# ASSESSMENT OF INTERSTATE STREAMS IN THE SUSQUEHANNA RIVER BASIN

Monitoring Report No. 15
July 1, 2000, Through June 20, 2001

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## ABSTRACT

The Susquehanna River Basin Commission (SRBC) used a water quality index (WQI) and the U.S. Environmental Protection Agency's (USEPA's) Rapid Bioassessment Protocol III (RBP III) to assess the chemical water quality, biological conditions, and physical habitat of 50 sample sites in the Interstate Streams Water Quality Network from July 1, 2000 to June 30, 2001. Only 38 out of 3,008 parameter observations exceeded water quality standards. Assessment results indicate that approximately 31 percent of the sites supported nonimpaired biological communities. Water quality impacts in the New York-Pennsylvania border streams were mostly from metals, while Pennsylvania-Maryland border sites suffered from low dissolved oxygen levels.

A Seasonal Kendall Test was performed on water quality parameters to determine trends and their magnitude for the period 1986-2001. Overall, an increasing trend was found in total chloride, while decreasing trends were found for total ammonia, total nitrogen, total phosphorus, total iron, and total manganese.

A Pearson Product Moment Correlation was performed on WQI, RBP III score, and physical habitat score. A significant ($p<0.05$) negative correlation occurred between WQI and biological community score for Pennsylvania-Maryland sites, and a significant ($p<0.05$) positive correlation occurred between biological community and physical habitat score for river sites. These relationships, while based on a small number of observations, are presented as subjects to be considered by resource managers, local interest groups, elected officials, and other policy-makers.

## INTRODUCTION

One of SRBC's functions is to review projects that may have interstate impacts on water resources in the Susquehanna River Basin. SRBC established a monitoring program in 1986 to collect data that were not available from monitoring programs implemented by 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. SRBC's ongoing interstate monitoring program is partially funded through a grant from the United States Environmental Protection Agency (USEPA).

The interstate water quality monitoring program includes periodic collection of water and biological samples from interstate streams, as well as physical habitat assessments of them. 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.

SRBC's interstate monitoring program began in April 1986. For the first five years, results were reported for water years that ran from October to September. In 1991, SRBC changed the reporting periods to correspond with its fiscal year that covers the period from July to June. This report is presented for fiscal year 2001, which covers July 1, 2000, to June 30, 2001.

## BASIN GEOGRAPHY

The Susquehanna River Basin is the largest river basin on the Atlantic Coast of the United States, draining 27,510 square miles. The Susquehanna River originates at the outlet of Otsego Lake, Cooperstown, N.Y., and flows 444 miles through New York, Pennsylvania, and Maryland to the Chesapeake Bay at Havre de Grace, Maryland. Eighty-three streams cross state lines in the basin (Table 1). Several streams traverse the state lines at multiple points, contributing to 91 crossings. At 45 of these locations, streams flow from New York into Pennsylvania. Twenty-two reaches cross from Pennsylvania into New York, 15 from Pennsylvania into Maryland, and nine from Maryland into Pennsylvania. Many streams are small, and 32 are unnamed.

## METHODS

### Field and Laboratory Methods

#### Sampling frequency

In Water Year 1989, the interstate streams were divided into three groups, according to the degree of water quality impairment, historical water quality impacts, and potential for degradation. These groupings were determined based on historical water quality and land use. To date, these groups remain consistent and are described below.

Streams with impaired water quality or judged to have a high potential for degradation due to large drainage areas or historical pollution were assigned to Group 1. Originally, water samples were collected from Group 1 stations every other month, except January and February. Sampling was alternated so that streams along the New York-Pennsylvania border were sampled during November, March, May, July, and September, while streams along the Pennsylvania-Maryland border were sampled during October, December, April, June, and August. During fiscal year 1997, water quality sampling of Group 1 streams was reduced to quarterly sampling. In this sampling period 2000-2001, New York-Pennsylvania streams were sampled July, November, February, and May. Pennsylvania-Maryland stations were sampled August, November, February, and May. Benthic macroinvertebrates were collected and habitat assessments were performed in Group 1 streams during July and August 2000.

Streams judged to have a moderate potential for impacts were assigned to Group 2. Water quality samples, benthic macroinvertebrate samples, and physical habitat information were obtained from Group 2 stations once a year; preferably during base flow conditions in the summer months. In this sampling period, water chemistry, macroinvertebrate, and physical habitat information were collected during July and August 2000.

***Table 1. Interstate Streams in the Susquehanna River Basin***

| Stream Name | Monitoring Group | Flow Direction (from ® to) |
|---|---|---|
| ***Streams Along the New York–Pennsylvania Border*** | | |
| Apalachin Creek | 2 | Pa.→ N.Y. |
| Babcock Run | 3 | N.Y.→ Pa. |
| Bentley Creek | 1 | Pa.→ N.Y. |
| Bill Hess Creek | 3 | N.Y.→Pa. |
| Bird Creek | 3 | Pa.→N.Y. |
| Biscuit Hollow | 3 | N.Y.→Pa. |
| Briggs Hollow Run | 3 | N.Y.→Pa. |
| Bulkley Brook | 3 | N.Y.→Pa. |
| Camp Brook | 3 | N.Y.→Pa. |
| Cascade Creek | 1 | N.Y.→Pa. |
| Cayuta Creek | 1 | N.Y.→Pa. |
| Chemung River | 1 | N.Y.→Pa.→N.Y.→Pa. |
| Choconut Creek | 2 | Pa.→ N.Y. |
| Cook Hollow | 3 | N.Y.→Pa. |
| Cowanesque River | 1 | Pa.→ N.Y. |
| Deep Hollow Brook | 3 | N.Y.→Pa. |
| Denton Creek* | 3 | N.Y.→Pa. |
| Dry Brook* | 3 | N.Y.→Pa. |
| Holden Creek* | 2 | N.Y.→Pa. |
| Little Snake Creek | 1 | Pa.→ N.Y. |
| Little Wappasening Creek | 3 | Pa.→ N.Y. |
| North Fork Cowanesque River | 2 | N.Y.→Pa. |
| Parks Creek | 3 | Pa.→ N.Y. |
| Prince Hollow Run | 3 | N.Y.→Pa. |
| Red House/Beagle Hollow | 3 | N.Y.→Pa. |
| Russell Run | 3 | N.Y.→Pa. |
| Sackett Creek | 3 | Pa.→ N.Y. |
| Seeley Creek | 1 | Pa.→ N.Y. |
| Smith Creek | 3 | Pa.→ N.Y. |
| Snake Creek | 2 | Pa.→ N.Y. |
| South Creek | 2 | Pa.→ N.Y. |
| Strait Creek | 3 | N.Y.→Pa. |
| Susquehanna River | 1 | N.Y.→Pa.→N.Y.→Pa. |
| Tioga River | 1 | Pa.→ N.Y. |
| Troups Creek | 1 | N.Y.→Pa. |
| Trowbridge Creek | 2 | N.Y.→Pa. |
| Wappasening Creek | 2 | Pa.→ N.Y. |
| White Branch | 3 | N.Y.→Pa. |
| White Hollow | 3 | Pa.→ N.Y. |
| 17 Unnamed tributaries* | 3 | N.Y.→Pa. |
| 2 Unnamed tributaries* | 3 | Pa.→ N.Y. |
| 2 Unnamed tributaries* | 3 | Pa.→ N.Y.→Pa. |

*Not sampled in 2000–2001

*Table 1. Interstate Streams in the Susquehanna River Basin—Continued*

| Stream Name | Monitoring Group | Flow Direction (from→to) |
|---|---|---|
| ***Streams Along The Pennsylvania–Maryland Border*** | | |
| Big Branch Deer Creek | 2 | Pa.→Md. |
| Conowingo Creek | 1 | Pa.→Md. |
| Deer Creek | 1 | Pa.→Md. |
| Ebaughs Creek | 1 | Pa.→Md. |
| Falling Branch Deer Creek | 2 | Pa.→Md. |
| Island Branch* | 3 | Pa.→Md. |
| Long Arm Creek | 1 | Md.→Pa. |
| Octoraro Creek | 1 | Pa.→Md. |
| Scott Creek | 1 | Md.→Pa. |
| South Branch Conewago Creek | 2 | Md.→Pa. |
| Susquehanna River | 1 | Pa.→Md. |
| 6 Unnamed tributaries* | 3 | Md.→Pa. |
| 7 Unnamed tributaries* | 3 | Pa.→Md. |

*Not sampled in 2000-2001

Streams judged to have a low potential for impacts were assigned to Group 3. During previous reporting years, these stations were not sampled but were visually inspected for signs of degradation once a year. However, beginning in fiscal year 2000, the biological and habitat conditions of these streams were assessed during May. Field chemistry parameters also were measured on Group 3 streams at the time of biological sampling. New York-Pennsylvania border and Pennsylvania-Maryland border stream stations sampled during fiscal year 2001 are listed in Tables 2 and 3, respectively, and are depicted in Figures 1 through 4.

### Stream discharge

Stream discharge was measured at all stations unless high streamflows made access impossible. Several stations are located near U.S. Geological Survey (USGS) stream gages. These stations include the following: the Susquehanna River at Windsor, N.Y., Kirkwood, N.Y., Sayre, Pa., Marietta, Pa., and Conowingo, Md.; the Chemung River at Chemung, N.Y.; the Tioga River at Lindley, N.Y.; and the Cowanesque River at Lawrenceville, Pa. Recorded stages from USGS gaging stations and rating curves were used to determine instantaneous discharges in cubic feet per second (cfs). Instantaneous discharges for stations not located near USGS gaging stations were measured at the time of sampling, using standard USGS procedures. Stream discharges are tabulated according to station name and date in Appendix A.

### Water samples

Water samples were collected at each of the sites to measure nutrient and metal concentrations. Chemical and physical parameters monitored are listed in Table 4. Water samples were collected using a depth-integrated sampler. Composite samples were obtained by collecting numerous depth-integrated samples across the stream channel and combining them in a churn splitter that was previously rinsed with distilled water. Water samples were thoroughly mixed in the churn splitter and collected in two 500-ml bottles and four 250-ml bottles. One of the 500-ml bottles was for a raw sample and the other 500-ml bottle consisted of a filtered sample. The two 250-ml bottles consisted of a whole water sample and a filtered sample fixed with concentrated nitric acid ($HNO_3$) for metal analysis. The other two 250-ml bottles consisted of a whole water sample and a filtered water sample fixed with concentrated sulfuric acid ($H_2SO_4$) for nutrient analysis. A cellulose nitrate filter with 0.45-micrometer pore size was used to obtain the filtrate for laboratory analysis. The samples were chilled on ice and sent to the Pennsylvania Department of Environmental Protection

***Table 2. Stream Stations Sampled Along the New York–Pennsylvania Border and Sampling Rationale***

| Station | Stream and Location | Monitoring Group | Rationale |
|---|---|---|---|
| APAL 6.9 | Apalachin Creek, Little Meadows, Pa. | 2 | Monitor for potential water quality impacts |
| BABC | Babcock Run, Cadis, Pa. | 3 | Monitor for potential impacts |
| BILL | Bill Hess Creek, Nelson, Pa. | 3 | Monitor for potential impacts |
| BIRD | Bird Creek, Webb Mills, N.Y. | 3 | Monitor for potential impacts |
| BISC | Biscuit Hollow, Austinburg, Pa. | 3 | Monitor for potential impacts |
| BNTY 0.9 | Bentley Creek, Wellsburg, N.Y. | 1 | Monitor for potential water quality impacts |
| BRIG | Briggs Hollow, Nichols, N.Y. | 3 | Monitor for potential impacts |
| BULK | Bulkley Brook, Knoxville, Pa. | 3 | Monitor for potential impacts |
| CAMP | Camp Brook, Osceola, Pa. | 3 | Monitor for potential impacts |
| CASC 1.6 | Cascade Creek, Lanesboro, Pa. | 1 | Monitor for potential water quality impacts |
| CAYT 1.7 | Cayuta Creek, Waverly, N.Y. | 1 | Municipal discharge from Waverly, N.Y. |
| CHEM 12.0 | Chemung River, Chemung, N.Y. | 1 | Municipal and industrial discharges from Elmira, N.Y. |
| CHOC 9.1 | Choconut Creek, Vestal Center, N.Y. | 2 | Monitor for potential water quality impacts |
| COOK | Cook Hollow, Austinburg, Pa. | 3 | Monitor for potential impacts |
| COWN 2.2 | Cowanesque River, Lawrenceville, Pa. | 1 | Impacts from flood control reservoir |
| COWN 1.0 | Cowanesque River, Lawrenceville, Pa | 1 | Recovery zone from upstream flood control reservoir |
| DEEP | Deep Hollow Brook, Danville, N.Y. | 3 | Monitor for potential impacts |
| DENT | Denton Creek, Hickory Grove, Pa. | 3 | Monitor for potential impacts |
| DRYB | Dry Brook, Waverly, N.Y. | 3 | Monitor for potential impacts |
| HLDN 3.5 | Holden Creek, Woodhull, NY | 2 | Monitor for potential water quality impacts |
| LSNK 7.6 | Little Snake Creek, Brackney, Pa. | 1 | Monitor for potential water quality impacts |
| LWAP | Little Wappasening Creek, Nichols, N.Y. | 3 | Monitor for potential impacts |
| NFCR 7.6 | North Fork Cowanesque River, North Fork, Pa. | 2 | Monitor for potential water quality impacts |
| PARK | Parks Creek, Litchfield, N.Y. | 3 | Monitor for potential impacts |
| PRIN | Prince Hollow Run Cadis, Pa. | 3 | Monitor for potential impacts |
| REDH | Red House Run, Osceola, Pa. | 3 | Monitor for potential impacts |
| RUSS | Russell Run, Windham, Pa. | 3 | Monitor for potential impacts |

***Table 2. Stream Stations Sampled Along the New York–Pennsylvania Border and Sampling Rationale - Continued***

| Station | Stream and Location | Monitoring Group | Rationale |
|---|---|---|---|
| SACK | Sackett Creek, Nichols, N.Y. | 3 | Monitor for potential impacts |
| SEEL 10.3 | Seeley Creek, Seeley Creek, N.Y. | 1 | Monitor for potential water quality impacts |
| SMIT | Smith Creek, East Lawrence, Pa. | 3 | Monitor for potential impacts |
| SNAK 2.3 | Snake Creek, Brookdale, Pa. | 2 | Monitor for potential water quality impacts |
| SOUT 7.8 | South Creek, Fassett, Pa. | 2 | Monitor for potential water quality impacts |
| STRA | Strait Creek, Nelson, Pa. | 3 | Monitor for potential impacts |
| SUSQ 365.0 | Susquehanna River, Windsor, N.Y. | 1 | Large drainage area (1,882 sq. mi.); municipal discharges from Cooperstown, Sidney, Bainbridge, and Oneonta |
| SUSQ 340.0 | Susquehanna River, Kirkwood, N.Y. | 1 | Large drainage area (2,232 sq. mi.); historical pollution due to sewage from Lanesboro, Oakland, Susquehanna, Great Bend, and Hallstead |
| SUSQ 289.1 | Susquehanna River, Sayre, Pa. | 1 | Large drainage area (4,933 sq. mi.); municipal and industrial discharges |
| TIOG 10.8 | Tioga River, Lindley, N.Y. | 1 | Pollution from acid mine discharges and impacts from flood control reservoirs |
| TRUP 4.5 | Troups Creek, Austinburg, Pa. | 1 | High turbidity and moderately impaired macroinvertebrate populations |
| TROW 1.8 | Trowbridge Creek, Great Bend, Pa. | 2 | Monitor for potential water quality impacts |
| WAPP 2.6 | Wappasening Creek, Nichols, N.Y. | 2 | Monitor for potential water quality impacts |
| WBCO | White Branch Cowanesque River, North Fork, Pa. | 3 | Monitor for potential impacts |
| WHIT | White Hollow, Wellsburg, N.Y. | 3 | Monitor for potential impacts |

***Table 3. Stream Stations Sampled Along the Pennsylvania–Maryland Border and Sampling Rationale***

| Station | Stream and Location | Monitoring Group | Rationale |
|---|---|---|---|
| LNGA 2.5 | Long Arm Creek, Bandanna, Pa. | 1 | Monitor for potential water quality impacts |
| SBCC 20.4 | South Branch Conewago Creek, Bandanna, Pa. | 2 | Monitor for potential water quality impacts |
| DEER 44.2 | Deer Creek, Gorsuch Mills, Md. | 1 | Past pollution from Gorsuch Mills, Md., Stewartstown, Pa.; Nonpoint runoff to Chesapeake Bay |
| EBAU 1.5 | Ebaughs Creek, Stewartstown, Pa. | 1 | Municipal discharge from Stewartstown, Pa.; Nonpoint runoff to Chesapeake Bay |
| SCTT 3.0 | Scott Creek, Delta, Pa. | 1 | Historical pollution due to untreated sewage |
| BBDC 4.1 | Big Branch Deer Creek, Fawn Grove, Pa. | 2 | Monitor for potential water quality impacts |
| FBDC 4.1 | Falling Branch Deer Creek, Fawn Grove, Pa. | 2 | Monitor for potential water quality impacts |
| CNWG 4.4 | Conowingo Creek, Pleasant Grove, Pa. | 1 | High nutrient loads and other agricultural runoff; Nonpoint runoff to Chesapeake Bay |
| OCTO 6.6 | Octoraro Creek, Rising Sun, Md. | 1 | High nutrient loads due to agricultural runoff from New Bridge, Md.; Water quality impacts from Octoraro Lake; Nonpoint runoff to Chesapeake Bay |
| SUSQ 44.5 | Susquehanna River, Marietta, Pa. | 1 | Bracket hydroelectric dams near the state line |
| SUSQ 10.0 | Susquehanna River, Conowingo, Md. | 1 | Bracket hydroelectric dams near the state line |

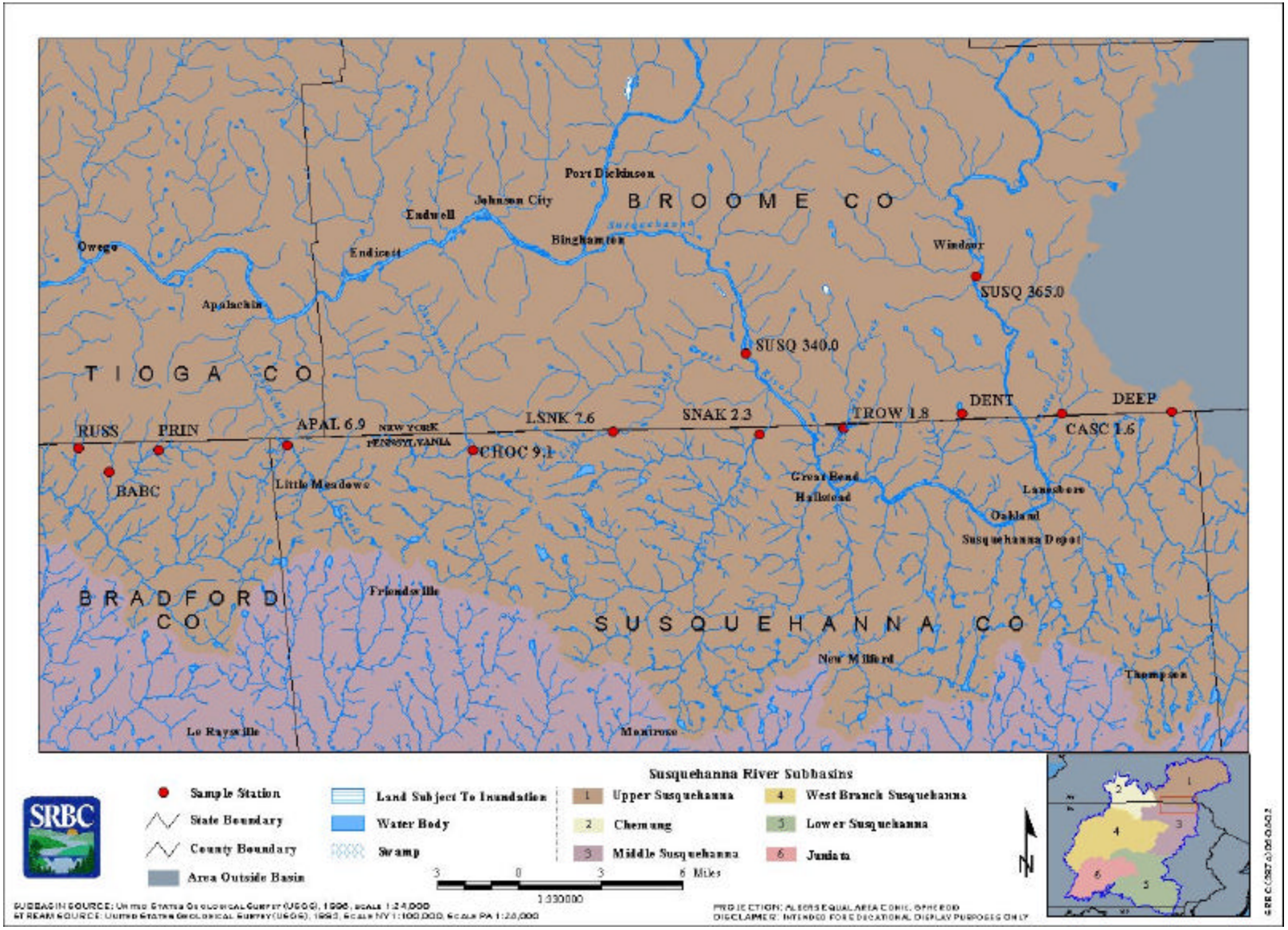


***Figure 1. Interstate Streams Along the New York-Pennsylvania Border Between Apalachin Creek and Cascade Creek***

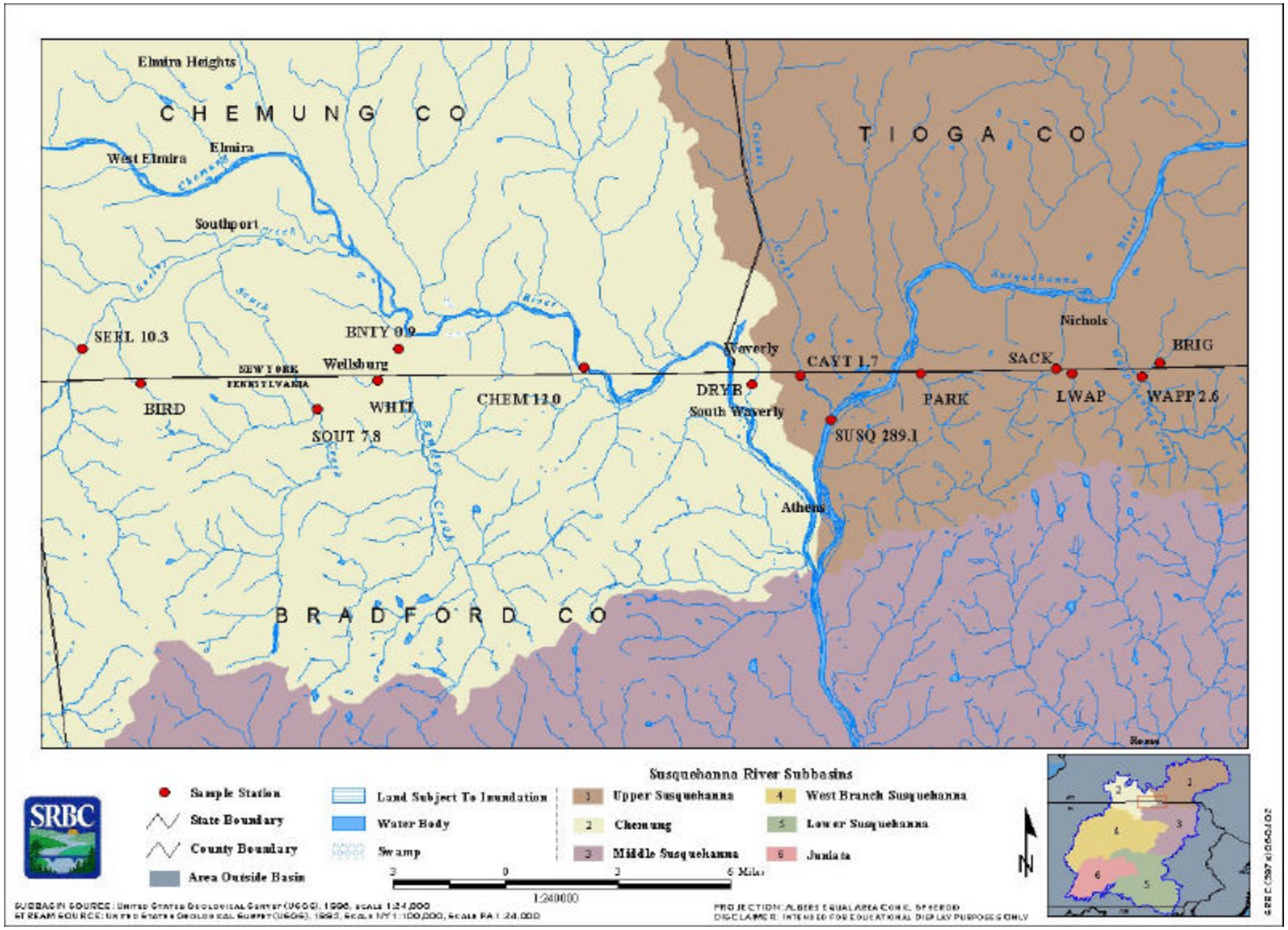


*Figure 2. Interstate Streams Along the New York-Pennsylvania Border Between Seeley Creek and Wappasening Creek*


