Resources: Currently, the Commission uses the PADEP lab for its chemical water quality sample processing and plans to continue to do so in the future. Commission staff identifies all macroinvertebrate samples and will seek certification from the North American Benthological Society training course in the future.

Funding: Although the Commission has lost its federal funding and is receiving limited Section 106 funds, it has managed to retain a viable monitoring program. The greatest need for the Commission's monitoring work is consistent funding. With increased funds, the Commission could consider additional monitoring programs, such as a lakes assessment project, wetlands assessment, bacterial monitoring, and monitoring for parameters of concern for drinking water and source water protection. Additional funds also could be used to assist the states with necessary additions to their own monitoring programs. Current funding resources are detailed in Table 5.

Table 5. Funding levels for the Commission's FY-2005 Monitoring Programs

Project	Total Funding Level	Sources
Year 1 Subbasin Survey	$84,088	USEPA 106 funds and Commission match
Year 2 Subbasin Survey	$56,420	USEPA 106 funds
ISWQN	$56,395	USEPA 106 funds
Large River Assessment	$45,651	USEPA 106 funds
Sediment and Nutrient Assessment Program	$207,105	PADEP, NYSDEC, CBP, and Commission match
AMD Monitoring	$94,100	PADEP
SSWAP	$35,000	PADEP
Consolidated Listing Report	$15,217	USEPA 106 funds
Database Management (STORET)	$16,026	USEPA 106 funds

Table 6. List of Acronyms

Acronym	Name
ADB	Assessment Database
AMD	Abandoned Mine Drainage
Basin	Susquehanna River Basin
Bay	Chesapeake Bay
CBP	Chesapeake Bay Program
Commission	Susquehanna River Basin Commission
Compact	Susquehanna River Basin Compact
EPT	Ephemeroptera/Plecoptera/Trichoptera
EWS	Early Warning System
ISWQN	Interstate Streams Water Quality Network
mg/l	Milligrams per liter
NHD	National Hydrologic Dataset
NYSDEC	New York State Department of Environmental Conservation
PADEP	Pennsylvania Department of Environmental Protection
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
RBP	Rapid Bioassessment Protocol
SOP	Standard Operating Procedure
SSWAP	State Surface Water Assessment Program
STORET	STOrage and RETrieval
TMDL	Total Maximum Daily Load
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WAP	Watershed Assessment and Protection
WQAC	Water Quality Advisory Committee
µg/l	Micrograms per liter
µmhos/cm	Micromhos per centimeter