*Figure 3. Interstate Streams Along the New York-Pennsylvania Border Between North Fork Cowanesque River and Tioga River*


***Figure 4. Interstate Streams Along the Pennsylvania-Maryland Border***

***Table 4. Monitored Parameters***

| Parameter | STORET Code |
|---|---|
| ***Physical*** | |
| Discharge | 00060 |
| Temperature | 00010 |
| ***Chemical*** | |
| Field Analyses | |
| Conductivity | 00095 |
| Dissolved Oxygen | 00300 |
| pH | 00400 |
| Alkalinity | 00410 |
| Acidity | 00435 |
| Laboratory Analyses | |
| Solids, Dissolved | 00515 |
| Solids, Total | 00500 |
| Ammonia as Nitrogen, Dissolved | 00608 |
| Ammonia as Nitrogen, Total | 00610 |
| Nitrite as Nitrogen, Dissolved | 00613 |
| Nitrite as Nitrogen, Total | 00615 |
| Nitrate as Nitrogen, Dissolved | 00618 |
| Nitrate as Nitrogen, Total | 00620 |
| Nitrogen, Dissolved | 00602 |
| Nitrogen, Total | 00600 |
| Phosphorus, Dissolved | 00666 |
| Phosphorus, Total | 00665 |
| Orthophosphate, Dissolved | 00671 |
| Orthophosphate, Total | 70507 |
| Organic Carbon, Total | 00680 |
| Calcium, Total | 00916 |
| Magnesium, Total | 00927 |
| Chloride, Total | 00940 |
| Sulfate, Total | 00945 |
| Iron, Dissolved | 01046 |
| Iron, Total | 01045 |
| Manganese, Dissolved | 01056 |
| Manganese, Total | 01055 |
| Aluminum, Dissolved | 01106 |
| Aluminum, Total | 01105 |
| Turbidity | 82079 |

(Pa. DEP), Bureau of Laboratories in Harrisburg, Pa., within 24 hours of collection.

#### Field chemistry

Temperature, dissolved oxygen, conductivity, pH, alkalinity, and acidity were measured in the field. Dissolved oxygen was measured using a YSI model 55 dissolved oxygen meter that was calibrated at the beginning of each day when water samples were collected. A VWR Scientific Model 2052 conductivity meter was used to measure conductivity. A Cole Parmer meter was used to measure pH. The pH meter was calibrated at the beginning of the day and randomly checked throughout the day. Alkalinity was determined by titrating a known volume of water to pH 4.5 with 0.02N sulfuric acid (H2SO4). Acidity was measured by titrating a known volume of sample water to pH 8.3 with 0.02N sodium hydroxide (NaOH).

#### Macroinvertebrate and physical habitat sampling

SRBC staff collected benthic macroinvertebrate samples from Group 1 and Group 2 stations between July 24 and August 3, 2000, and from Group 3 streams between May 1 and 7, 2001. The benthic macroinvertebrate community was sampled to provide an indication of the biological condition of the stream. Macroinvertebrates are defined as aquatic insects and other invertebrates too large to pass through a No. 30 sieve.

Benthic macroinvertebrate samples were analyzed using field and laboratory methods described in Rapid Bioassessment Protocol for Use in Streams and Rivers by Barbour and others (1999). Sampling was performed using a 1-meter-square kick screen with size No. 30 mesh. The kick screen was stretched across the current to collect organisms dislodged from riffle/run areas by physical agitation of the stream substrate. Two kick screen samples were collected from a representative riffle/run at each station. The two samples were composited and preserved in isopropyl alcohol for later laboratory analysis.

In the laboratory, composite samples were sorted into 100-organism subsamples using a gridded pan and a random numbers table. The organisms contained in the subsamples were identified to genus (except Chironomidae and Oligochaeta) and enumerated. Each taxon was assigned an organic pollution tolerance value and a functional feeding category as outlined in Appendix B. A taxa list for each station can be found in Appendix C.

Physical habitat conditions at each station were assessed using a slightly modified version of the habitat assessment procedure outlined by Barbour and others (1999). 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. Table 5 summarizes criteria used to evaluate habitat parameters.

### Data Synthesis Methods

#### Chemical water quality

Results of laboratory analysis for chemical parameters were compared to New York, Pennsylvania, and Maryland State water quality standards. In addition, a simple WQI was calculated, using procedures established by McMorran and Bollinger (1990). The WQI was used to make comparisons between sampling periods and stations within the same geographical region; therefore, the water quality data were divided into two groups. One group contained stations along the New York-Pennsylvania border, and the other group contained stations along the Pennsylvania-Maryland border. The data in each group were sorted by parameter and ranked by increasing order of magnitude, with several exceptions. Dissolved oxygen was ranked by decreasing order of magnitude, while pH, alkalinity, acidity, calcium, and magnesium were not included in the WQI analysis. The values of

*Table 5. Criteria Used to Evaluate Physical Habitat*

| Habitat Parameter | OPTIMAL (20-16) | SUBOPTIMAL (15-11) | MARGINAL (10-6) | POOR (5-0) |
|---|---|---|---|---|
| 1 **Epifaunal Substrate (R/R)**[1] | Well-developed riffle/run; riffle is as wide as stream and length extends 2 times the width of stream; abundance of cobble | Riffle is as wide as stream but length is less than 2 times width; abundance of cobble; boulders and gravel common | Run area may be lacking; riffle not as wide as stream and its length is less than 2 times the width; some cobble present | Riffle or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking |
| 1 **Epifaunal Substrate (G/P)**[2] | Preferred benthic substrate abundant throughout stream site and at stage to allow full colonization (i.e. log/snags that are not new fall and not transient) | Substrate common but not prevalent or well suited for full colonization potential | Substrate frequently disturbed or removed | Substrate unstable or lacking |
| 2 **Instream Cover (R/R)** | > 50% mix of boulders, cobble, submerged logs, undercut banks or other stable habitat | 30-50% mix of boulder, cobble, or other stable habitat; adequate habitat | 10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable | < 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious |
| 2 **Instream Cover (G/P)** | > 50% mix of snags, submerged logs, undercut banks or other stable habitat; rubble, gravel may be present | 30-50% mix of stable habitat; adequate habitat for maintenance of populations | 10-30% mix of stable habitat; habitat availability less than desirable | Less than 10% stable habitat; lack of habitat obvious |
| 3 **Embeddedness** [a] **(R/R)** | Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediments | Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments | Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediments | Gravel, cobble, and boulder particles are >75% surrounded by fine sediments |
| 3 **Pool Substrate Characterization (G/P)** | Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common | Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present | All mud or clay or sand bottom; little or no root mat; no submerged vegetation | Hard-pan clay or bedrock; no root mat or vegetation |
| 4 **Velocity/Depth Regimes** [b] **(R/R)** | All 4 velocity/depth regimes present (slow/deep, slow/shallow, fast/deep, fast/shallow) | Only 3 of 4 regimes present (if fast/shallow is missing, score lower than if missing other regimes) | Only 2 of 4 regimes present (if fast/shallow or slow/shallow are missing, score low) | Dominated by 1 velocity/depth regime |
| 4 **Pool Variability** [c] **(G/P)** | Even mix of large-shallow, large-deep, small-shallow, small-deep pools present | Majority of pools large-deep; very few shallow | Shallow pools much more prevalent than deep pools | Majority of pools small-shallow or pools absent |

*Table 5. Criteria Used to Evaluate Physical Habitat—Continued*

| Habitat Parameter | OPTIMAL (20-16) | SUBOPTIMAL (15-11) | MARGINAL (10-6) | POOR (5-0) |
|---|---|---|---|---|
| **5 Sediment Deposition (R/R)** | Little or no enlargement of islands or point bars and <5% of the bottom affected by sediment deposition | Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools | Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions; moderate deposition of pools prevalent | Heavy deposits of fine material, increased bar development; >50% of the bottom changing frequently; pools almost absent due to sediment deposition |
| **5 Sediment Deposition (G/P)** | Less than 20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of island of point bars | 20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation | 50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial movement during storm events | Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to substantial sediment deposition |
| **6 Channel Flow Status (R/R) (G/P)** | Water reaches base of both lower banks and minimal amount of channel substrate is exposed | Water fills >75% of the available channel; or <25% of channel substrate exposed | Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed | Very little water in channel and mostly present as standing pools |
| **7 Channel Alteration [d] (R/R) (G/P)** | No channelization or dredging present | Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 yr) may be present, but not recent | New embankments present on both banks; and 40-80% of stream reach channelized and disrupted | Banks shored with gabion or cement; >80% of the reach channelized and disrupted |
| **8. Frequency of Riffles (R/R)** | Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat | Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15 | Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the stream width is between 15-25 | Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is >25 |
| **8. Channel Sinuosity (G/P)** | The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line | The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line | The bend in the stream increase the stream length 1 to 2 times longer than if it was in a straight line | Channel straight; waterway has been channelized for a long time |
| **9. Condition of Banks [e] (R/R) (G/P)** | Banks stable; no evidence of erosion or bank failure, little potential for future problems; <5% of bank affected; on Glide/Pool streams side slopes generally <30% | Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion; on Glide/Pool streams side slopes up to 40% on one bank; slight erosion potential in extreme floods | Moderately unstable, 30-60% of banks in reach have areas of erosion; high erosion potential during floods; on Glide/Pool streams side slopes up to 60% on some banks | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars; on Glide/Pool streams side slopes > 60% common |
| **(score each bank 0-10)** | **(9-10)** | **(6-8)** | **(3-5)** | **(0-2)** |

*Table 5. Criteria Used to Evaluate Physical Habitat—Continued*

| Habitat Parameter | OPTIMAL (20-16) | SUBOPTIMAL (15-11) | MARGINAL (10-6) | POOR (5-0) |
|---|---|---|---|---|
| **10. Vegetative Protective Cover (R/R) (G/P)** | >90% of the streambank surfaces covered by vegetation; vegetative disruption through grazing or mowing minimal | 70-90% of the streambank surfaces covered by vegetation; disruption evident but not affecting full plant growth potential to any great extent | 50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation | <50% of the streambank surfaces covered by vegetation; disruption is very high; vegetation removed to 5 cm or less |
| **(score each bank 0-10)** | **(9-10)** | **(6-8)** | **(3-5)** | **(0-2)** |
| **11. Riparian Vegetative Zone Width (R/R) (G/P)** | Width of riparian zone >18 meters; human activities (i.e. parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone | Width or riparian zone 12-18 meters; human activities have impacted zone only minimally | Width of riparian zone 6-12 meters; human activities have impacted zone only minimally | Width of riparian zone <6 meters; little or no riparian vegetation due to human activities |
| **(score each bank 0-10)** | **(9-10)** | **(6-8)** | **(3-5)** | **(0-2)** |



[1]R/R – Riffle/Run — Habitat assessment parameters that are used for streams that are characterized by riffles and runs.

[2]G/P – Glide/Pool — Habitat assessment parameters that are used for streams that are characterized by glides and pools.

[a] Embeddedness — The degree to which the substrate materials that serve as habitat for benthic macroinvertebrates and for fish spawning and egg incubation (predominantly cobble and/or gravel) are surrounded by fine sediment. Embeddedness is evaluated with respect to the suitability of these substrate materials as habitat for macroinvertebrates and fish by providing shelter from the current and predators, and by providing egg deposition and incubation sites.

[b] Velocity/Depth Regimes — The general guidelines are 0.5 m depth to separate shallow from deep, and 0.3 m/sec to separate fast from slow.

[c] Pool Variability — Rated based on the variety and spatial complexity of slow- or still-water habitat within the sample segment. It should be noted that even in high - gradient segments, functionally important slow-water habitat may exist in the form of plunge-pools and/or larger eddies. General guidelines are any pool dimension (i.e., length, width, oblique) greater than half the cross-section of the stream for separating large from small and 1 m depth separating shallow and deep.

[d] Channel Alteration — A measure of large-scale changes in the shape of the stream channel. Channel alteration includes: concrete channels, artificial embankments, obvious straightening of the natural channel, rip-rap, or other structures.

[e] Condition of Banks — Steep banks are more likely to collapse and suffer from erosion than are gently sloping banks and are therefore considered to be unstable. Left and right bank orientation is determined by facing downstream.

Source: Modified from Barbour and others, 1999.

each chemical analysis were divided by the highest ranking value in the group to obtain a percentile. The WQI score was calculated by averaging all percentile ranks for each sample. Water quality index scores range from 1 to 100, and high WQI scores indicate poor water quality. Water quality scores and a list of parameters exceeding standards for each site can be found in the "Bioassessment of Interstate Streams" section, beginning on page 48.

### Reference category designations

Four reference sites were included in this study. These four sites represented the best available suite of conditions, in terms of habitat and biological community, for each of the categories. Sites located on the New York-Pennsylvania border were compared to Little Snake Creek (LSNK 7.6) at Brackney, Pa. Little Snake Creek represented the best biological and habitat conditions in the Northern Appalachian Plateau and Uplands Ecoregion. Big Branch Deer Creek (BBDC 4.1) near Fawn Grove, Pa., served as the reference site for sampling stations located on the Pennsylvania-Maryland border. Big Branch Deer Creek had the best biological and habitat conditions in the Northern Piedmont Ecoregion (Omernik, 1987). The Susquehanna River (SUSQ 289.1) at Sayre, Pa., was used as the reference site for all of the Susquehanna River main stem samples, as well as for Cowanesque River, Chemung River, and Tioga River sites. Bill Hess Creek (BILL) near Nelson, Pa., served as the reference site for Group 3 sites, as it had the best biological and habitat conditions of these sites.

### Biological and physical habitat conditions

Benthic macroinvertebrate samples were assessed using procedures described by Barbour and others (1999), Klemm and others (1990), and Plafkin and others (1989). Using these methods, staff calculated a series of biological indexes for a stream and compared them to a reference station in the same region to determine the degree of impairment. The metrics used in this survey are summarized in Table 6. Metrics 1, 3, 4, and 6 were taken from Barbour and others (1999). Metric 2 (Shannon-Weaver Diversity Index) followed the methods described in Klemm and others (1990), and was substituted for the recommended ratio of shredders to total macroinvertebrates, which required specialized sampling procedures. The source for Metric 5 was from Plafkin and others (1989).

The 100-organism subsample data were used to generate scores for each of the eight metrics. Each metric score was then converted to a biological condition score, based on the percent similarity of the metric score, relative to the metric score of 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 (Table 7). Habitat assessment scores of sample sites were compared to those of reference sites to classify each sample site into a habitat condition category (Table 8).

### Trend analysis

A long-term trend has been defined as a steady increase or decrease of a variable over time, as opposed to a change (step trend), which is a sudden difference in water quality associated with an event (Bauer and others, 1984). As the interstate streams data are not useful for analyzing step trends due to large drainage areas and insufficient information about discharges, only long-term trends were included in this study. Trends analysis was performed on Group 1 streams (see Table 1) for the following parameters: total suspended solids, total ammonia, total nitrogen, total phosphorus, total chloride, total sulfate, total iron, total manganese, total aluminum, and water quality index. The period covered for the trends analysis was April 1986 through June 2001. Streams that have been recently added to the Group 1 sampling were not included in the trends analysis due to lack of historic seasonal data. Those steams were Bentley Creek, Cascade Creek, Little Snake Creek, Seeley Creek, and Long Arm Creek.

***Table 6. Summary of Metrics Used to Evaluate the Overall Biological Integrity of Stream and River Benthic Macroinvertebrate Communities***

| Metric | Description |
|---|---|
| 1. Taxonomic Richness (a) | The total number of taxa present in the 100-organism subsample. Number decreases with increasing stress. |
| 2. Shannon-Weaver Diversity Index (b) | A measure of biological community complexity based on the number of equally or nearly equally abundant taxa in the community. Index value decreases with increasing stress. |
| 3. Hilsenhoff Biotic Index (a) | A measure of the organic pollution tolerance of a benthic macroinvertebrate community. Index value increases with increasing stress. |
| 4. EPT Index (a) | The total number of Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) taxa present in the 100-organism subsample. Number decreases with increasing stress. |
| 5. Ratio of EPT/Chironomids (c) | The total number of individuals in the orders Ephemeroptera, Plecoptera, and Trichoptera divided by the number of Chironomidae (midges) in a sample. A measure of community balance and indicator of environmental stress. Ratio decreases with increasing stress. |
| 6. Percent Dominant Taxa (a) | A measure of community balance at the lowest positive taxonomic level. Percentage increases with increasing stress. |

Sources: (a) Barbour and others, 1999
(b) Klemm and others, 1990
(c) Plafkin and others, 1989

*Table 7. Summary of Criteria Used to Classify the Biological Conditions of Sample Sites*

**SAMPLING AND ANALYSIS**

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**TOTAL BIOLOGICAL SCORE DETERMINATION**

| Metric | Biological Condition Scoring Criteria | | | |
|---|---|---|---|---|
| | 6 | 4 | 2 | 0 |
| 1. Taxonomic Richness (a) | >80 % | 79 – 60 % | 59 – 40 % | <40 % |
| 2. Shannon Diversity Index (a) | >75 % | 74 – 50 % | 49 – 25 % | <25 % |
| 3. Modified Hilsenhoff Biotic Index (b) | >85 % | 84 – 70 % | 69 – 50 % | <50 % |
| 4. EPT Index (a) | >90 % | 89 – 80 % | 79 – 70 % | <70 % |
| 5. Ratio EPT/Chironomids (a) | >75 % | 74 – 50 % | 49 – 25 % | <25 % |
| 6. Percent Dominant Taxa (c) | <20 % | 20 – 30 % | 31 – 40 % | >40 % |
| **Total Biological Score (d)** | | | | |

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**BIOASSESSMENT**

| Percent Comparability of Study and Reference Site Total Biological Scores (g) | Biological Condition Category |
|---|---|
| >83 | Nonimpaired |
| 79 - 54 | Slightly Impaired |
| 50 - 21 | Moderately Impaired |
| <17 | Severely Impaired |

(a) Score is study site value/reference site value X 100.
(b) Score is reference site value/study site value X 100.
(c) Scoring criteria evaluate actual percent contribution, not percent comparability to the reference station.
(d) Total Biological Score = the sum of Biological Condition Scores assigned to each metric.
(e) Values obtained that are intermediate to the indicated ranges will require subjective judgment as to the correct placement into a biological condition category.

*Table 8. Summary of Criteria Used to Classify the Habitat Conditions of Sample Sites*

| DETERMINATION OF HABITAT ASSESSMENT SCORES | | | | |
|---|---|---|---|---|
| **Parameter** | **Habitat Parameter Scoring Criteria** | | | |
| | **Excellent** | **Good** | **Fair** | **Poor** |
| Epifaunal Substrate | 20-16 | 15-11 | 10-6 | 5-0 |
| Instream Cover | 20-16 | 15-11 | 10-6 | 5-0 |
| Embeddedness/Pool Substrate | 20-16 | 15-11 | 10-6 | 5-0 |
| Velocity/Depth Regimes/Pool Variability | 20-16 | 15-11 | 10-6 | 5-0 |
| Sediment Deposition | 20-16 | 15-11 | 10-6 | 5-0 |
| Channel Flow Status | 20-16 | 15-11 | 10-6 | 5-0 |
| Channel Alteration | 20-16 | 15-11 | 10-6 | 5-0 |
| Frequency of Riffles/Channel Sinuosity | 20-16 | 15-11 | 10-6 | 5-0 |
| Condition of Banks (a) | 20-16 | 15-11 | 10-6 | 5-0 |
| Vegetative Protective Cover (a) | 20-16 | 15-11 | 10-6 | 5-0 |
| Riparian Vegetative Zone Width (a) | 20-16 | 15-11 | 10-6 | 5-0 |
| **Habitat Assessment Score (b)** | | | | |

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| HABITAT ASSESSMENT | |
|---|---|
| **Percent Comparability of Study and Reference Site Habitat Assessment Scores** | **Habitat Condition Category** |
| >90 | Excellent (comparable to reference) |
| 89-75 | Supporting |
| 74-60 | Partially Supporting |
| <60 | Nonsupporting |

(a) Combined score of each bank
(b) Habitat Assessment Score = Sum of Habitat Parameter Scores

The nonparametric trend test used in this study was the Seasonal Kendall Test, which is described by Bauer and others (1984) and Smith and others (1982). The Seasonal Kendall Test was used to detect the presence or absence of monotonic trends in the parameters described above. This test is useful for testing trends of quarterly water quality samples with seasonal variability, because seasonality is removed by comparing data points only within the same quarter for all years in the data set. Outliers also do not present a problem, because the test only considers differences in the data points. The Seasonal Kendall Test also can be used with missing and censored data.

Differences in flow also can produce trends in water quality. To adjust the concentrations to compensate for flow, a technique known as Locally Weighted Scatterplot Smoothing (LOWESS), described by Hirsch and others (1991), was used. This technique flow-adjusts the concentrations by using the residual, the result of the actual observation minus the expected observation. The residuals were tested for trends using the Seasonal Kendall Test. Detailed descriptions of the procedures for Seasonal Kendall Test and LOWESS can be found in Trends in Nitrogen, Phosphorus, and Suspended Sediment in the Susquehanna River Basin, 1974-93 (Edwards, 1995).

# RESULTS

## Water Quality

During fiscal year 2001, water quality in approximately half of the Group 1 and Group 2 interstate streams continued to meet designated use classes and water quality standards (Table 9, Appendix D). Fifteen out of the 31 sites had parameters exceeding water quality standards. The parameters that most frequently exceeded water quality standards were pH and dissolved oxygen (Table 10, Figure 5). Most of these exceedances in pH and dissolved oxygen standards occurred in the river sites. Only 38 out of 3,008 total observations exceeded water quality standards.

## Biological Communities and Physical Habitat

RBP III biological data for New York-Pennsylvania, Pennsylvania-Maryland, river sites, and Group 3 streams are summarized in Tables 11 through 14, respectively. A high rapid bioassessment protocol score indicates a low degree of impairment and a healthy macroinvertebrate population. RBP III results for each site can be found in the "Bioassessment of Interstate Streams" section, beginning on page 48.

RBP III physical habitat data for New York-Pennsylvania, Pennsylvania-Maryland, river sites, and Group 3 streams are presented in Tables 15 through 18, respectively. A high score indicates a high-quality physical habitat. RBP III physical habitat and biological data are summarized in Figures 6 through 9.

### New York-Pennsylvania streams

New York-Pennsylvania sampling stations consisted of 13 sites located near or on the New York-Pennsylvania border. The biological communities of five (38.5 percent) of these streams were nonimpaired. Six streams were slightly impaired (46.2 percent), and two streams were moderately impaired (15.4 percent). Five of the New York-Pennsylvania sites had excellent habitats (38.5 percent). Eight sites (61.5 percent) had supporting habitats, and no sites had partially supporting or nonsupporting habitat. Holden Creek was not sampled due to drought conditions.

### Pennsylvania-Maryland streams

The Pennsylvania-Maryland interstate streams included nine stations located on or near the Pennsylvania-Maryland border. Two (22 2 percent) streams were designated nonimpaired, using RBP III protocol designations. Five sites (55.5 percent) were slightly impaired, and of the remaining two sites one (11.1 percent) was moderately impaired and the other was designated severely impaired (11.1 percent). Four (44.4 percent) of the Pennsylvania-Maryland border sites had excellent habitats.

***Table 9. Stream Classifications***

| Stream | Pa. Classification * | N.Y. Classification * |
|---|---|---|
| Apalachin Creek | CWF | C |
| Babcock Run | CWF | C |
| Bentley Creek | WWF | C |
| Bill Hess Creek | WWF | C |
| Bird Creek | CWF | C |
| Biscuit Hollow | CWF | C |
| Briggs Hollow | CWF | C |
| Bulkley Brook | WWF | C |
| Camp Brook | WWF | C |
| Cascade Creek | CWF | C |
| Cayuta Creek | WWF | B |
| Chemung River | WWF | A |
| Choconut Creek | WWF | C |
| Cook Hollow | CWF | C |
| Cowanesque River | WWF | C |
| Deep Hollow Brook | CWF | C |
| Denton Creek | CWF | C |
| Dry Brook | WWF | C |
| Little Snake Creek | CWF | C |
| Little Wappasening Creek | WWF | C |
| North Fork Cowanesque River | CWF | C |
| Parks Creek | WWF | C |
| Prince Hollow Run | CWF | C |
| Red House Hollow | WWF | C |
| Russell Run | CWF | C |
| Sackett Creek | WWF | C |
| Seeley Creek | CWF | C (T) |
| Smith Creek | WWF | C |
| Snake Creek | CWF | C |
| South Creek | CWF | C |
| Strait Creek | WWF | C |
| Susquehanna River @ Windsor | | B |
| Susquehanna River @ Kirkwood | WWF | B |
| Susquehanna River @ Sayre | WWF | B |
| Tioga River | WWF | C |
| Trowbridge Creek | CWF | C |
| Troups Creek | CWF | C |
| Wappasening Creek | CWF | C |
| White Branch Cowanesque River | WWF | C |
| White Hollow | WWF | C |
| **Stream** | **Pa. Classification** | **Md. Classification *** |
| Big Branch Deer Creek | CWF | III-P |
| Conowingo Creek | CWF | I-P |
| Deer Creek | CWF | III-P |
| Ebaughs Creek | CWF | III-P |
| Falling Branch Deer Creek | CWF | IV-P |
| Long Arm Creek | WWF | I-P |
| Octoraro Creek | WWF-MF | IV-P |
| Scott Creek | TSF | I-P |
| South Branch Conewago Creek | WWF | I-P |
| Susquehanna River @ Marietta | WWF | |
| Susquehanna River @ Conowingo | | I-P |

* See Appendix D for stream classification descriptions

***Table 10. Water Quality Standard Summary***

| Parameter | Number of Observations | Number Exceeding Standards | Standard |
|---|---|---|---|
| Alkalinity | 94 | 2 | Pa. aquatic life |
| pH | 59 | 8 | N.Y. general |
| | 94 | 2 | Pa. aquatic life |
| Dissolved Oxygen | 59 | 1 | N.Y. trout waters |
| | 92 | 3 | Pa. aquatic life |
| | 35 | 6 | Md. aquatic life |
| Dissolved Iron | 94 | 4 | Pa. aquatic life |
| Total Iron | 59 | 7 | N.Y. aquatic (chronic) |
| Total Aluminum | 59 | 3 | N.Y. aquatic (chronic) |
| Sulfate | 94 | 1 | Pa. water supply |
| Total Nitrite | 59 | 1 | N.Y. aquatic (chronic) |

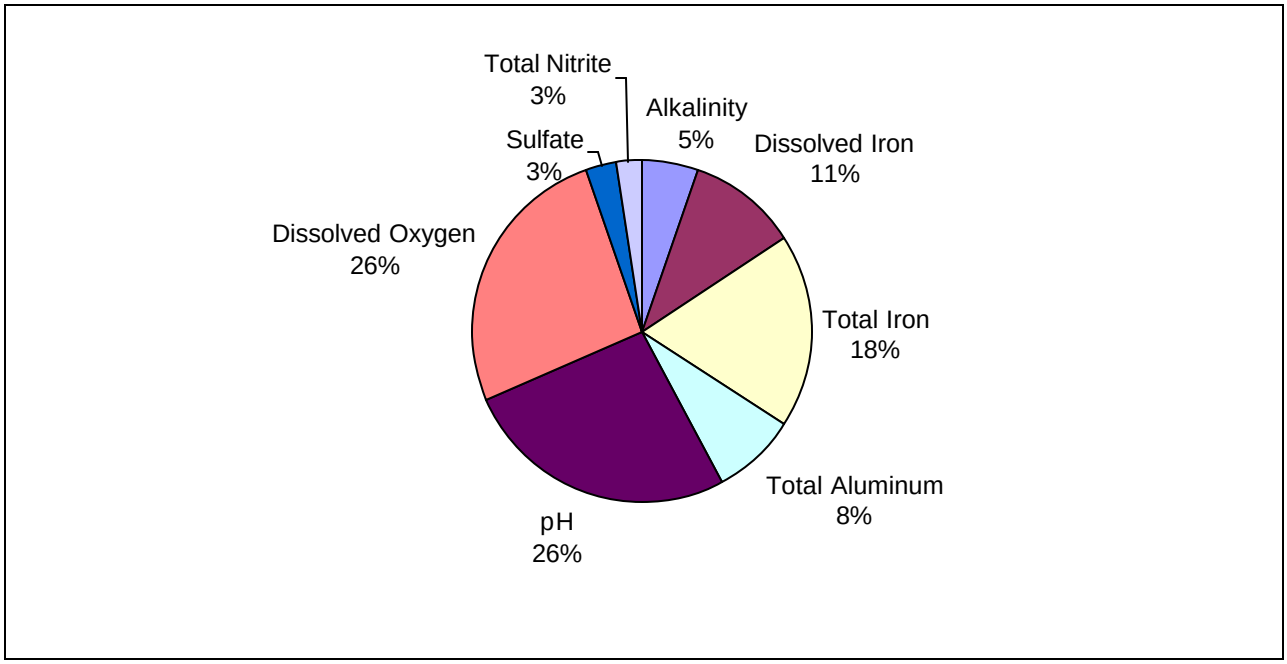



***Figure 5. Parameters Exceeding Water Quality Standards***

*Table 11. Summary of New York-Pennsylvania Border RBP III Biological Data*

| | SNAK 2.3 | APAL 6.9 | BNTY 0.9 | CASC 1.6 | CAYT 1.7 | CHOC 9.1 |
|---|---|---|---|---|---|---|
| ***Raw Summary*** | | | | | | |
| Number of Individuals | 172 | 220 | 145 | 195 | 157 | 196 |
| % Shredders | 0 | 0.5 | 0.7 | 5.6 | 1.3 | 1.5 |
| % Collector-Gatherers | 42.4 | 12.3 | 46.2 | 39.5 | 49 | 36.7 |
| % Filterer-Collectors | 46.5 | 46.4 | 29 | 31.8 | 10.2 | 25 |
| % Scrapers | 5.8 | 29.5 | 13.1 | 3.6 | 36.3 | 25 |
| % Predators | 5.2 | 11.4 | 11 | 19.5 | 3.2 | 11.7 |
| Number of EPT Taxa | 14 | 12 | 15 | 16 | 10 | 10 |
| Number of EPT Individuals | 114 | 108 | 66 | 99 | 41 | 95 |
| ***Metric Scores*** | | | | | | |
| Taxonomic Richness | 22 | 24 | 22 | 26 | 18 | 23 |
| Shannon Diversity Index | 2.4 | 2.6 | 2.2 | 2.4 | 2.1 | 2.6 |
| Modified Hilsenhoff Biotic Index | 4.2 | 4.5 | 4.9 | 4.3 | 5.1 | 4.5 |
| EPT Index | 14 | 12 | 15 | 16 | 10 | 10 |
| Ratio EPT/Chironomids | 2.8 | 4.9 | 1.3 | 1.4 | 0.7 | 2.4 |
| Percent Dominant Taxa | 23.8 | 18.2 | 35.2 | 35.9 | 35.7 | 19.9 |
| ***Percent of Reference*** | | | | | | |
| Taxonomic Richness | 73.3 | 80 | 73.3 | 86.7 | 60 | 76.7 |
| Shannon Diversity Index | 89.1 | 94.8 | 80.6 | 88.3 | 76.4 | 96 |
| Hilsenhoff Index | 91.2 | 85.5 | 77.3 | 89.1 | 75.2 | 85.4 |
| EPT Index | 77.7 | 66.7 | 83.3 | 88.9 | 55.6 | 55.6 |
| Ratio EPT/Chironomids | 113.4 | 200.3 | 52.8 | 57.7 | 29.9 | 99.4 |
| Percent Dominant Taxa | 23.8 | 18.2 | 35.2 | 35.9 | 35.7 | 19.9 |
| ***Biological Condition Scores*** | | | | | | |
| Taxonomic Richness | 4 | 6 | 4 | 6 | 4 | 4 |
| Shannon Diversity Index | 6 | 6 | 6 | 6 | 6 | 6 |
| Hilsenhoff Index | 6 | 6 | 4 | 6 | 4 | 6 |
| EPT Index | 2 | 0 | 4 | 4 | 0 | 0 |
| Ratio EPT/Chironomids | 6 | 6 | 4 | 4 | 2 | 6 |
| Percent Dominant Taxa | 4 | 6 | 2 | 2 | 2 | 6 |
| ***Total Biological Score*** | | | | | | |
| Total Biological Score | 28 | 30 | 24 | 28 | 18 | 28 |
| Biological % of Reference | 82.4 | 88.2 | 70.6 | 82.4 | 52.9 | 82.4 |

***Table 11. Summary of New York-Pennsylvania Border RBP III Biological Data—Continued***

| | LSNK 7.6 | SEEL 10.3 | SOUT 7.8 | TROW 1.8 | NFCR 7.6 | TRUP 4.5 | WAPP 2.6 |
|---|---|---|---|---|---|---|---|
| ***Raw Summary*** | | | | | | | |
| Number of Individuals | 203 | 196 | 213 | 217 | 170 | 127 | 147 |
| % Shredders | 4.9 | 0 | 0.5 | 0.9 | 5.9 | 0 | 0 |
| % Collector-Gatherers | 30.5 | 51 | 38.5 | 66.8 | 53.5 | 17.3 | 57.1 |
| % Filterer-Collectors | 39.4 | 36.2 | 40.4 | 9.7 | 2.4 | 40.2 | 31.3 |
| % Scrapers | 7.4 | 2.6 | 16.9 | 7.8 | 16.5 | 16.5 | 7.5 |
| % Predators | 17.2 | 10.2 | 3.8 | 14.7 | 21.8 | 26 | 4.1 |
| Number of EPT Taxa | 18 | 8 | 10 | 14 | 13 | 10 | 11 |
| Number of EPT Individuals | 125 | 75 | 105 | 109 | 40 | 82 | 70 |
| ***Metric Scores*** | | | | | | | |
| Taxonomic Richness | 30 | 16 | 18 | 22 | 26 | 20 | 17 |
| Shannon Diversity Index | 2.7 | 1.8 | 2.2 | 2.1 | 2.3 | 2.3 | 2 |
| Modified Hilsenhoff Biotic Index | 3.8 | 5.1 | 4.9 | 4.4 | 4.5 | 4.5 | 5 |
| EPT Index | 18 | 8 | 10 | 14 | 13 | 10 | 11 |
| Ratio EPT/Chironomids | 2.5 | 0.8 | 1.5 | 1.4 | 0.6 | 4.8 | 1.1 |
| Percent Dominant Taxa | 25.1 | 47.4 | 32.4 | 35.9 | 38.8 | 22.8 | 44.2 |
| ***Percent of Reference*** | | | | | | | |
| Taxonomic Richness | 100 | 53.3 | 60 | 73.3 | 86.7 | 66.7 | 56.7 |
| Shannon Diversity Index | 100 | 65.7 | 80.9 | 77.7 | 85.4 | 86 | 72.3 |
| Hilsenhoff Index | 100 | 74.3 | 77.3 | 87.5 | 85.4 | 84.2 | 75.7 |
| EPT Index | 100 | 44.4 | 55.6 | 77.8 | 72.2 | 55.6 | 61.1 |
| Ratio EPT/Chironomids | 100 | 32.9 | 62.1 | 57 | 24.7 | 196.8 | 43.9 |
| Percent Dominant Taxa | 25.1 | 47.4 | 32.4 | 35.9 | 38.8 | 22.8 | 44.2 |
| ***Biological Condition Scores*** | | | | | | | |
| Taxonomic Richness | 6 | 2 | 4 | 4 | 6 | 4 | 2 |
| Shannon Diversity Index | 6 | 4 | 6 | 6 | 6 | 6 | 4 |
| Hilsenhoff Index | 6 | 4 | 4 | 6 | 6 | 4 | 4 |
| EPT Index | 6 | 0 | 0 | 2 | 2 | 0 | 0 |
| Ratio EPT/Chironomids | 6 | 2 | 4 | 4 | 0 | 6 | 2 |
| Percent Dominant Taxa | 4 | 0 | 2 | 2 | 2 | 4 | 0 |
| ***Total Biological Score*** | | | | | | | |
| Total Biological Score | 34 | 12 | 20 | 24 | 22 | 24 | 12 |
| Biological % of Reference | 100 | 35.3 | 58.8 | 70.6 | 64.7 | 70.6 | 35.3 |

***Table 12. Summary of Pennsylvania-Maryland Border RBP III Biological Data***

| | BBDC 4.1 | CNWG 4.4 | DEER 44.2 | EBAU 1.5 | FBDC 4.1 |
|---|---|---|---|---|---|
| ***Raw Data Summary*** | | | | | |
| Number of Individuals | 159 | 159 | 215 | 122 | 215 |
| % Shredders | 8.2 | 0 | 0 | 2.5 | 7.4 |
| % Collector-Gatherers | 22.6 | 13.2 | 34 | 32 | 32.1 |
| % Filterer-Collectors | 37.1 | 34.6 | 27.9 | 32.8 | 11.2 |
| % Scrapers | 18.9 | 44.7 | 29.8 | 30.3 | 28.8 |
| % Predators | 13.2 | 7.5 | 7.4 | 2.5 | 14.4 |
| Number of EPT Taxa | 15 | 9 | 10 | 7 | 17 |
| Number of EPT Individuals | 99 | 85 | 77 | 49 | 68 |
| ***Metric Scores*** | | | | | |
| Taxonomic Richness | 20 | 16 | 22 | 14 | 28 |
| Shannon Diversity Index | 2.5 | 2.2 | 2.5 | 2.1 | 2.5 |
| Modified Hilsenhoff Biotic Index | 3.3 | 4.7 | 4.7 | 4.7 | 4.2 |
| EPT Index | 15 | 9 | 10 | 7 | 17 |
| Ratio EPT/Chironomids | 4.3 | 12.1 | 1.7 | 1.8 | 1.3 |
| Percent Dominant Taxa | 18.2 | 33.3 | 20.9 | 25.4 | 25.1 |
| ***Percent of Reference*** | | | | | |
| Taxonomic Richness | 100 | 80 | 110 | 70 | 140 |
| Shannon Diversity Index | | | | | |
| Hilsenhoff Index | 100 | 70.5 | 70 | 69.4 | 78 |
| EPT Index | 100 | 60 | 66.7 | 46.7 | 113.3 |
| Ratio EPT/Chironomids | 100 | 282.1 | 39.8 | 42.2 | 29.3 |
| Percent Dominant Taxa | 18.2 | 33.3 | 20.9 | 25.4 | 25.1 |
| ***Biological Condition Scores*** | | | | | |
| Taxonomic Richness | 6 | 6 | 6 | 4 | 6 |
| Shannon Diversity Index | 6 | 6 | 6 | 6 | 6 |
| Hilsenhoff Index | 6 | 4 | 4 | 2 | 4 |
| EPT Index | 6 | 0 | 0 | 0 | 6 |
| Ratio EPT/Chironomids | 6 | 6 | 2 | 2 | 2 |
| Percent Dominant Taxa | 6 | 2 | 4 | 4 | 4 |
| ***Total Biological Score*** | | | | | |
| Total Biological Score | 36 | 24 | 22 | 18 | 28 |
| Biological % of Reference | 100 | 66.7 | 61.1 | 50 | 77.8 |

***Table 12. Summary of Pennsylvania-Maryland Border RBP III Biological Data—Continued***

| | LNGA 2.5 | OCTO 6.6 | SBCC 20.4 | SCTT 3.0 |
|---|---|---|---|---|
| ***Raw Data Summary*** | | | | |
| Number of Individuals | 106 | 170 | 131 | 185 |
| % Shredders | 3.8 | 6.5 | 19.8 | 2.2 |
| % Collector-Gatherers | 12.3 | 16.5 | 20.6 | 82.2 |
| % Filterer-Collectors | 37.7 | 48.8 | 28.2 | 12.4 |
| % Scrapers | 35.8 | 27.6 | 6.9 | 0 |
| % Predators | 8.5 | 0.6 | 24.4 | 3.2 |
| Number of EPT Taxa | 7 | 13 | 9 | 1 |
| Number of EPT Individuals | 46 | 132 | 82 | 1 |
| ***Metric Scores*** | | | | |
| Taxonomic Richness | 18 | 22 | 17 | 7 |
| Shannon Diversity Index | 2.5 | 2.4 | 2.3 | 0.8 |
| Modified Hilsenhoff Biotic Index | 4.4 | 4.4 | 2.1 | 6 |
| EPT Index | 7 | 13 | 9 | 1 |
| Ratio EPT/Chironomids | 7.7 | 12 | 3 | 0 |
| Percent Dominant Taxa | 20.8 | 24.7 | 24.4 | 78.4 |
| ***Percent of Reference*** | | | | |
| Taxonomic Richness | 90 | 110 | 85 | 35 |
| Shannon Diversity Index | 96.9 | 95.9 | 89.1 | 32.1 |
| Hilsenhoff Index | 75.3 | 74.7 | 157 | 55 |
| EPT Index | 46.7 | 86.7 | 60 | 6.7 |
| Ratio EPT/Chironomids | 178.1 | 278.8 | 70.6 | 0.2 |
| Percent Dominant Taxa | 20.8 | 24.7 | 24.4 | 78.4 |
| ***Biological Condition Scores*** | | | | |
| Taxonomic Richness | 6 | 6 | 6 | 0 |
| Shannon Diversity Index | 6 | 6 | 6 | 2 |
| Hilsenhoff Index | 4 | 4 | 6 | 2 |
| EPT Index | 0 | 4 | 0 | 0 |
| Ratio EPT/Chironomids | 6 | 6 | 4 | 0 |
| Percent Dominant Taxa | 4 | 4 | 4 | 0 |
| ***Total Biological Score*** | | | | |
| Total Biological Score | 26 | 30 | 26 | 4 |
| Biological % of Reference | 72.2 | 83.3 | 72.2 | 11.1 |

***Table 13. Summary of River RBP III Biological Data***

| | SUSQ 365 | CHEM 12.0 | COWN 2.2 | COWN 1.0 |
|---|---|---|---|---|
| ***Raw Summary*** | | | | |
| Number of Individuals | 115 | 174 | 172 | 155 |
| % Shredders | 2.6 | 0 | 25.6 | 12.3 |
| % Collector-Gatherers | 38.3 | 12.1 | 57 | 19.4 |
| % Filterer-Collectors | 6.1 | 70.1 | 17.4 | 38.7 |
| % Scrapers | 32.2 | 14.9 | 0 | 27.7 |
| % Predators | 20.9 | 2.9 | 0 | 1.9 |
| Number of EPT Taxa | 12 | 8 | 3 | 7 |
| Number of EPT Individuals | 54 | 127 | 19 | 72 |
| ***Metric Scores*** | | | | |
| Taxonomic Richness | 20 | 18 | 7 | 16 |
| Shannon Diversity Index | 2.5 | 2.1 | 1.3 | 2.4 |
| Modified Hilsenhoff Biotic Index | 4.5 | 4.9 | 6 | 5.2 |
| EPT Index | 12 | 8 | 3 | 7 |
| Ratio EPT/Chironomids | 3.2 | 8.5 | 0.2 | 4.2 |
| Percent Dominant Taxa | 14.8 | 32.8 | 56.4 | 18.1 |
| ***Percent of Reference*** | | | | |
| Taxonomic Richness | 83.3 | 75 | 29.2 | 66.7 |
| Shannon Diversity Index | 98.8 | 82.2 | 51.1 | 95 |
| Hilsenhoff Index | 99.4 | 91.2 | 75.2 | 86.2 |
| EPT Index | 70.6 | 47.1 | 17.6 | 41.2 |
| Ratio EPT/Chironomids | 15 | 39.9 | 0.9 | 20 |
| Percent Dominant Taxa | 14.8 | 32.8 | 56.4 | 18.1 |
| ***Biological Condition Scores*** | | | | |
| Taxonomic Richness | 6 | 4 | 0 | 4 |
| Shannon Diversity Index | 6 | 6 | 4 | 6 |
| Hilsenhoff Index | 6 | 6 | 4 | 6 |
| EPT Index | 2 | 0 | 0 | 0 |
| Ratio EPT/Chironomids | 0 | 2 | 0 | 0 |
| Percent Dominant Taxa | 6 | 2 | 0 | 6 |
| ***Total Biological Score*** | | | | |
| Total Biological Score | 26 | 20 | 8 | 22 |
| Percent of Reference | 72.2 | 55.6 | 22.2 | 61.1 |

***Table 13. Summary of River RBP III Biological Data—Continued***

| | SUSQ 340 | SUSQ 289.1 | TIOG 10.8 |
|---|---|---|---|
| ***Raw Summary*** | | | |
| Number of Individuals | 144 | 153 | 160 |
| % Shredders | 0.7 | 2 | 0.6 |
| % Collector-Gatherers | 12.5 | 16.3 | 26.3 |
| % Filterer-Collectors | 37.5 | 49 | 63.8 |
| % Scrapers | 35.4 | 30.7 | 3.8 |
| % Predators | 13.2 | 2 | 5.6 |
| Number of EPT Taxa | 14 | 17 | 10 |
| Number of EPT Individuals | 78 | 106 | 106 |
| ***Metric Scores*** | | | |
| Taxonomic Richness | 22 | 24 | 18 |
| Shannon Diversity Index | 2.5 | 2.6 | 2.2 |
| Modified Hilsenhoff Biotic Index | 4.4 | 4.5 | 4.8 |
| EPT Index | 14 | 17 | 10 |
| Ratio EPT/Chironomids | 13 | 21.2 | 2.9 |
| Percent Dominant Taxa | 27.1 | 15 | 23.8 |
| ***Percent of Reference*** | | | |
| Taxonomic Richness | 91.7 | 100 | 75 |
| Shannon Diversity Index | 97.8 | 100 | 84.6 |
| Hilsenhoff Index | 101.8 | 100 | 94.1 |
| EPT Index | 82.4 | 100 | 58.8 |
| Ratio EPT/Chironomids | 61.3 | 100 | 13.5 |
| Percent Dominant Taxa | 27.1 | 15 | 23.8 |
| ***Biological Condition Scores*** | | | |
| Taxonomic Richness | 6 | 6 | 4 |
| Shannon Diversity Index | 6 | 6 | 6 |
| Hilsenhoff Index | 6 | 6 | 6 |
| EPT Index | 4 | 6 | 0 |
| Ratio EPT/Chironomids | 4 | 6 | 0 |
| Percent Dominant Taxa | 4 | 6 | 4 |
| ***Total Biological Score*** | | | |
| Total Biological Score | 30 | 36 | 20 |
| Percent of Reference | 83.3 | 100 | 55.6 |

***Table 14. Summary of Group 3 Sites RBP III Biological Data***

| | COOK | BABC | BILL | BIRD | BISC | BRIG |
|---|---|---|---|---|---|---|
| ***Raw Summary*** | | | | | | |
| Number of Individuals | 149 | 211 | 142 | 128 | 140 | 145 |
| % Shredders | 3.4 | 20.9 | 9.2 | 5.5 | 1.4 | 2.8 |
| % Collector-Gatherers | 50.3 | 57.3 | 63.4 | 72.7 | 58.6 | 79.3 |
| % Filterer-Collectors | 4 | 0.5 | 3.5 | 0.8 | 3.6 | 0 |
| % Scrapers | 14.8 | 5.2 | 8.5 | 10.2 | 14.3 | 0 |
| % Predators | 27.5 | 16.1 | 15.5 | 10.9 | 22.1 | 17.9 |
| Number of EPT Taxa | 18 | 15 | 16 | 10 | 12 | 11 |
| Number of EPT Individuals | 101 | 139 | 109 | 62 | 94 | 69 |
| ***Metric Scores*** | | | | | | |
| Taxonomic Richness | 23 | 20 | 21 | 15 | 14 | 13 |
| Shannon Diversity Index | 2.4 | 2.3 | 2.6 | 1.8 | 2.1 | 1.5 |
| Modified Hilsenhoff Biotic Index | 2.6 | 3.1 | 2.8 | 3.2 | 2.7 | 3.2 |
| EPT Index | 18 | 15 | 16 | 10 | 12 | 11 |
| Ratio EPT/Chironomids | 2.4 | 2.1 | 7.3 | 1.1 | 2.1 | 1 |
| Percent Dominant Taxa | 28.2 | 30.8 | 21.8 | 42.2 | 32.1 | 49.7 |
| ***Percent of Reference*** | | | | | | |
| Taxonomic Richness | 109.5 | 95.2 | 100 | 71.4 | 66.7 | 61.9 |
| Shannon Diversity Index | 91 | 86.3 | 100 | 70.7 | 78.7 | 58.3 |
| Hilsenhoff Index | 107.6 | 90.2 | 100 | 87.7 | 105.4 | 87.7 |
| EPT Index | 112.5 | 93.8 | 100 | 62.5 | 75 | 68.8 |
| Ratio EPT/Chironomids | 33.1 | 29.4 | 100 | 15.8 | 28.7 | 13.2 |
| Percent Dominant Taxa | 28.2 | 30.8 | 21.8 | 42.2 | 32.1 | 49.7 |
| ***Biological Condition Scores*** | | | | | | |
| Taxonomic Richness | 6 | 6 | 6 | 4 | 4 | 4 |
| Shannon Diversity Index | 6 | 6 | 6 | 4 | 6 | 4 |
| Hilsenhoff Index | 6 | 6 | 6 | 6 | 6 | 6 |
| EPT Index | 6 | 6 | 6 | 0 | 2 | 0 |
| Ratio EPT/Chironomids | 2 | 2 | 6 | 0 | 2 | 0 |
| Percent Dominant Taxa | 4 | 2 | 4 | 0 | 2 | 0 |
| ***Total Biological Score*** | | | | | | |
| Total Biological Score | 30 | 28 | 34 | 14 | 22 | 14 |
| Biological % of Reference | 88.2 | 82.4 | 100 | 41.2 | 64.7 | 41.2 |

***Table 14. Summary of Group 3 Sites RBP III Biological Data—Continued***

| | BULK | CAMP | DEEP | LWAP |
|---|---|---|---|---|
| ***Raw Summary*** | | | | |
| Number of Individuals | 148 | 129 | 122 | 145 |
| % Shredders | 22.3 | 5.4 | 2.5 | 0.7 |
| % Collector-Gatherers | 49.3 | 40.3 | 59 | 75.2 |
| % Filterer-Collectors | 2.7 | 8.5 | 4.9 | 0 |
| % Scrapers | 4.7 | 11.6 | 7.4 | 9.7 |
| % Predators | 20.9 | 34.1 | 26.2 | 14.5 |
| Number of EPT Taxa | 12 | 15 | 14 | 12 |
| Number of EPT Individuals | 90 | 109 | 35 | 79 |
| ***Metric Scores*** | | | | |
| Taxonomic Richness | 18 | 19 | 25 | 13 |
| Shannon Diversity Index | 2.2 | 2.4 | 2.3 | 1.8 |
| Modified Hilsenhoff Biotic Index | 3.1 | 1.7 | 4.2 | 3.5 |
| EPT Index | 12 | 15 | 14 | 12 |
| Ratio EPT/Chironomids | 1.8 | 54.5 | 0.7 | 1.2 |
| Percent Dominant Taxa | 33.8 | 30.2 | 43.4 | 45.5 |
| ***Percent of Reference*** | | | | |
| Taxonomic Richness | 85.7 | 90.5 | 119 | 61.9 |
| Shannon Diversity Index | 84 | 90.1 | 89.5 | 67.4 |
| Hilsenhoff Index | 92.2 | 162.2 | 66.5 | 79.8 |
| EPT Index | 75 | 93.8 | 87.5 | 75 |
| Ratio EPT/Chironomids | 24.8 | 750 | 9.1 | 16.5 |
| Percent Dominant Taxa | 33.8 | 30.2 | 43.4 | 45.5 |
| ***Biological Condition Scores*** | | | | |
| Taxonomic Richness | 6 | 6 | 6 | 4 |
| Shannon Diversity Index | 6 | 6 | 6 | 4 |
| Hilsenhoff Index | 6 | 6 | 2 | 4 |
| EPT Index | 2 | 6 | 4 | 2 |
| Ratio EPT/Chironomids | 0 | 6 | 0 | 0 |
| Percent Dominant Taxa | 2 | 4 | 0 | 0 |
| ***Total Biological Score*** | | | | |
| Total Biological Score | 22 | 34 | 18 | 14 |
| Biological % of Reference | 64.7 | 100 | 52.9 | 41.2 |

***Table 14. Summary of Group 3 Sites RBP III Biological Data—Continued***

| | PARK | PRIN | REDH | RUSS | SACK | SMIT |
|---|---|---|---|---|---|---|
| ***Raw Summary*** | | | | | | |
| Number of Individuals | 141 | 119 | 151 | 138 | 121 | 132 |
| % Shredders | 6.4 | 4.2 | 7.9 | 8.7 | 2.5 | 6.8 |
| % Collector-Gatherers | 75.9 | 55.5 | 37.1 | 58 | 66.9 | 53 |
| % Filterer-Collectors | 3.5 | 16.8 | 14.6 | 2.9 | 4.1 | 3 |
| % Scrapers | 4.3 | 15.1 | 4.6 | 0 | 5.8 | 28 |
| % Predators | 9.9 | 8.4 | 35.8 | 30.4 | 20.7 | 9.1 |
| Number of EPT Taxa | 14 | 14 | 12 | 10 | 11 | 12 |
| Number of EPT Individuals | 62 | 50 | 83 | 78 | 91 | 31 |
| ***Metric Scores*** | | | | | | |
| Taxonomic Richness | 17 | 20 | 17 | 13 | 14 | 19 |
| Shannon Diversity Index | 1.8 | 2.2 | 1.9 | 1.8 | 2.2 | 1.8 |
| Modified Hilsenhoff Biotic Index | 3.9 | 4.1 | 2.7 | 2.8 | 2 | 4.3 |
| EPT Index | 14 | 14 | 12 | 10 | 11 | 12 |
| Ratio EPT/Chironomids | 0.8 | 1.1 | 1.5 | 1.4 | 4.8 | 0.5 |
| Percent Dominant Taxa | 52.5 | 39.5 | 35.8 | 40.6 | 32.2 | 46.2 |
| ***Percent of Reference*** | | | | | | |
| Taxonomic Richness | 81 | 95.2 | 81 | 61.9 | 66.7 | 90.5 |
| Shannon Diversity Index | 68.1 | 84.8 | 73 | 70.2 | 84 | 69.8 |
| Hilsenhoff Index | 72.5 | 69.3 | 106.1 | 101.2 | 142.6 | 65 |
| EPT Index | 87.5 | 87.5 | 75 | 62.5 | 68.8 | 75 |
| Ratio EPT/Chironomids | 11.5 | 14.6 | 21.2 | 19.2 | 65.9 | 7 |
| Percent Dominant Taxa | 52.5 | 39.5 | 35.8 | 40.6 | 32.2 | 46.2 |
| ***Biological Condition Scores*** | | | | | | |
| Taxonomic Richness | 6 | 6 | 6 | 4 | 4 | 6 |
| Shannon Diversity Index | 4 | 6 | 4 | 4 | 6 | 4 |
| Hilsenhoff Index | 4 | 2 | 6 | 6 | 6 | 2 |
| EPT Index | 4 | 4 | 2 | 0 | 0 | 2 |
| Ratio EPT/Chironomids | 0 | 0 | 0 | 0 | 4 | 0 |
| Percent Dominant Taxa | 0 | 2 | 2 | 0 | 2 | 0 |
| ***Total Biological Score*** | | | | | | |
| Total Biological Score | 18 | 20 | 20 | 14 | 22 | 14 |
| Biological % of Reference | 52.9 | 58.8 | 58.8 | 41.2 | 64.7 | 41.2 |

***Table 14. Summary of Group 3 Sites RBP III Biological Data—Continued***

| | STRA | WBCO | WHIT |
|---|---|---|---|
| ***Raw Summary*** | | | |
| Number of Individuals | 153 | 119 | 138 |
| % Shredders | 5.2 | 1.7 | 17.4 |
| % Collector-Gatherers | 51.6 | 31.9 | 49.3 |
| % Filterer-Collectors | 8.5 | 61.3 | 2.2 |
| % Scrapers | 15.7 | 4.2 | 5.1 |
| % Predators | 19 | 0.8 | 26.1 |
| Number of EPT Taxa | 17 | 3 | 12 |
| Number of EPT Individuals | 104 | 36 | 104 |
| ***Metric Scores*** | | | |
| Taxonomic Richness | 22 | 12 | 17 |
| Shannon Diversity Index | 2.6 | 1.9 | 2.1 |
| Modified Hilsenhoff Biotic Index | 2.9 | 4.5 | 1.5 |
| EPT Index | 17 | 3 | 12 |
| Ratio EPT/Chironomids | 5.5 | 1.1 | 5.8 |
| Percent Dominant Taxa | 22.2 | 31.1 | 32.6 |
| ***Percent of Reference*** | | | |
| Taxonomic Richness | 104.8 | 57.1 | 81 |
| Shannon Diversity Index | 99.8 | 71 | 81.5 |
| Hilsenhoff Index | 96.6 | 62.1 | 185.1 |
| EPT Index | 106.3 | 18.8 | 75 |
| Ratio EPT/Chironomids | 75.3 | 15.5 | 79.5 |
| Percent Dominant Taxa | 22.2 | 31.1 | 32.6 |
| ***Biological Condition Scores*** | | | |
| Taxonomic Richness | 6 | 2 | 6 |
| Shannon Diversity Index | 6 | 4 | 6 |
| Hilsenhoff Index | 6 | 2 | 6 |
| EPT Index | 6 | 0 | 2 |
| Ratio EPT/Chironomids | 6 | 0 | 6 |
| Percent Dominant Taxa | 4 | 2 | 2 |
| ***Total Biological Score*** | | | |
| Total Biological Score | 34 | 10 | 28 |
| Biological % of Reference | 100 | 29.4 | 82.4 |

***Table 15. Summary of New York-Pennsylvania Sites Physical Habitat Data***

| | SNAK 2.3 | APAL 6.9 | BNTY 0.9 | CASC 1.6 | CAYT 1.7 | CHOC 9.1 |
|---|---|---|---|---|---|---|
| Epifaunal Substrate | 16 | 14 | 15 | 15 | 15 | 17 |
| Instream Cover | 15 | 13 | 10 | 17 | 14 | 14 |
| Embeddedness/Pool Substrate | 16 | 13 | 13 | 13 | 14 | 14 |
| Velocity/Depth Regimes/Pool Variability | 16 | 13 | 13 | 13 | 14 | 10 |
| Sediment Deposition | 15 | 12 | 10 | 12 | 12 | 14 |
| Channel Flow Status | 15 | 13 | 13 | 10 | 15 | 15 |
| Channel Alteration | 14 | 14 | 11 | 16 | 13 | 14 |
| Frequency of Riffles/Channel Sinuosity | 16 | 10 | 14 | 15 | 12 | 15 |
| Condition of Banks | 16 | 12 | 12 | 14 | 15 | 12 |
| Left Bank | 8 | 7 | 8 | 7 | 7 | 6 |
| Right Bank | 8 | 5 | 4 | 7 | 8 | 6 |
| Vegetative Protective Cover | 16 | 14 | 12 | 16 | 14 | 14 |
| Left Bank | 8 | 8 | 8 | 8 | 7 | 7 |
| Right Bank | 8 | 6 | 4 | 8 | 7 | 7 |
| Riparian Vegetative Zone Width | 10 | 8 | 14 | 14 | 7 | 9 |
| Left Bank | 5 | 4 | 7 | 9 | 2 | 5 |
| Right Bank | 5 | 4 | 7 | 5 | 5 | 4 |
| ***Total Habitat Score*** | | | | | | |
| Total Habitat Score | 207 | 170 | 175 | 199 | 181 | 183 |
| Habitat Percent of Reference | 99.5 | 81.7 | 84.1 | 95.7 | 87 | 88 |

| | LSNK 7.6 | SEEL 10.3 | SOUT 7.8 | TROW 1.5 | TRUP 4.5 | NFCR 7.6 | WAPP 2.6 |
|---|---|---|---|---|---|---|---|
| Epifaunal Substrate | 15 | 11 | 16 | 14 | 10 | 15 | 16 |
| Instream Cover | 14 | 9 | 11 | 13 | 9 | 14 | 15 |
| Embeddedness/Pool Substrate | 14 | 15 | 15 | 16 | 15 | 13 | 15 |
| Velocity/Depth Regimes/Pool Variability | 10 | 9 | 9 | 10 | 12 | 10 | 15 |
| Sediment Deposition | 14 | 11 | 15 | 15 | 14 | 13 | 15 |
| Channel Flow Status | 12 | 12 | 13 | 11 | 10 | 11 | 15 |
| Channel Alteration | 14 | 10 | 13 | 15 | 15 | 18 | 14 |
| Frequency of Riffles/Channel Sinuosity | 15 | 11 | 13 | 17 | 15 | 16 | 14 |
| Condition of Banks | 18 | 16 | 14 | 12 | 13 | 18 | 16 |
| Left Bank | 9 | 8 | 8 | 7 | 5 | 9 | 9 |
| Right Bank | 9 | 8 | 6 | 5 | 8 | 9 | 7 |
| Vegetative Protective Cover | 18 | 17 | 15 | 14 | 16 | 18 | 17 |
| Left Bank | 9 | 8 | 9 | 9 | 7 | 9 | 9 |
| Right Bank | 9 | 9 | 6 | 5 | 9 | 9 | 8 |
| Riparian Vegetative Zone Width | 14 | 7 | 7 | 10 | 7 | 15 | 14 |
| Left Bank | 7 | 3 | 4 | 8 | 3 | 10 | 7 |
| Right Bank | 7 | 4 | 3 | 2 | 4 | 5 | 7 |
| ***Total Habitat Score*** | | | | | | | |
| Total Habitat Score | 208 | 168 | 177 | 183 | 172 | 212 | 213 |
| Habitat Percent of Reference | 100 | 80.7 | 85.1 | 88 | 82.7 | 101.9 | 102.4 |

***Table 16. Summary of Pennsylvania-Maryland Sites Physical Habitat Data***

| | BBDC 4.1 | CNWG 4.4 | DEER 44.2 | EBAU 1.5 | FBDC 4.1 |
|---|---|---|---|---|---|
| Epifaunal Substrate | 16 | 16 | 14 | 15 | 14 |
| Instream Cover | 15 | 15 | 14 | 14 | 15 |
| Embeddedness/Pool Substrate | 15 | 10 | 13 | 12 | 12 |
| Velocity/Depth Regimes/Pool Variability | 12 | 16 | 13 | 10 | 10 |
| Sediment Deposition | 14 | 8 | 11 | 14 | 10 |
| Channel Flow Status | 18 | 15 | 15 | 18 | 15 |
| Channel Alteration | 14 | 16 | 14 | 14 | 14 |
| Frequency of Riffles/Channel Sinuosity | 16 | 15 | 13 | 15 | 13 |
| Condition of Banks | 16 | 14 | 8 | 14 | 16 |
| Left Bank | 7 | 6 | 2 | 6 | 8 |
| Right Bank | 9 | 8 | 6 | 8 | 8 |
| Vegetative Protective Cover | 17 | 15 | 12 | 16 | 16 |
| Left Bank | 8 | 7 | 6 | 8 | 9 |
| Right Bank | 9 | 8 | 6 | 8 | 7 |
| Riparian Vegetative Zone Width | 10 | 6 | 2 | 11 | 7 |
| Left Bank | 2 | 2 | 1 | 5 | 5 |
| Right Bank | 8 | 4 | 1 | 6 | 2 |
| ***Total Habitat Score*** | | | | | |
| Total Habitat Score | 206 | 181 | 151 | 194 | 181 |
| Habitat Percent of Reference | 100 | 87.9 | 73.3 | 94.2 | 87.9 |

| | LNGA 2.5 | OCTO 6.6 | SBCC 20.4 | SCTT 3.0 |
|---|---|---|---|---|
| Epifaunal Substrate | 11 | 15 | 17 | 14 |
| Instream Cover | 14 | 15 | 16 | 12 |
| Embeddedness/Pool Substrate | 10 | 14 | 15 | 10 |
| Velocity/Depth Regimes/Pool Variability | 12 | 16 | 14 | 10 |
| Sediment Deposition | 10 | 14 | 16 | 10 |
| Channel Flow Status | 18 | 16 | 16 | 13 |
| Channel Alteration | 18 | 14 | 15 | 13 |
| Frequency of Riffles/Channel Sinuosity | 10 | 15 | 16 | 13 |
| Condition of Banks | 12 | 14 | 16 | 14 |
| Left Bank | 9 | 8 | 8 | 6 |
| Right Bank | 3 | 6 | 8 | 8 |
| Vegetative Protective Cover | 11 | 16 | 17 | 16 |
| Left Bank | 8 | 8 | 8 | 8 |
| Right Bank | 3 | 8 | 9 | 8 |
| Riparian Vegetative Zone Width | 11 | 6 | 13 | 4 |
| Left Bank | 7 | 3 | 5 | 2 |
| Right Bank | 4 | 3 | 8 | 2 |
| ***Total Habitat Score*** | | | | |
| Total Habitat Score | 171 | 191 | 217 | 163 |
| Habitat Percent of Reference | 83.0 | 92.7 | 105.3 | 79.1 |

***Table 17. Summary of River Sites Physical Habitat Data***

| | SUSQ 365 | CHEM 12.0 | COWN 2.2 | COWN 1.0 |
|---|---|---|---|---|
| Epifaunal Substrate | 15 | 14 | 8 | 15 |
| Instream Cover | 16 | 14 | 6 | 16 |
| Embeddedness/Pool Substrate | 14 | 13 | 13 | 14 |
| Velocity/Depth Regimes/Pool Variability | 17 | 16 | 8 | 16 |
| Sediment Deposition | 14 | 13 | 12 | 14 |
| Channel Flow Status | 15 | 13 | 16 | 15 |
| Channel Alteration | 15 | 13 | 11 | 17 |
| Frequency of Riffles/Channel Sinuosity | 16 | 11 | 6 | 11 |
| Condition of Banks | 14 | 15 | 18 | 14 |
| Left Bank | 8 | 7 | 9 | 9 |
| Right Bank | 6 | 8 | 9 | 5 |
| Vegetative Protective Cover | 18 | 16 | 16 | 16 |
| Left Bank | 9 | 7 | 8 | 9 |
| Right Bank | 9 | 9 | 8 | 7 |
| Riparian Vegetative Zone Width | 14 | 11 | 11 | 11 |
| Left Bank | 7 | 4 | 7 | 5 |
| Right Bank | 7 | 7 | 4 | 6 |
| ***Total Habitat Score*** | | | | |
| Total Habitat Score | 214 | 191 | 170 | 200 |
| Habitat Percent of Reference | 107 | 95.5 | 85 | 100 |

| | SUSQ 340 | SUSQ 289.1 | TIOG 10.8 |
|---|---|---|---|
| Epifaunal Substrate | 14 | 14 | 14 |
| Instream Cover | 14 | 14 | 14 |
| Embeddedness/Pool Substrate | 14 | 15 | 14 |
| Velocity/Depth Regimes/Pool Variability | 16 | 16 | 16 |
| Sediment Deposition | 14 | 13 | 12 |
| Channel Flow Status | 16 | 16 | 16 |
| Channel Alteration | 16 | 14 | 16 |
| Frequency of Riffles/Channel Sinuosity | 10 | 14 | 14 |
| Condition of Banks | 18 | 16 | 15 |
| Left Bank | 9 | 8 | 8 |
| Right Bank | 9 | 8 | 7 |
| Vegetative Protective Cover | 18 | 16 | 15 |
| Left Bank | 9 | 8 | 8 |
| Right Bank | 9 | 8 | 7 |
| Riparian Vegetative Zone Width | 12 | 10 | 12 |
| Left Bank | 6 | 7 | 6 |
| Right Bank | 6 | 3 | 6 |
| ***Total Habitat Score*** | | | |
| Total Habitat Score | 210 | 200 | 200 |
| Habitat Percent of Reference | 105 | 100 | 100 |

***Table 18. Summary of Group 3 Sites Physical Habitat Data***

| | COOK | BABC | BILL | BIRD | BISC | BRIG |
|---|---|---|---|---|---|---|
| Epifaunal Substrate | 15 | 15 | 15 | 15 | 10 | 12 |
| Instream Cover | 15 | 15 | 16 | 15 | 10 | 8 |
| Embeddedness/Pool Substrate | 17 | 16 | 17 | 16 | 11 | 11 |
| Velocity/Depth Regimes/Pool Variability | 10 | 10 | 10 | 10 | 9 | 8 |
| Sediment Deposition | 17 | 16 | 17 | 17 | 10 | 8 |
| Channel Flow Status | 12 | 11 | 12 | 12 | 9 | 13 |
| Channel Alteration | 16 | 16 | 17 | 14 | 16 | 14 |
| Frequency of Riffles/Channel Sinuosity | 16 | 16 | 17 | 17 | 12 | 15 |
| Condition of Banks | 15 | 13 | 14 | 7 | 11 | 9 |
| Left Bank | 7 | 8 | 7 | 3 | 7 | 5 |
| Right Bank | 8 | 5 | 7 | 4 | 4 | 4 |
| Vegetative Protective Cover | 18 | 11 | 15 | 5 | 10 | 11 |
| Left Bank | 9 | 4 | 8 | 2 | 5 | 6 |
| Right Bank | 9 | 7 | 7 | 3 | 5 | 5 |
| Riparian Vegetative Zone Width | 15 | 15 | 15 | 12 | 4 | 9 |
| Left Bank | 8 | 7 | 7 | 7 | 2 | 5 |
| Right Bank | 7 | 8 | 8 | 5 | 2 | 4 |
| ***Total Habitat Score*** | | | | | | |
| Total Habitat Score | 202 | 171 | 209 | 164 | 137 | 147 |
| Habitat Percent of Reference | 96.7 | 81.8 | 100.0 | 78.5 | 65.6 | 70.3 |

| | BULK | CAMP | DEEP | LWAP |
|---|---|---|---|---|
| Epifaunal Substrate | 18 | 14 | 16 | 15 |
| Instream Cover | 17 | 12 | 16 | 12 |
| Embeddedness/Pool Substrate | 16 | 16 | 15 | 16 |
| Velocity/Depth Regimes/Pool Variability | 10 | 8 | 10 | 7 |
| Sediment Deposition | 16 | 16 | 16 | 16 |
| Channel Flow Status | 14 | 11 | 15 | 9 |
| Channel Alteration | 17 | 11 | 17 | 2 |
| Frequency of Riffles/Channel Sinuosity | 17 | 15 | 17 | 13 |
| Condition of Banks | 15 | 10 | 15 | 4 |
| Left Bank | 8 | 5 | 8 | 2 |
| Right Bank | 7 | 5 | 7 | 2 |
| Vegetative Protective Cover | 17 | 9 | 17 | 4 |
| Left Bank | 9 | 5 | 9 | 2 |
| Right Bank | 8 | 4 | 8 | 2 |
| Riparian Vegetative Zone Width | 18 | 7 | 15 | 5 |
| Left Bank | 9 | 3 | 9 | 3 |
| Right Bank | 9 | 4 | 6 | 2 |
| ***Total Habitat Score*** | | | | |
| Total Habitat Score | 198 | 155 | 216 | 116 |
| Habitat Percent of Reference | 94.7 | 74.2 | 103.3 | 55.5 |

***Table 18. Summary of Group 3 Sites Physical Habitat Data – continued.***

| | PARK | PRIN | REDH | RUSS | SACK | SMIT |
|---|---|---|---|---|---|---|
| Epifaunal Substrate | 14 | 11 | 15 | 10 | 16 | 17 |
| Instream Cover | 14 | 14 | 16 | 10 | 15 | 16 |
| Embeddedness/Pool Substrate | 16 | 14 | 16 | 14 | 16 | 16 |
| Velocity/Depth Regimes/Pool Variability | 8 | 9 | 10 | 6 | 9 | 8 |
| Sediment Deposition | 10 | 11 | 17 | 12 | 16 | 16 |
| Channel Flow Status | 9 | 6 | 11 | 8 | 14 | 12 |
| Channel Alteration | 3 | 12 | 17 | 5 | 15 | 13 |
| Frequency of Riffles/Channel Sinuosity | 16 | 15 | 16 | 11 | 17 | 15 |
| Condition of Banks | 4 | 10 | 12 | 5 | 11 | 15 |
| Left Bank | 2 | 6 | 6 | 2 | 6 | 7 |
| Right Bank | 2 | 4 | 6 | 3 | 5 | 8 |
| Vegetative Protective Cover | 4 | 10 | 13 | 5 | 12 | 14 |
| Left Bank | 2 | 7 | 6 | 2 | 6 | 7 |
| Right Bank | 2 | 3 | 7 | 3 | 6 | 7 |
| Riparian Vegetative Zone Width | 8 | 5 | 16 | 6 | 11 | 11 |
| Left Bank | 3 | 3 | 8 | 3 | 6 | 6 |
| Right Bank | 5 | 2 | 8 | 3 | 5 | 5 |
| ***Total Habitat Score*** | | | | | | |
| Total Habitat Score | 122 | 142 | 200 | 108 | 186 | 176 |
| Habitat Percent of Reference | 58.4 | 67.9 | 95.7 | 51.7 | 89.0 | 84.2 |

| | STRA | WBCO | WHIT |
|---|---|---|---|
| Epifaunal Substrate | 15 | 16 | 15 |
| Instream Cover | 13 | 15 | 13 |
| Embeddedness/Pool Substrate | 16 | 16 | 16 |
| Velocity/Depth Regimes/Pool Variability | 9 | 10 | 10 |
| Sediment Deposition | 15 | 13 | 16 |
| Channel Flow Status | 13 | 15 | 11 |
| Channel Alteration | 10 | 10 | 12 |
| Frequency of Riffles/Channel Sinuosity | 16 | 16 | 16 |
| Condition of Banks | 5 | 15 | 10 |
| Left Bank | 3 | 8 | 5 |
| Right Bank | 2 | 7 | 5 |
| Vegetative Protective Cover | 6 | 10 | 9 |
| Left Bank | 3 | 5 | 4 |
| Right Bank | 3 | 5 | 5 |
| Riparian Vegetative Zone Width | 5 | 4 | 11 |
| Left Bank | 2 | 2 | 4 |
| Right Bank | 3 | 2 | 7 |
| ***Total Habitat Score*** | | | |
| Total Habitat Score | 126 | 169 | 169 |
| Habitat Percent of Reference | 60.3 | 80.9 | 80.9 |

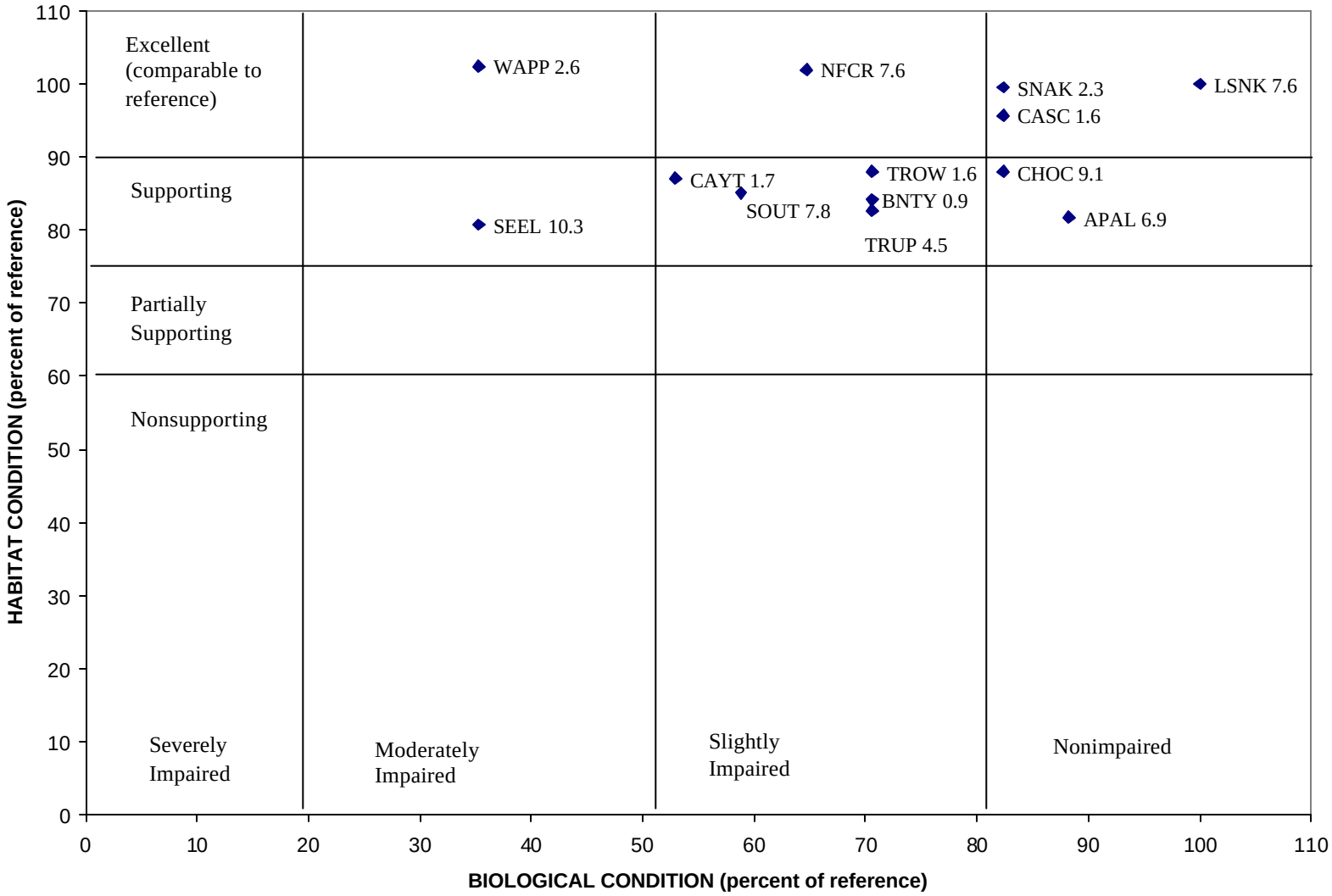



***Figure 6. Summary of New York-Pennsylvania Border Streams Habitat and Biological Condition Scores***

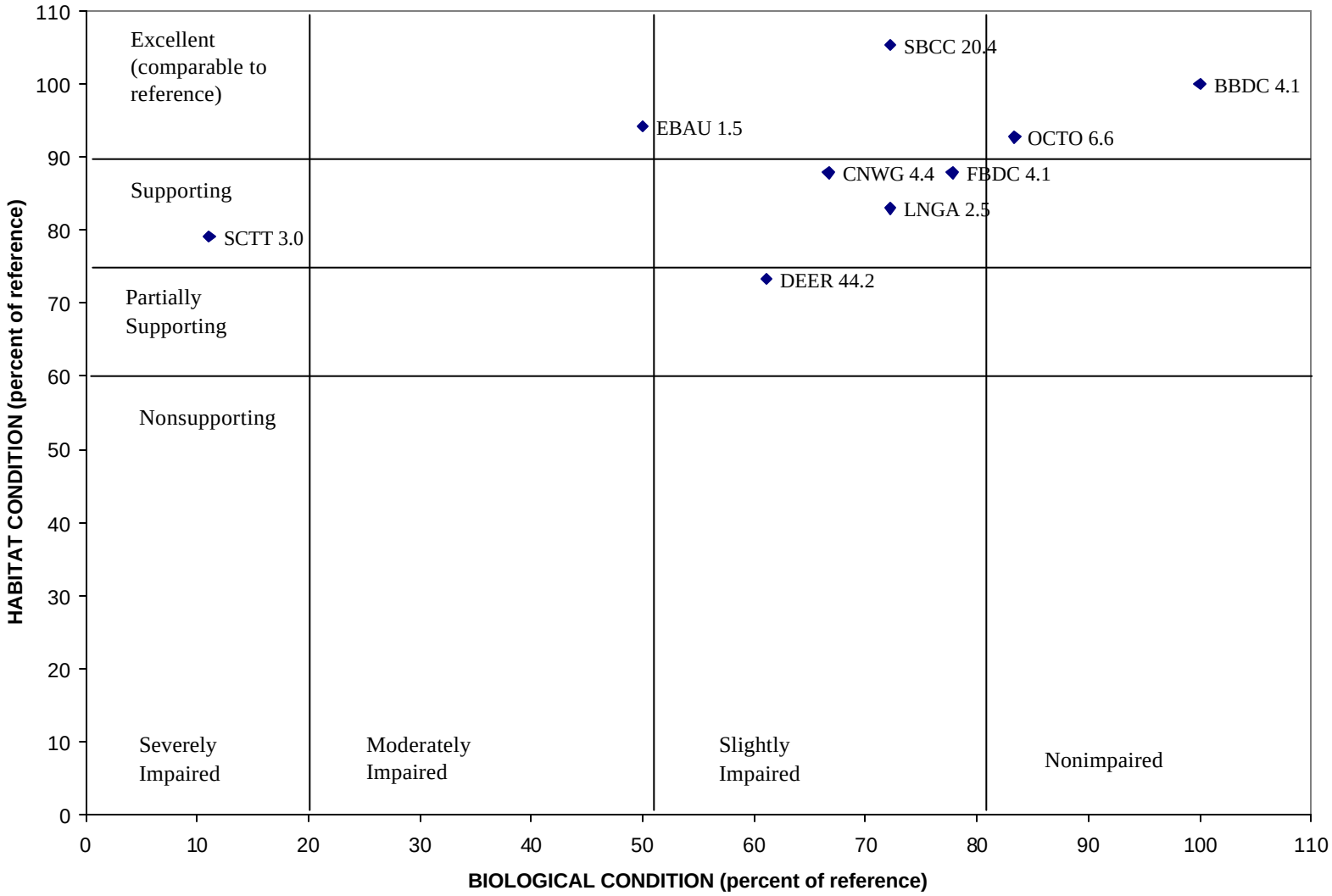



***Figure 7. Summary of Pennsylvania-Maryland Border Streams Habitat and Biological Condition Scores***

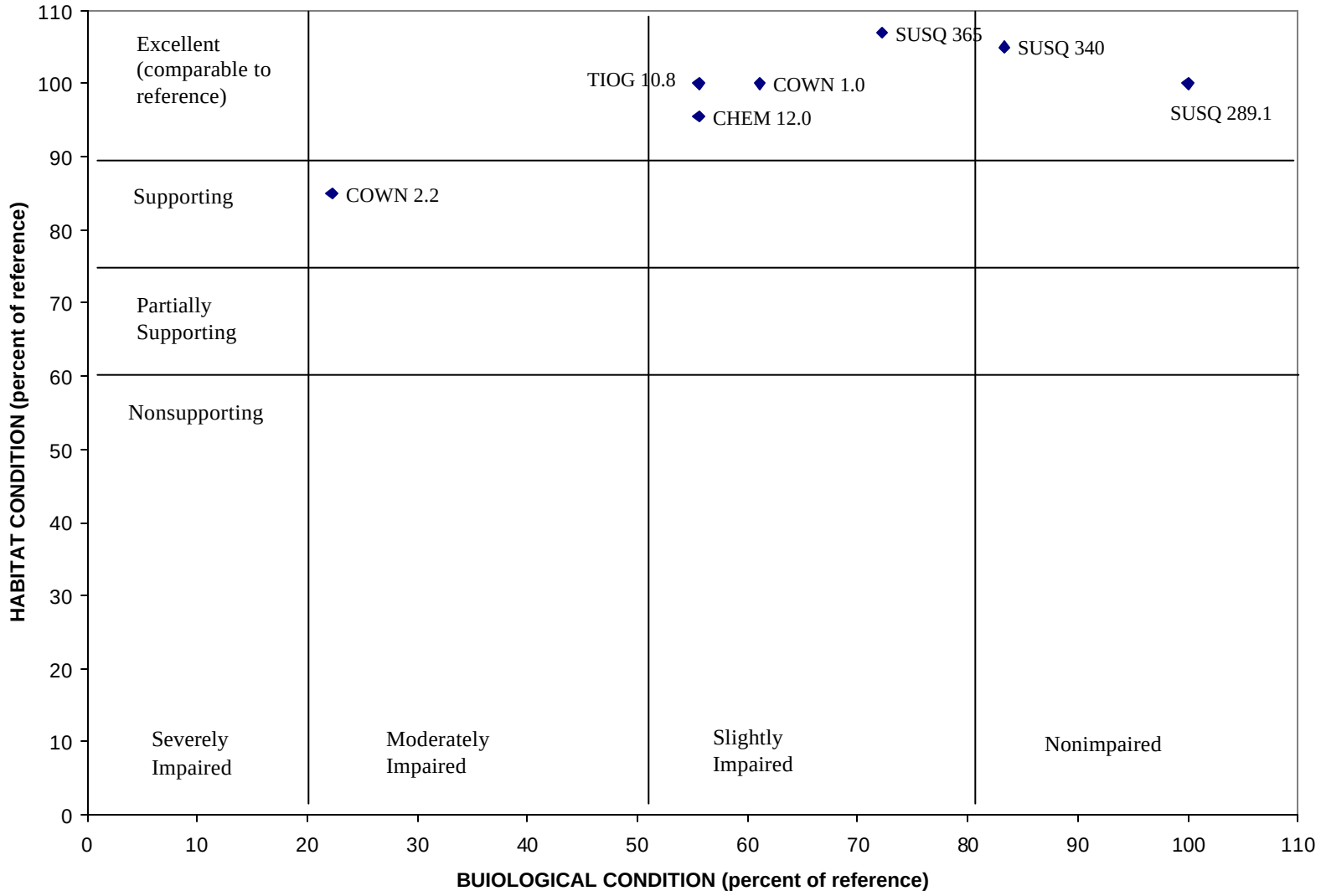



***Figure 8. Summary of River Habitat and Biological Condition Scores***

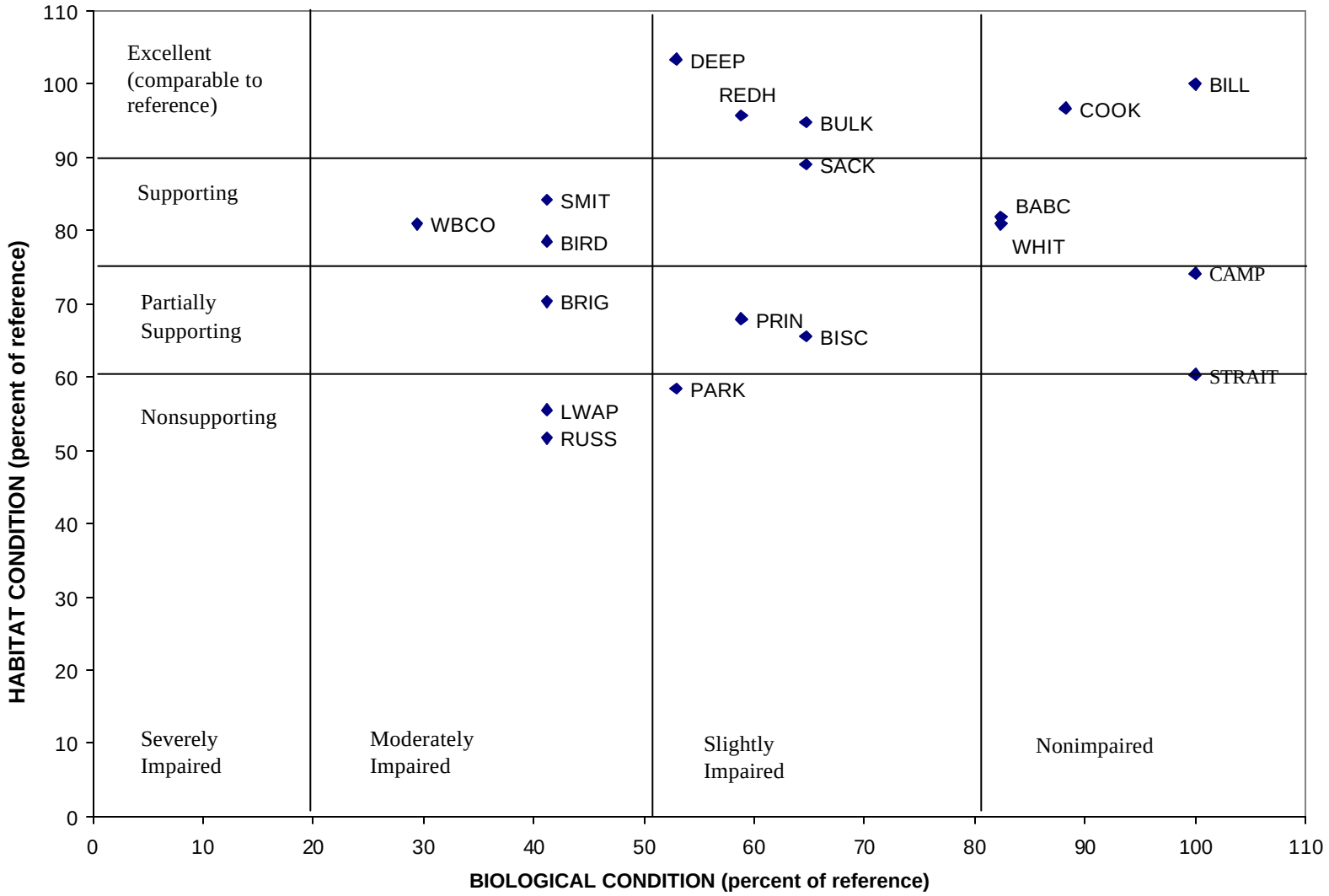



***Figure 9. Summary of Group 3 Streams Habitat and Biological Condition Scores***

Four sites (44.4 percent) had supporting habitats, and one site (11.1 percent) had partially supporting habitats. None of the sites was designated nonsupporting in habitat. Island Branch is not sampled due to its small size.

#### River sites

River sites consisted of nine stations located on the Susquehanna, Chemung, Cowanesque, and Tioga Rivers. Two stations (SUSQ 10.0, SUSQ 44.5) were not sampled for macroinvertebrates due to deep water and a lack of riffle habitat at the sites. The biological communities of two out of seven sites (28.5 percent) were nonimpaired, four sites (57 percent) were slightly impaired, and one site (14.3 percent) was moderately impaired. Six of the seven sites (85.7 percent) had excellent habitats. The remaining site (14.3 percent) was supporting.

#### Group 3 Sites

Group 3 sampling stations consisted of 21 sites on small streams located along the New York-Pennsylvania border. Two of these sites (DENT, DRYB) were dry at the time of sampling. Six of the 19 sites sampled (31.6 percent) had nonimpaired biological conditions. Seven sites (36.8 percent) were slightly impaired, and six sites (31.6 percent) were moderately impaired. Five (26.3 percent) of the Group 3 sites had excellent habitat scores. Six sites (31.6 percent) had supporting habitat conditions. Five sites (26.3 percent) were designated partially supporting, and the remaining three sites (15.8 percent) were nonsupporting.

### Trends Analysis

A summary of trend statistics is presented in Table 19. The statistical trends were simplified into trend categories: a highly significant ($p<0.05$) trend that was increasing (INC) or decreasing (DEC); a significant ($p<0.10$) trend that was increasing (inc) or decreasing (dec); or no trend (0). The trend categories are presented for both the concentration and the flow-adjusted concentrations. In Tables 20 and 21, weighted values were assigned for each station, and an average weighted value was calculated to indicate the strength of an overall trend for each variable. Each category was given a value: -2 for DEC, -1 for dec, 0 for 0, +1 for inc, and +2 for INC. An average value was calculated for each parameter. An analysis of "strong decreasing trend" required an average weighted value of less than –1.50. An analysis of "decreasing trend" required an average value between –1.00 and –1.50. An analysis of no trend was indicated by a value of –1.00 to +1.00.

Detailed results of the Seasonal Kendall Test are presented in Appendix E, Tables E1-E8. The statistics include the probability, (P), slope estimate (b), Kendall's Tau median, and percent slope. The median was calculated from the median of the entire quarterly time series. The percent slope was expressed in percent of the median concentration per year and was calculated by dividing the slope (b) by the median and multiplying by 100. The percent slope identifies those stations for which trend slope (b) is large with respect to the median value. Table 54 provides a summary of detected trends and overall direction.

#### Total suspended solids

Trend analysis results for total suspended solids are presented in Appendix E, Table E1. Concentration values at the stations showed one decreasing trend at Tioga River, and no trends for flow-adjusted concentration analysis (Table 19). There was no overall trend, indicated by a weighted average value of –0.07 for unadjusted concentrations and zero for flow-adjusted concentrations (Tables 20 and 21, respectively).

#### Total ammonia

Total ammonia trend analysis results are presented in Appendix E, Table E2. Concentration values showed strongly decreasing values at Cayuta Creek, Chemung River, Deer Creek, Ebaughs Creek, Octoraro Creek, Tioga River, and Susquehanna River sites 44.5, 289.1, 340, and 365, and decreasing trends at Conowingo Creek and Susquehanna River site 10.0 (Table 19). Flow adjusted concentrations indicated strongly decreasing trends at Cayuta Creek, Chemung River, Tioga River, and

Susquehanna River sites 289.1, 340, and 365, and decreasing trends at Ebaughs Creek and Susquehanna River site 44.5 (Table 19). There was an overall decreasing trend in concentration with a weighted value of –1.47 (Table 20), but a weighted value of –0.93 indicates that there was no overall trend in flow-adjusted concentrations (Table 21). This indicates this decreasing trend may be due to flow or climatic patterns.

**Total nitrogen**

The results of trend analysis for total nitrogen are presented in Appendix E, Table E3. Concentration values at the Group 1 stations showed strongly decreasing trends at Chemung River, Cowanesque River, Tioga River, Troups Creek, and Susquehanna River sites 289.1, 340, and 365, decreasing trends at Cayuta Creek and Susquehanna River site 10.0, and a strongly increasing trend at Conowingo Creek (Table 19). Flow adjusted concentrations indicated strongly decreasing trends at Cayuta Creek, Chemung River, Cowanesque River, Tioga River, and Susquehanna River sites 10.0, 289.1, 340, and 365. A decreasing trend was found at Scott Creek. A strongly increasing trend occurred at Conowingo Creek (Table 19). Overall, there was no trend in concentration, and a decreasing trend in flow-adjusted concentrations, with average weighted values of –0.93 and –1.00, respectively (Tables 20 and 21). Note that an increasing trend for total nitrogen was found only in Conowingo Creek, which is a Pennsylvania-Maryland border site heavily influenced by agriculture.

**Total phosphorus**

Trend analysis results for total phosphorus are presented in Appendix E, Table E4. Concentration values showed strongly decreasing trends at Susquehanna River sites 10, 289.1, 340, and 365, Conowingo Creek, Deer Creek, Octoraro Creek, and Tioga River, decreasing trends at Cayuta Creek and Susquehanna River 44.5, and an increasing trend at Troups Creek (Table 19). Flow-adjusted concentrations showed strongly decreasing trends at Susquehanna River sites 289.1, 340, and 365, Conowingo Creek, and Deer Creek. Decreasing trends were found at Cayuta Creek, Tioga River, and Susquehanna River site 44.5 (Table 19). Overall, there was a decreasing trend in unadjusted phosphorus concentrations (average value = -1.13) but no trend in flow-adjusted concentration (average value = -0.87) (Tables 20 and 21). The decreasing trend may have been due to a decrease of phosphates in detergents, to the application of agricultural Best Management Practices (BMPs), and to the upgrade of wastewater treatment plants.

**Total chloride**

The results of trend analysis for total chloride are presented in Appendix E, Table E5. Concentration values showed strongly increasing trends in Chemung River, Conowingo Creek, Deer Creek, Ebaughs Creek, Octoraro Creek, and Susquehanna River sites 44.5, 289.1, 340, and 365 (Table 19). Flow-adjusted concentrations indicated strongly increasing trends at Chemung River, Conowingo Creek, Deer Creek, Octoraro Creek, and Susquehanna River sites 44.5, 289.1, 340, and 365, and an increasing trend at Ebaughs Creek (Table 19). Overall, there was an increasing trend in both concentration and flow-adjusted concentrations, with average weighted values of 1.20 and 1.13, respectively (Tables 20 and 21).

**Total sulfate**

Trend analysis results for total sulfate are presented in Appendix E, Table E6. Concentration values at the stations showed strongly decreasing trends at Cayuta Creek, Chemung River, Cowanesque River, Tioga River, and Troups Creek, a decreasing trend at Scott Creek, and an increasing trend at Deer Creek (Table 19). Strongly decreasing trends were found at Cayuta Creek, Chemung River, Susquehanna River site 289.1, Tioga River, and Troups Creek, and decreasing trends at Cowanesque River and Susquehanna River 44.5, indicated by flow-adjusted concentrations (Table 19). There were no overall trends in concentrations and flow-adjusted concentrations, with weighted values of –0.67 and –0.80, respectively (Tables 20 and 21).

*Table 19. Trend Summary of Selected Parameters for Group 1 Streams, 1986-2001*

| Site | Total Solids | | Total Ammonia | | Total Nitrogen | | Total Phosphorus | | Total Chloride | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CONC | FAC | CONC | FAC | CONC | FAC | CONC | FAC | CONC | FAC |
| Cayuta Creek | 0 | 0 | DEC | DEC | dec | DEC | dec | dec | 0 | 0 |
| Chemung River | 0 | 0 | DEC | DEC | DEC | DEC | 0 | 0 | INC | INC |
| Conowingo Creek | 0 | 0 | dec | 0 | INC | INC | DEC | DEC | INC | INC |
| Cowanesque River | 0 | 0 | 0 | 0 | DEC | DEC | 0 | 0 | 0 | 0 |
| Deer Creek | 0 | 0 | DEC | 0 | 0 | 0 | DEC | DEC | INC | INC |
| Ebaughs Creek | 0 | 0 | DEC | dec | 0 | 0 | 0 | 0 | INC | inc |
| Octoraro Creek | 0 | 0 | DEC | 0 | 0 | 0 | DEC | 0 | INC | INC |
| Scott Creek | 0 | 0 | 0 | 0 | 0 | dec | 0 | 0 | 0 | 0 |
| Susquehanna River 10.0 | 0 | 0 | dec | 0 | dec | DEC | DEC | 0 | 0 | 0 |
| Susquehanna River 44.5 | 0 | 0 | DEC | dec | 0 | 0 | dec | dec | INC | INC |
| Susquehanna River 289.1 | 0 | 0 | DEC | DEC | DEC | DEC | DEC | DEC | INC | INC |
| Susquehanna River 340 | 0 | 0 | DEC | DEC | DEC | DEC | DEC | DEC | INC | INC |
| Susquehanna River 365 | 0 | 0 | DEC | DEC | DEC | DEC | DEC | DEC | INC | INC |
| Tioga River | dec | 0 | DEC | DEC | DEC | DEC | DEC | dec | 0 | 0 |
| Troups Creek | 0 | 0 | 0 | 0 | DEC | 0 | inc | 0 | 0 | 0 |

| Site | Total Sulfate | | Total Iron | | Total Aluminum | | Total Manganese | | WQI | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CONC | FAC | CONC | FAC | CONC | FAC | CONC | FAC | CONC | FAC |
| Cayuta Creek | DEC | DEC | DEC | 0 | 0 | 0 | DEC | DEC | 0 | 0 |
| Chemung River | DEC | DEC | DEC | DEC | 0 | 0 | DEC | DEC | 0 | 0 |
| Conowingo Creek | 0 | 0 | DEC | DEC | DEC | DEC | dec | 0 | DEC | 0 |
| Cowanesque River | DEC | dec | 0 | 0 | 0 | 0 | INC | 0 | 0 | 0 |
| Deer Creek | inc | 0 | DEC | DEC | dec | 0 | DEC | 0 | 0 | 0 |
| Ebaughs Creek | 0 | 0 | DEC | DEC | 0 | 0 | 0 | 0 | 0 | 0 |
| Octoraro Creek | 0 | 0 | DEC | 0 | dec | 0 | DEC | 0 | dec | 0 |
| Scott Creek | dec | 0 | 0 | 0 | 0 | 0 | dec | 0 | 0 | 0 |
| Susquehanna River 10.0 | 0 | 0 | DEC | DEC | dec | DEC | DEC | DEC | 0 | 0 |
| Susquehanna River 44.5 | 0 | dec | DEC | DEC | DEC | DEC | DEC | DEC | 0 | 0 |
| Susquehanna River 289.1 | 0 | DEC | DEC | DEC | dec | DEC | DEC | DEC | 0 | 0 |
| Susquehanna River 340 | 0 | 0 | DEC | DEC | 0 | 0 | 0 | 0 | 0 | 0 |
| Susquehanna River 365 | 0 | 0 | DEC | DEC | 0 | dec | 0 | 0 | 0 | 0 |
| Tioga River | DEC | DEC | dec | 0 | 0 | inc | DEC | DEC | 0 | 0 |
| Troups Creek | DEC | DEC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

INC Strong, Significant Increasing Trend; Probability < 5 %
inc Significant Increasing Trend; 5 % < Probability < 10 %
O No Significant Trend; Probability > 10%
dec Significant Decreasing Trend; 5 % < Probability < 10 %
DEC Strong, Significant Decreasing Trend; Probability < 5 %
CONC Concentrations
FAC Flow-Adjusted Concentrations

***Table 20. Trend Category Counts and Weighted Values of Concentrations for Group 1 Streams***

| Concentration | Trend Category Count | | | | | |
|---|---|---|---|---|---|---|
| | DEC | dec | O | inc | INC | Total |
| Total Solids | 0 | 1 | 14 | 0 | 0 | 15 |
| Total Ammonia | 10 | 2 | 3 | 0 | 0 | 15 |
| Total Nitrogen | 7 | 2 | 5 | 0 | 1 | 15 |
| Total Phosphorus | 8 | 2 | 4 | 1 | 0 | 15 |
| Total Chlorides | 0 | 0 | 6 | 0 | 9 | 15 |
| Total Sulfate | 5 | 1 | 8 | 1 | 0 | 15 |
| Total Iron | 11 | 1 | 3 | 0 | 0 | 15 |
| Total Aluminum | 2 | 4 | 9 | 0 | 0 | 15 |
| Total Manganese | 8 | 2 | 4 | 0 | 1 | 15 |
| Water Quality Index | 1 | 1 | 13 | 0 | 0 | 15 |

| Concentration | Weighted Values | | | | | | |
|---|---|---|---|---|---|---|---|
| | DEC | dec | O | inc | INC | Sum | Average Value* |
| Total Solids | 0 | -1 | 0 | 0 | 0 | -1 | -0.07 |
| Total Ammonia | -20 | -2 | 0 | 0 | 0 | -22 | -1.47 |
| Total Nitrogen | -14 | -2 | 0 | 0 | 2 | -14 | -0.93 |
| Total Phosphorus | -16 | -2 | 0 | 1 | 0 | -17 | -1.13 |
| Total Chlorides | 0 | 0 | 0 | 0 | 18 | 18 | 1.20 |
| Total Sulfate | -10 | -1 | 0 | 1 | 0 | -10 | -0.67 |
| Total Iron | -22 | -1 | 0 | 0 | 0 | -23 | -1.53 |
| Total Aluminum | -4 | -4 | 0 | 0 | 0 | -8 | -0.53 |
| Total Manganese | -16 | -2 | 0 | 0 | 2 | -16 | -1.07 |
| Water Quality Index | -2 | -1 | 0 | 0 | 0 | -3 | -0.20 |

DEC = -2 each
dec = -1 each
0 = 0 each
inc = 1 each
INC = 2 each

| *Average Value | |
|---|---|
| < - 1.50 | Strong Decreasing Trend |
| -1.5 to -1.00 | Decreasing Trend |
| -1.00 to 1.00 | No Trend |
| 1.00 to 1.50 | Increasing Trend |
| >1.50 | Strong Increasing Trend |

***Table 21. Trend Category Counts and Weighted Values of Flow-Adjusted Concentrations for Group 1 Streams***

| Concentration | Trend Category Count | | | | | |
|---|---|---|---|---|---|---|
| | DEC | dec | O | inc | INC | Total |
| Total Solids | 0 | 0 | 15 | 0 | 0 | 15 |
| Total Ammonia | 6 | 2 | 7 | 0 | 0 | 15 |
| Total Nitrogen | 8 | 1 | 5 | 0 | 1 | 15 |
| Total Phosphorus | 5 | 3 | 7 | 0 | 0 | 15 |
| Total Chlorides | 0 | 0 | 6 | 1 | 8 | 15 |
| Total Sulfate | 5 | 2 | 8 | 0 | 0 | 15 |
| Total Iron | 9 | 0 | 6 | 0 | 0 | 15 |
| Total Aluminum | 4 | 1 | 9 | 1 | 0 | 15 |
| Total Manganese | 6 | 0 | 9 | 0 | 0 | 15 |
| Water Quality Index | 0 | 0 | 15 | 0 | 0 | 15 |

| Concentration | *Weighted Values* | | | | | | |
|---|---|---|---|---|---|---|---|
| | DEC | dec | O | inc | INC | Sum | *Average* Value* |
| Total Solids | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Ammonia | -12 | -2 | 0 | 0 | 0 | -14 | -0.93 |
| Total Nitrogen | -16 | -1 | 0 | 0 | 2 | -15 | -1.00 |
| Total Phosphorus | -10 | -3 | 0 | 0 | 0 | -13 | -0.87 |
| Total Chlorides | 0 | 0 | 0 | 1 | 16 | 17 | 1.13 |
| Total Sulfate | -10 | -2 | 0 | 0 | 0 | -12 | -0.80 |
| Total Iron | -18 | 0 | 0 | 0 | 0 | -18 | -1.20 |
| Total Aluminum | -8 | -1 | 0 | 1 | 0 | -8 | -0.53 |
| Total Manganese | -12 | 0 | 0 | 0 | 0 | -12 | -0.80 |
| Water Quality Index | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

DEC = -2 each
dec = -1 each
0 = 0 each
inc = 1 each
INC =2 each

| *Average Value | |
|---|---|
| < - 1.50 | Strong Decreasing Trend |
| -1.5 to -1.00 | Decreasing Trend |
| -1.00 to 1.00 | No Trend |
| 1.00 to 1.50 | Increasing Trend |
| >1.50 | Strong Increasing Trend |

#### Total iron

Total iron trend analysis results are found in Appendix E, Table E7. Group 1 concentration values showed strongly decreasing trends at all Susquehanna River sites, Cayuta Creek, Chemung River, Conowingo Creek, Deer Creek, Ebaughs Creek, and Octoraro Creek, and a decreasing trend at Tioga River (Table 19). Flow-adjusted concentrations indicated similar results, with strongly decreasing trends at Chemung River, Conowingo Creek, Deer Creek, Ebaughs Creek, and all Susquehanna River sites (Table 19). Overall, there was a strongly decreasing trend in unadjusted concentrations (average value = -1.53), and a decreasing trend in flow-adjusted concentrations for iron (average value = -1.20) (Tables 20 and 21).

#### Total aluminum

The results of trend analysis for total aluminum are presented in Appendix E, Table E8. Concentration values at the Group 1 stations showed strongly decreasing trends at Conowingo Creek and Susquehanna River site 44.5, and a decreasing trend at Deer Creek, Octoraro Creek, and Susquehanna River sites 10.0 and 289.1 (Table 19). Flow adjusted concentration values showed strongly decreasing trends at Conowingo Creek, and Susquehanna River sites 10.0, 44.5, and 289.1, a decreasing trend at Susquehanna River site 365, and an increasing trend at Tioga River (Table 19). There was no overall trend, indicated by a weighted value of –0.53 for both the concentrations and flow-adjusted concentrations (Tables 20 and 21).

#### Total manganese

Trend analysis results for total manganese are presented in Appendix E, Table E9. Concentration values showed strongly decreasing trends at Cayuta Creek, Chemung River, Deer Creek, Octoraro Creek, Susquehanna River sites 10.0, 44.5, and 289.1, and Tioga River, decreasing trends at Conowingo Creek and Scott Creek, and a strongly increasing trend at Cowanesque River (Table 19). Flow-adjusted concentrations showed strongly decreasing tends at Cayuta Creek, Chemung River, Susquehanna River sites 10.0, 44.5, and 289.1, and Tioga River (Table 19). Overall, there was a decreasing trend in unadjusted manganese concentrations (average value = -1.07), but not flow adjusted concentrations with a value of –0.80 (Tables 20 and 21).

#### Water quality index

Trend analysis results for the water quality index are presented in Appendix E, Table E10. Concentration values at the stations showed a strongly decreasing trend at Conowingo Creek. A decreasing trend was found at Octoraro Creek (Table 19). Flow-adjusted concentrations had no trends (Table 19). There were no overall trends for WQI values with an average weighted value of –0.20 for concentrations and an average weighted value of zero for flow-adjusted concentrations (Tables 20 and 21).

## BIOASSESSMENT OF INTERSTATE STREAMS

Abbreviations for water quality standards are provided in Table 22. Summaries of all stations include WQI scores, parameters that exceeded water quality standards, and parameters that exceeded the 90$^{th}$ percentile at each station. RBP III biological and habitat data also are provided, along with graphs depicting historical water quality and biological conditions over the past five years. A white bar indicates fiscal year 2001 WQI scores, and black bars in all WQI graphs indicate previous WQI scores.

### New York-Pennsylvania Border Streams

#### Apalachin Creek (APAL 6.9)

Apalachin Creek at Little Meadows, Pa., (APAL 6.9) showed a nonimpaired biological community during fiscal year 2001, increased from a moderately impaired designation the previous year. The ratio of EPT/Chironomids (4.91) was the highest and the percent dominant taxa value (18.2) was the lowest of all the New York-Pennsylvania border streams.

*Table 22. Abbreviations Used in Tables 23 Through 53*

| Abbreviation | Parameter |
|---|---|
| ALK | Alkalinity |
| COND | Conductivity |
| DAl | Dissolved Aluminum |
| TAl | Total Aluminum |
| TCa | Total Calcium |
| TCl | Total Chloride |
| DFe | Dissolved Iron |
| TFe | Total Iron |
| TMg | Total Magnesium |
| DMn | Dissolved Manganese |
| TMn | Total Manganese |
| DNH3 | Dissolved Ammonia |
| TNH3 | Total Ammonia |
| DNO2 | Dissolved Nitrite |
| TNO2 | Total Nitrite |
| DNO3 | Dissolved Nitrate |
| TNO3 | Total Nitrate |
| DN | Dissolved Nitrogen |
| TN | Total Nitrogen |
| DO | Dissolved Oxygen |
| DP | Dissolved Phosphorus |
| TP | Total Phosphorus |
| DPO4 | Dissolved Orthophosphate |
| TPO4 | Total Orthophosphate |
| DS | Dissolved Solids |
| TS | Total Solids |
| TSO4 | Total Sulfate |
| TOC | Total Organic Carbon |
| TURB | Turbidity |
| WQI | Water Quality Index |
| RBP | Rapid Bioassessment Protocol |

Total iron exceeded water quality standards during July 2000, as in July 1999. Turbidity also exceeded the 90th percentile, and the water quality index increased slightly from the previous year as it has done over the past five years (Table 23).

**Bentley Creek (BNTY 0.9)**

A slightly impaired biological community existed at Bentley Creek at Wellsburg, N.Y. (BNTY 0.9). Biological conditions at BNTY 0.9 have been impaired for the past 10 years. This could be due to heavy disturbance in this stream due to dredging and the unstable nature of this stream. Even though the habitat has been rated as nonsupporting in the past years, the current assessment occurred in a relatively stable portion of the stream, earning it a much higher rating. Furthermore, the Bradford County Conservation District and the United States Fish and Wildlife Service are conducting a stream stabilization project on this stream. Rock structures, such as cross vanes and single rock vanes, have been constructed into portions of the stream to redirect the force of the flow and create a more stable channel.

During fiscal year 2000, water quality sampling at BNTY 0.9 was increased to quarterly sampling, and the stream was added to the Group 1 stations. Total iron concentrations exceeded New York standards during February and May 2000, but no exceedances were found in fiscal year 2001. Additionally, total ammonia, dissolved oxygen, and total orthophosphates exceeded the 90th percentile during the 1999–2000 sampling period, but no parameters exceeded the 90th percentile in the 2000–2001 sampling period (Table 24).

**Cascade Creek (CASC 1.6)**

Despite high levels of iron, Cascade Creek at Lanesboro, Pa., (CASC 1.6) showed a nonimpaired macroinvertebrate community compared to the other New York-Pennsylvania border streams. There were 14 organic pollution-intolerant taxa located at CASC 1.6 including *Dicranota* and *Hexatoma* (Diptera: Tipulidae); *Epeorus* and *Stenonema* (Ephemeroptera: Heptageniidae); *Isonychia* (Ephemeroptera: Isonychiidae); *Nigronia* (Megaloptera: Corydalidae); *Boyeria* (Odonata: Aeshnidae); *Haploperla*, *Suwallia*, and *Sweltsa* (Plecoptera: Chloroperlidae); *Acroneuria* (Plecoptera: Perlidae); *Pteronarcys* (Plecoptera: Pteronarcyidae); and *Dolophilodes* and *Wormaldia* (Trichoptera: Philopotamidae). The habitat was excellent and consisted of approximately 50 percent coniferous forest with numerous fallen trees in the stream.

Cascade Creek was added to the Group 1 streams during the 2000 sampling season to monitor conditions in the stream during the winter months. Water quality standards for total iron, dissolved iron, and alkalinity were exceeded during the 2000-2001 sampling period (Table 25). Values of pH had improved from the previous year and no longer exceeded the standards. Iron values fluctuated throughout the year and were highest during the low flow seasons.

**Cayuta Creek (CAYT 1.7)**

Biological conditions of Cayuta Creek at Waverly, N.Y., (CAYT 1.7) were designated slightly impaired, same as the previous year. The water quality conditions appear to have degraded over the past five years and were best during the years when the biological condition was nonimpaired (1996 and 1998). Water quality standards for pH were exceeded at CAYT 1.7. Many parameters exceeded the 90th percentile including conductivity, total and dissolved nitrates, total and dissolved phosphorus, total and dissolved orthophosphate, total chloride, total and dissolved nitrogen, total and dissolved solids, and total and dissolved nitrites (Table 26).

Poor water quality conditions may be due to a variety of causes, including wastewater discharges from the Waverly sewage treatment facility, runoff from the city of Waverly, failure of upstream septic systems, or agriculture. More detailed studies would need to be performed in order to determine the cause of impairment.

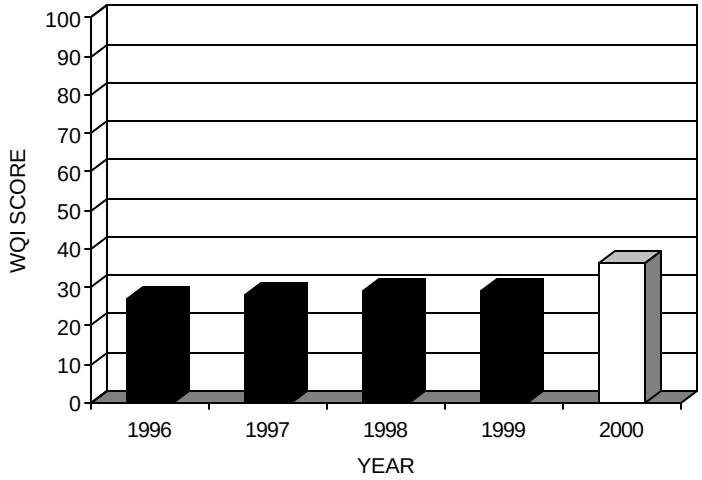
Cayuta Creek showed several downward trends for total concentrations. Total nitrogen and total phosphorus showed a significant decreasing trend ($0.05<p<0.10$), while strong, significant

*Table 23. Water Quality Summary Apalachin Creek at Little Meadows, Pa.*

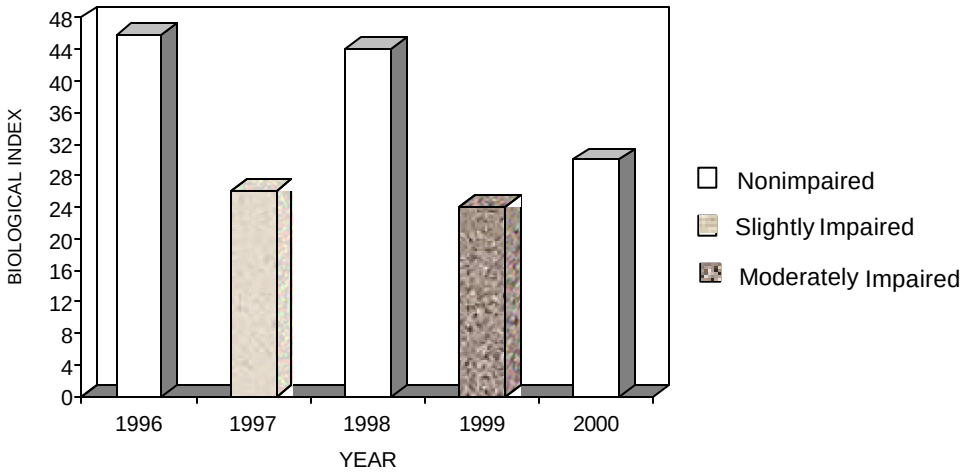
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| TFe | 07/26/00 | 567 µg/l | 300 µg/l | N.Y. aquatic (chronic) |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/26/00 | 36.5 | TURB | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 24 |
| Diversity Index | 2.6 |
| RBP Score | 30 |
| RBP Condition | Nonimpaired |
| Total Habitat Score | 170 |
| Habitat Condition Category | Supporting |




**Water Quality Index**



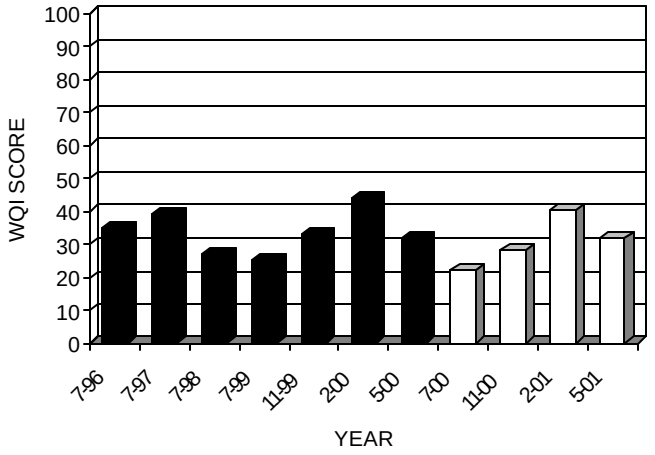

**Biological Index**

*Table 24. Water Quality Summary Bentley Creek at Wellsburg, N.Y.*

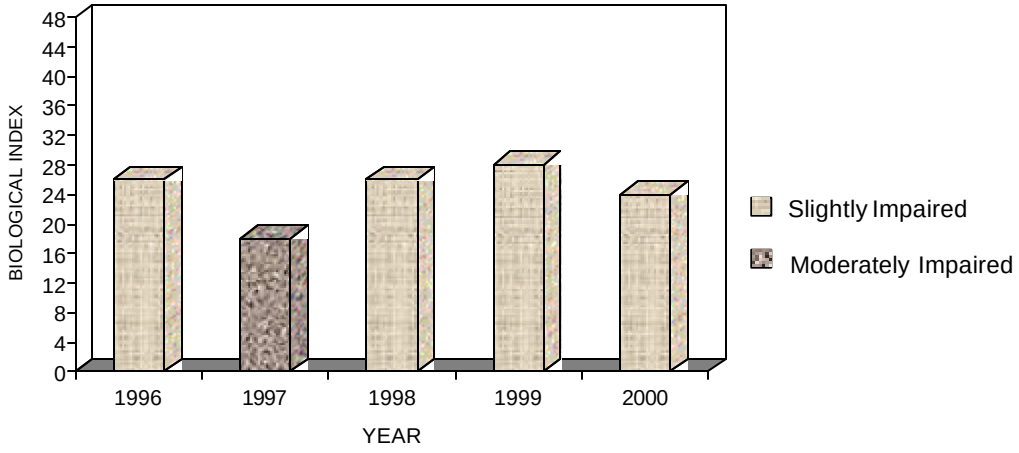
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/25/00 | 22.2 | None | | | | | | | |
| 11/07/00 | 28 | None | | | | | | | |
| 02/07/01 | 40.2 | None | | | | | | | |
| 05/08/01 | 31.8 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 22 |
| Diversity Index | 2.2 |
| RBP III Score | 24 |
| RBP III Condition | Slightly Impaired |
| Total Habitat Score | 208 |
| Habitat Condition Category | Excellent |




**Water Quality Index**



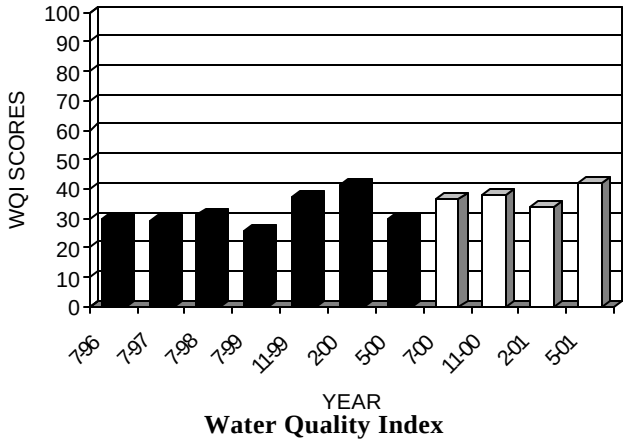

**Biological Index**

***Table 25. Water Quality Summary Cascade Creek at Lanesboro, Pa.***

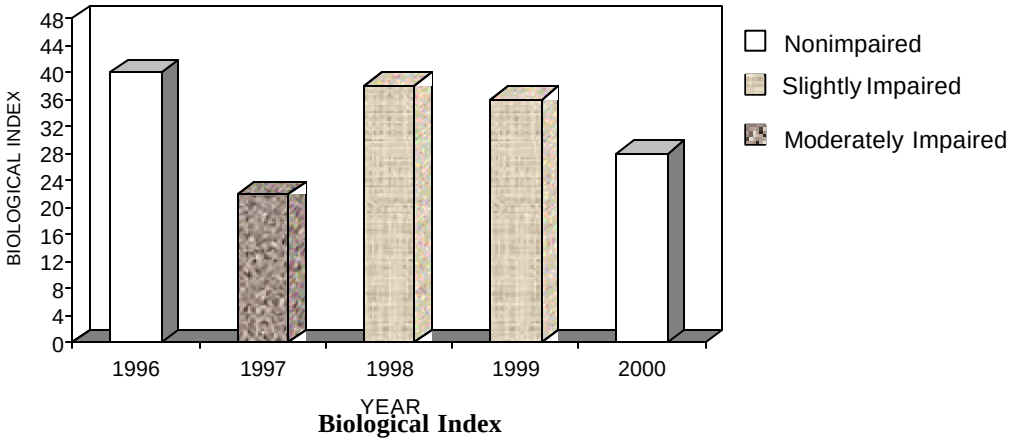
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| TFe | 07/26/00 | 811 µg/l l | 300 µg/l | N.Y. aquatic (chronic) |
| DFe | 07/26/00 | 467 µg/l | 300 µg/l | Pa. aquatic life |
| TFe | 11/06/00 | 608 µg/l l | 300 µg/l | N.Y. aquatic (chronic) |
| ALK | 02/06/01 | 10 mg/l | 20 mg/l | Pa. aquatic life |
| TFe | 05/07/01 | 500 µg/l | 300 µg/l | N.Y. aquatic (chronic) |
| DFe | 05/07/01 | 301 µg/l | 300 µg/l | Pa. aquatic life |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/26/00 | 36.3 | TURB | TFe | DFe | | | | | |
| 11/06/00 | 38.2 | TURB | TFe | DFe | | | | | |
| 02/06/01 | 33.9 | DFe | | | | | | | |
| 05/07/01 | 42.1 | TFe | DFe | DO | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 26 |
| Diversity Index | 2.4 |
| RBP III Score | 28 |
| RBP III Condition | Nonimpaired |
| Total Habitat Score | 199 |
| Habitat Condition Category | Excellent |




**Water Quality Index**



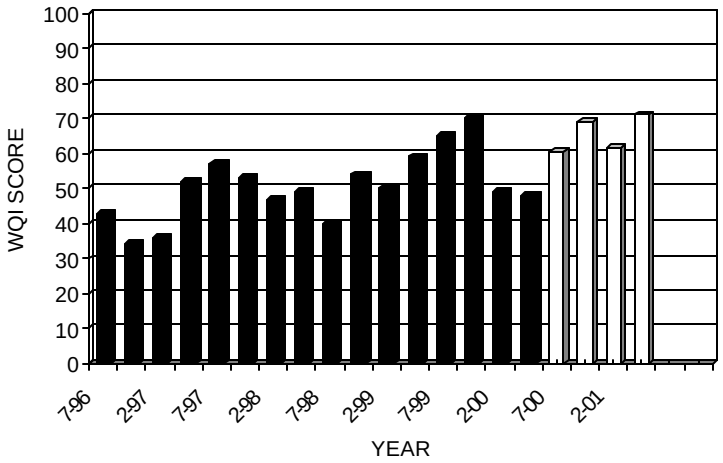

**Biological Index**

*Table 26. Water Quality Summary Cayuta Creek at Waverly, N.Y.*

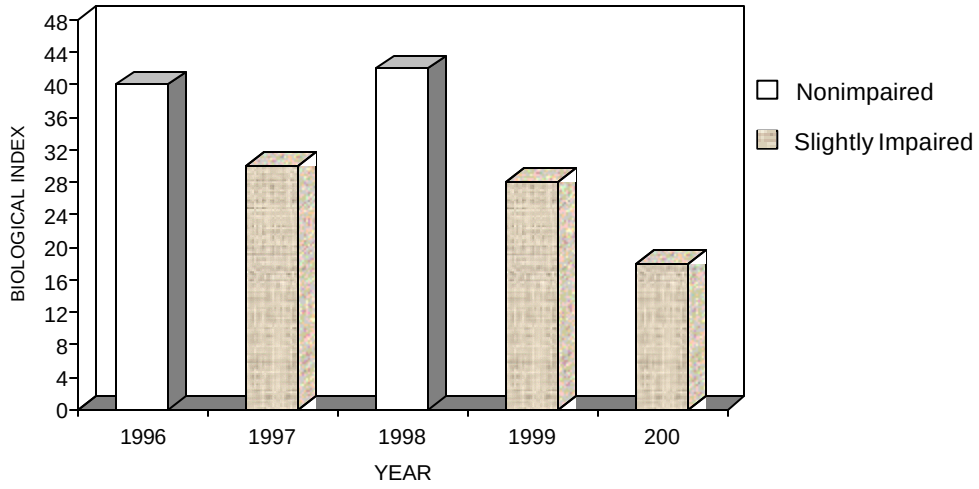
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| pH | 11/06/00 | 9.0 | 6.5-8.5 | N.Y. general |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 7/25/00 | 60.6 | COND | TNO3 | DNO3 | TP | DP | TPO4 | DPO4 | TCl |
| | | TN | DN | | | | | | |
| 11/06/00 | 69 | COND | DS | TNO3 | DNO3 | TP | DP | TPO4 | DPO4 |
| | | TCl | TN | DN | | | | | |
| 02/06/01 | 61.7 | TNO2 | DNO2 | | | | | | |
| 05/08/01 | 71.1 | COND | TS | DS | TNO2 | TNO3 | TP | DP | TPO4 |
| | | DPO4 | TCl | TN | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 18 |
| Diversity Index | 2.1 |
| RBP Score | 18 |
| RBP Condition | Slightly Impaired |
| Total Habitat Score | 181 |
| Habitat Condition Category | Supporting |




**Water Quality Index**




**Biological Index**

decreasing trends ($p<0.05$) were observed for total ammonia, total sulfate, total iron, and total manganese (Table 19). When flow-adjusted concentrations were calculated, total phosphorus showed a significant decreasing trend, while total ammonia, total nitrogen, total sulfate, and total manganese showed strong, significant decreasing trends (Table 19).

**Choconut Creek (CHOC 9.1)**

During fiscal year 2001, the biological community of Choconut Creek at Vestal Center, N.Y., (CHOC 9.1) was designated nonimpaired for the fourth consecutive year. CHOC 9.1 had several organic pollution-intolerant taxa, including *Atherix* (Diptera: Athericidae), *Antocha* (Diptera: Tipulidae), *Dicranota*, *Hexatoma*, *Stenonema*, *Isonychia*, *Nigronia*, *Ophiogomphus* (Odonata: Gomphidae), *Sweltsa*, *Leuctra* (Plecoptera: Leuctridae), *Acroneuria*, and *Agnetina* (Plecoptera: Perlidae).

No parameters exceeded standards during July 2000, and water quality analysis indicated that water quality conditions were comparable to the reference site. No parameters exceeded the 90$^{th}$ percentile (Table 27). Impairment during 1996 may have been due to rechannelization as evidenced by large amounts of riprap at the site.

**Little Snake Creek (LSNK 7.6)**

Little Snake Creek at Brackney, Pa., (LSNK 7.6) showed a nonimpaired biological community in July 2000, and served as the reference site for New York-Pennsylvania border streams. This site was chosen as the reference site since it had the best values in taxonomic richness, EPT, Shannon-Weaver Diversity Index, and Hilsenhoff Biotic Index metrics, and had a high habitat score. This sample had many taxa scoring a three or lower in the Hilsenhoff Biotic Index, including *Atherix*, *Dicranota*, *Isonychia*, *Nigronia*, *Boyeria*, *Sweltsa*, *Leuctra*, *Acroneuria*, *Paragnetina* (Plecoptera: Perlidae), *Pteronarcys*, *Dolophilodes*, and *Wormaldia*.

Even though a healthy macroinvertebrate community exists at this sampling site, the water quality exceeds standards in iron, aluminum, and alkalinity (Table 28). This suggests that the water quality fluctuates or the particular species that are present are tolerant of these conditions. The WQI was higher than it was in previous years, so the water samples may have been taken during poor water quality episodes or the condition of this stream is degrading. The habitat at this site was largely forested with a beaver dam located approximately 75 yards upstream.

**Seeley Creek (SEEL 10.3)**

Seeley Creek at Seeley Creek, N.Y., (SEEL 10.3) contained a moderately impaired biological community for the past four years. In July 2000, this site scored the worst of the New York-Pennsylvania border streams in taxonomic richness, EPT Index, percent dominant taxa, Shannon-Weaver Diversity Index, and Hilsenhoff Biotic Index metrics. Chironomidae (Diptera) heavily dominated this site. During the 1999-2000 sampling season, Seeley Creek was added to the Group 1 streams in the ISWQN. Water quality analysis indicated fairly good water quality conditions in the stream with no parameters exceeding standards and only dissolved oxygen and total sulfate exceeding the 90$^{th}$ percentile (Table 29).

Habitat conditions appear to be a possible cause for the moderately impaired macroinvertebrate community. New York State Department of Conservation (NYSDEC) listed Seeley Creek as "threatened" in their publication, The 1998 Chemung River Basin Waterbody Inventory and Priority Waterbodies List (NYSDEC, 1998). According to this publication, the stream is threatened by habitat alteration, streambank erosion, and instability of the stream channel. SRBC staff saw evidence of dredging and noted unstable substrate in the habitat assessment.

**Snake Creek (SNAK 2.3)**

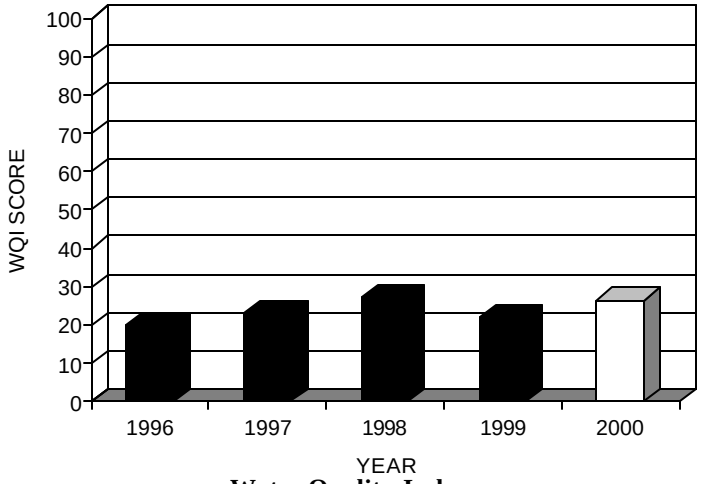
Snake Creek at Brookdale, Pa., (SNAK 2.3) had a nonimpaired biological community and excellent physical habitat, with a relatively low WQI score (Table 30). The biological community has remained nonimpaired for at least the past five years, and this site has served as a reference site in

*Table 27. Water Quality Summary Choconut Creek at Vestal Center, N.Y.*

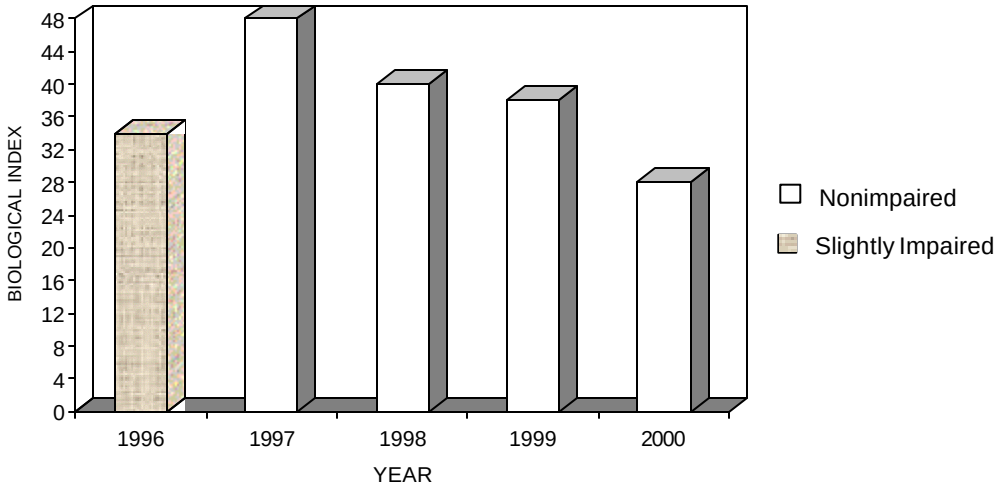
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/26/00 | 26.4 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 23 |
| Diversity Index | 2.6 |
| RBP Score | 28 |
| RBP Condition | Nonimpaired |
| Total Habitat Score | 183 |
| Habitat Condition Category | Supporting |




**Water Quality Index**



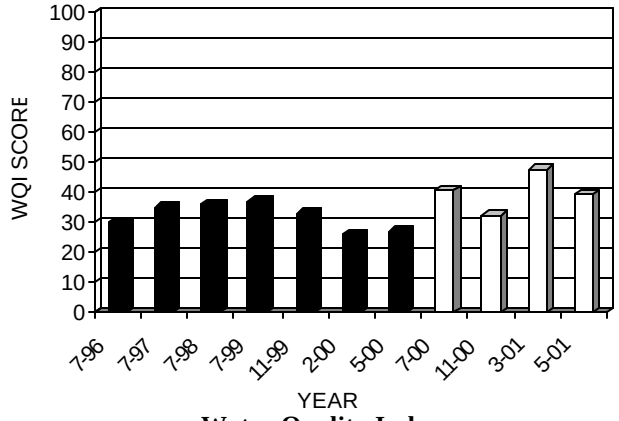

**Biological Index**

***Table 28. Water Quality Summary Little Snake Creek at Brackney, Pa.***

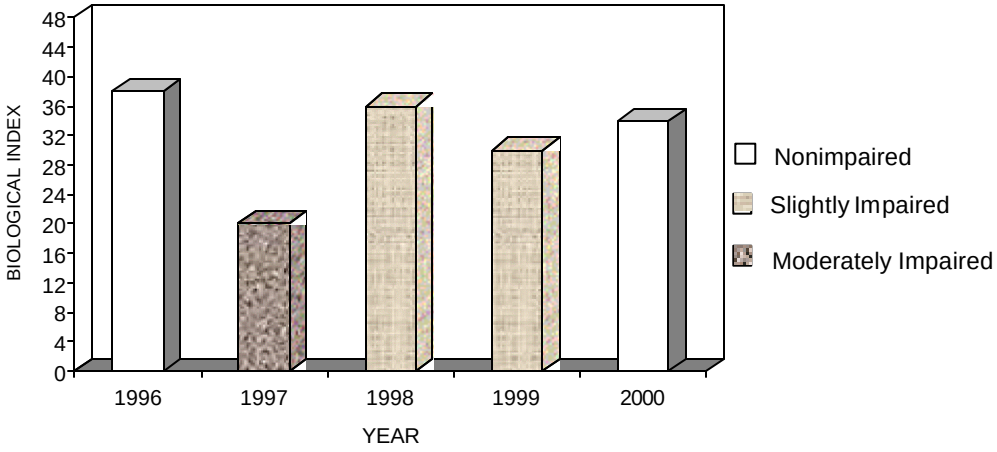
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| TFe | 07/26/00 | 781 µg/l | 300 µg/l | N.Y. aquatic (chronic) |
| DFe | 07/26/00 | 307 µg/l | 300 µg/l | Pa. aquatic life |
| TFe | 03/13/01 | 484 µg/l | 300 µg/l | N.Y. aquatic (chronic) |
| TAl | 03/13/01 | 308 µg/l | 100 µg/l | N.Y. aquatic (chronic) |
| ALK | 03/13/01 | 12 mg/l | 20 mg/l | Pa. aquatic life |
| TFe | 05/08/01 | 351 µg/l | 300 µg/l | N.Y. aquatic (chronic) |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/26/00 | 40.6 | TFe | DMn | | | | | | |
| 11/06/00 | 32.5 | None | | | | | | | |
| 03/13/01 | 47.6 | TFe | DFe | TAl | TURB | | | | |
| 05/08/01 | 39.3 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 30 |
| Diversity Index | 2.7 |
| RBP III Score | 34 |
| RBP III Condition | Reference |
| Total Habitat Score | 208 |
| Habitat Condition Category | Reference |




**Water Quality Index**



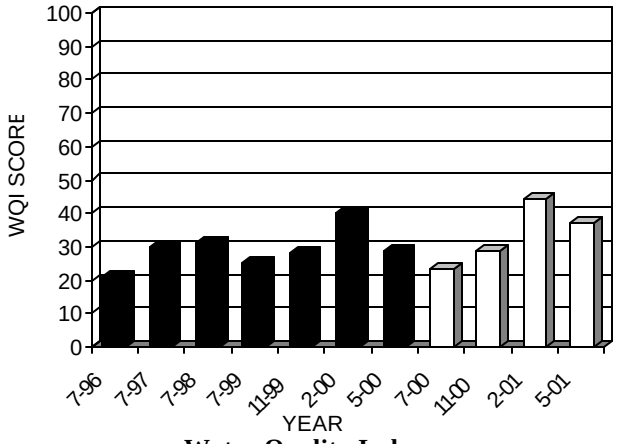

**Biological Index**

***Table 29. Water Quality Summary Seeley Creek at Seeley Creek, N.Y.***

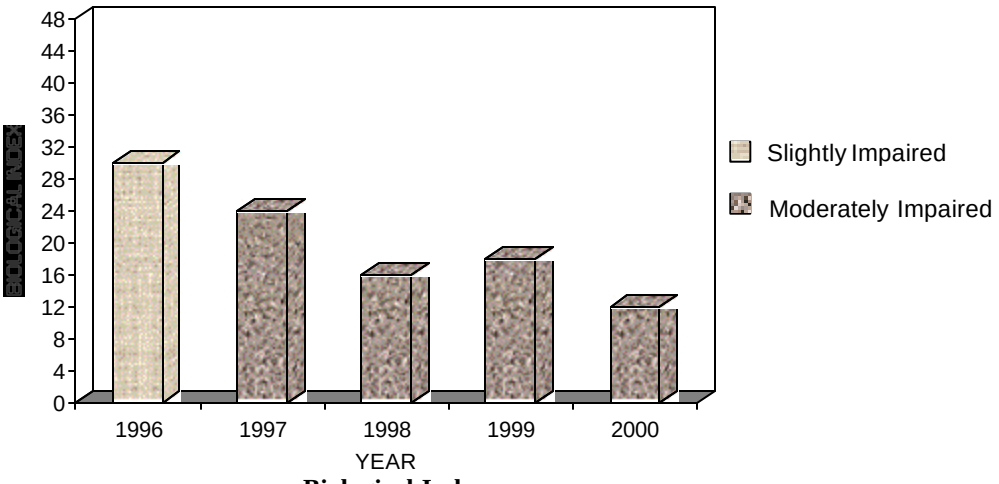
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/25/00 | 23.6 | None | | | | | | | |
| 11/07/00 | 29 | DO | | | | | | | |
| 02/07/01 | 44.1 | DO | | | | | | | |
| 05/08/01 | 37 | TSO4 | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 16 |
| Diversity Index | 1.8 |
| RBP III Score | 12 |
| RBP III Condition | Moderately Impaired |
| Total Habitat Score | 168 |
| Habitat Condition Category | Supporting |




**Water Quality Index**



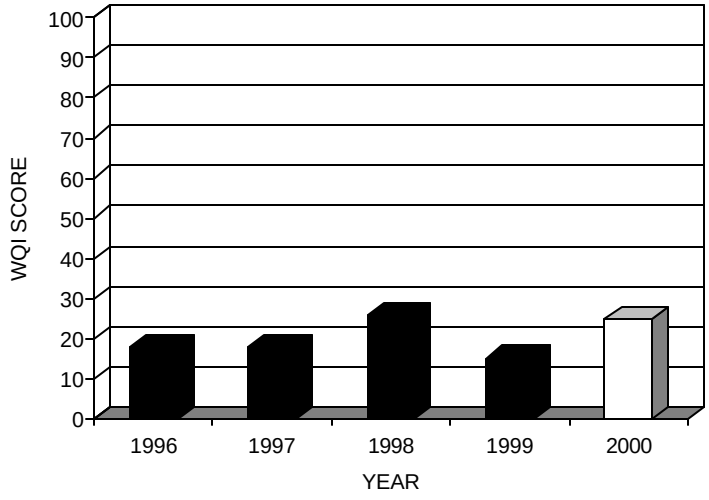

**Biological Index**

*Table 30. Water Quality Summary Snake Creek at Brookdale, Pa.*

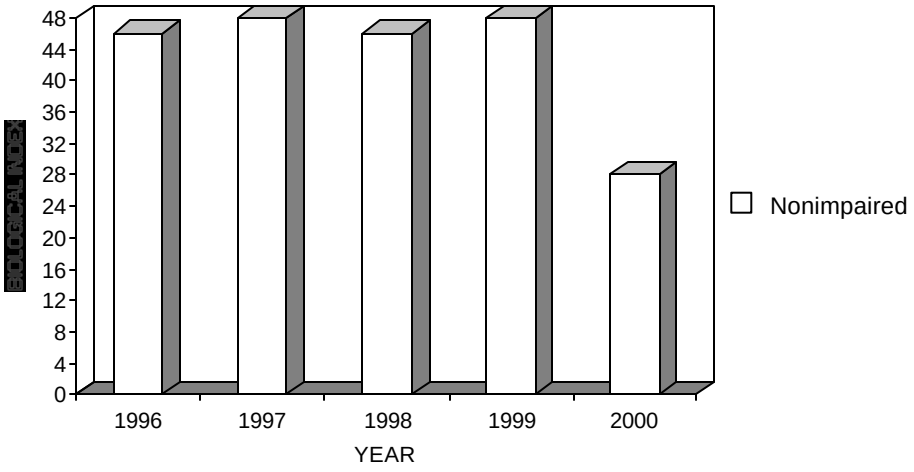
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/26/00 | 24.8 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 22 |
| Diversity Index | 2.4 |
| RBP III Score | 28 |
| RBP III Condition | Nonimpaired |
| Total Habitat Score | 207 |
| Habitat Condition Category | Excellent |




**Water Quality Index**




**Biological Index**

previous reports. Snake Creek supported many pollution-intolerant taxa, including *Atherix*, *Stenonema*, *Isonychia*, *Nigronia*, *Acroneuria*, *Paragnetina*, and *Dolophilodes*. The sampling site was in a predominantly forested area with sufficient amounts of shade provided to the stream.

SRBC staff conducted a small watershed study on the Snake Creek Watershed during the second year of the Upper Susquehanna Subbasin Survey (Diehl and Sitlinger, 2001). Ten sites in the Snake Creek Watershed and three sites on the Little Snake Creek Watershed were monitored during low and high flow for water quality, macroinvertebrates, and physical habitat. It was concluded that the Snake Creek Watershed was healthy, and it was recommended that this watershed be protected. The Little Snake Creek Watershed showed signs of heavy dredging and it was recommended that the riparian vegetation along areas of the stream be reestablished.

**South Creek (SOUT 7.8)**

During fiscal year 2001, South Creek at Fassett, Pa., (SOUT 7.8) showed a slightly impaired biological community. The macroinvertebrate community at this site has fluctuated in its degree of impairment throughout the past five years between moderately impaired, slightly impaired, and nonimpaired. However, for the years prior to 1996, a slightly to moderately impaired macroinvertebrate population had inhabited this site.

Water quality at SOUT 7.8 was fair for a Group 2 New York-Pennsylvania stream, with no parameters exceeding standards or the 90$^{th}$ percentile (Table 31). No parameters were exceeded in the previous year either and the WQI remained relatively the same, only increasing slightly. Impairment of the biological community at this site may be due to periodic drying of the streambed or to poor habitat diversity.

**Troups Creek (TRUP 4.5)**

Troups Creek at Austinburg, Pa., (TRUP 4.5) had a slightly impaired biological community. This site also has fluctuated in its degree of impairment between moderately impaired, slightly impaired, and nonimpaired. Total aluminum and pH exceeded the New York standards. The only parameters to exceed the 90$^{th}$ percentile were dissolved nitrate and turbidity. The WQI seems to have improved from previous years (Table 32).

Troups Creek showed a strong, significant decreasing trend in total sulfate in both concentrations and flow-adjusted concentrations. The stream also showed a strong, significant decreasing trend in total nitrogen, and a significant increasing trend in total phosphorus unadjusted concentrations (Table 19).

**Trowbridge Creek (TROW 1.8)**

Despite good water quality, Trowbridge Creek at Great Bend, Pa., (TROW 1.8) had a slightly impaired biological community. Impaired biological conditions at this site may be due to low flow conditions at the time of sampling or poor water quality episodes during other seasons of the year. The location of the site also may contribute to the impaired designation of the site. TROW 1.8 is located directly adjacent to a road and near a dump pile, which may lead to an influx of pollutants. In the past, chemically treated grass clippings were deposited in the stream, as reported by local residents.

During the time of sampling, TROW 1.8 had the lowest WQI score (20.9) of the New York-Pennsylvania border streams in 2000, as in previous years (Table 33). No parameters exceeded water quality standards or the 90$^{th}$ percentile.

**Wappasening Creek (WAPP 2.6)**

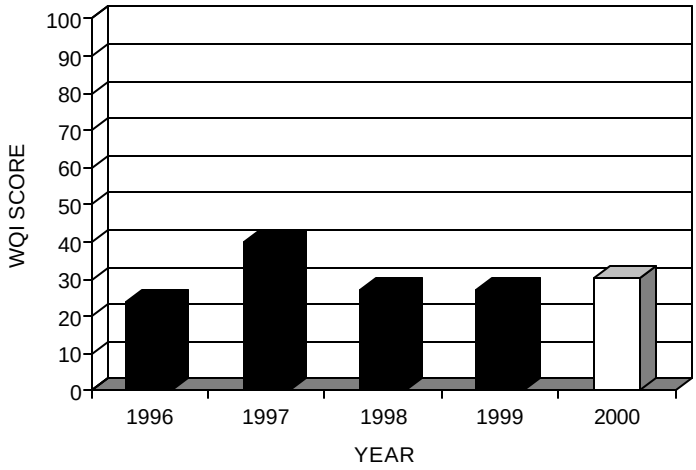
The biological index rating for Wappasening Creek at Nichols, N.Y., (WAPP 2.6) decreased from slightly impaired to moderately impaired during fiscal year 2001. The past three years have shown an increase in impairment at WAPP 2.6 (Table 34). This site scored poorly in many of the metrics, in particular taxonomic richness, percent dominant taxa, and Shannon-Weaver Diversity Index.

*Table 31. Water Quality Summary South Creek at Fassett, Pa.*

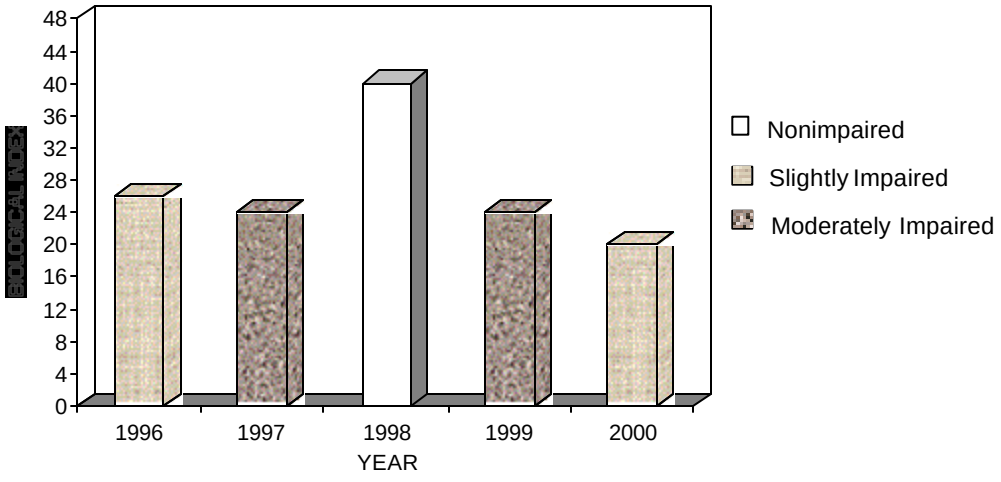
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/25/00 | 30.5 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 18 |
| Diversity Index | 2.2 |
| RBP III Score | 20 |
| RBP III Condition | Slightly Impaired |
| Total Habitat Score | 177 |
| Habitat Condition Category | Supporting |




**Water Quality Index**



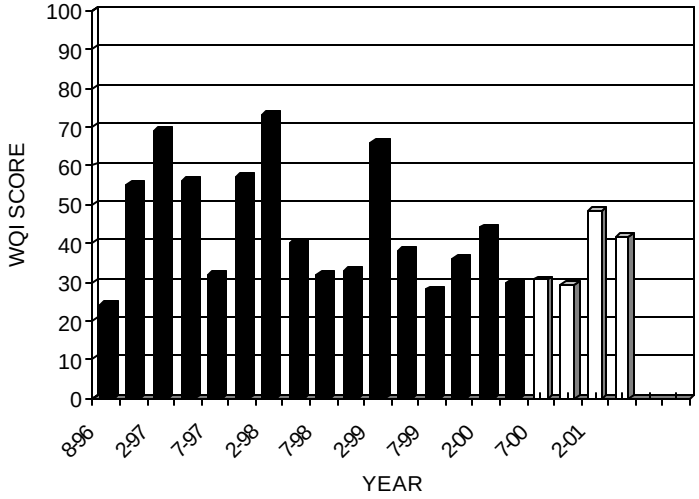

**Biological Index**

***Table 32. Water Quality Summary Troups Creek at Austinburg, Pa.***

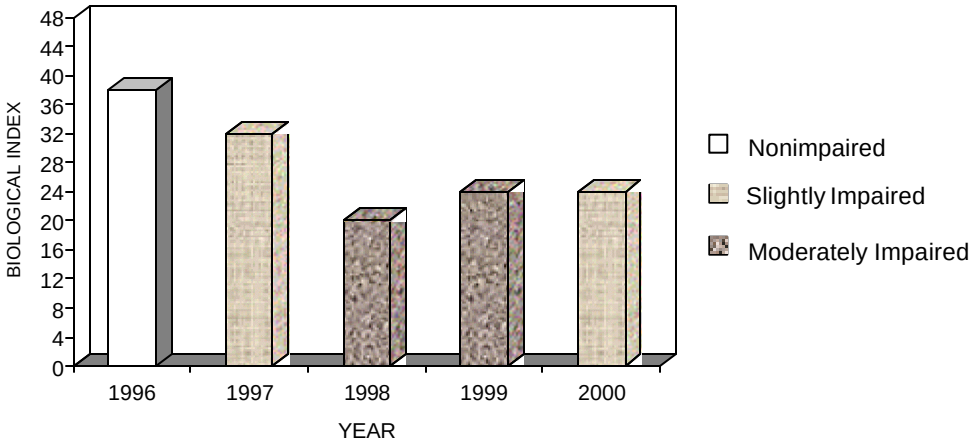
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| TAl | 02/07/01 | 237 µg/l | 100 µg/l | N.Y. aquatic (chronic) |
| pH | 05/09/01 | 8.8 | 6.5 – 8.5 | N.Y. general |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/24/00 | 30.6 | DNO3 | | | | | | | |
| 11/07/00 | 29.4 | None | | | | | | | |
| 02/07/01 | 48.2 | None | | | | | | | |
| 05/09/01 | 41.8 | TURB | | | | | | | |

| **Biological and Habitat Summary** | |
|---|---|
| Number of Taxa | 20 |
| Diversity Index | 2.3 |
| RBP Score | 24 |
| RBP Condition | Slightly Impaired |
| Total Habitat Score | 172 |
| Habitat Condition Category | Supporting |




**Water Quality Index**



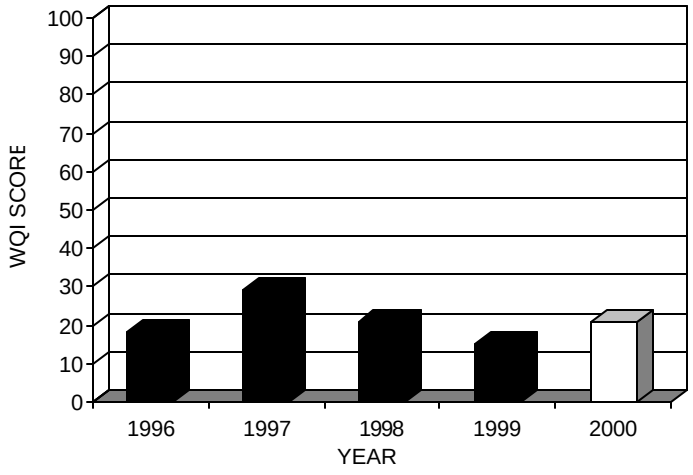

**Biological Index**

*Table 33. Water Quality Summary Trowbridge Creek at Great Bend, Pa.*

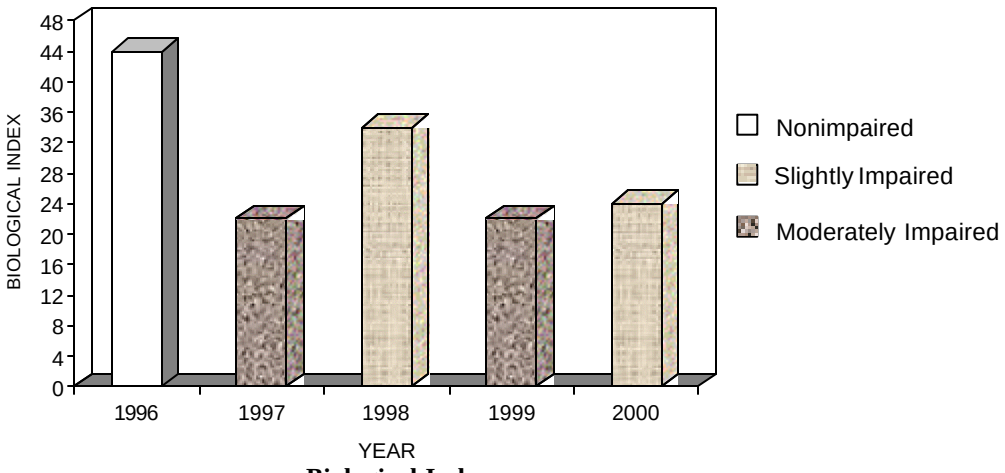
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0726/00 | 20.9 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 22 |
| Diversity Index | 2.1 |
| RBP III Score | 24 |
| RBP III Condition | Slightly Impaired |
| Total Habitat Score | 183 |
| Habitat Condition Category | Supporting |




**Water Quality Index**



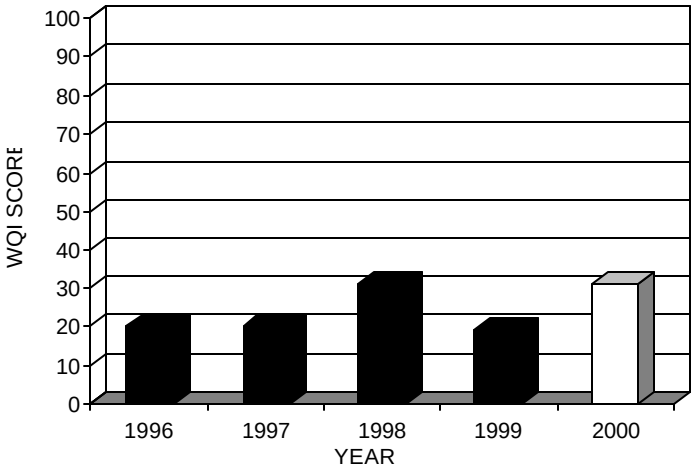

**Biological Index**

***Table 34. Water Quality Summary Wappasening Creek at Nichols, N.Y.***

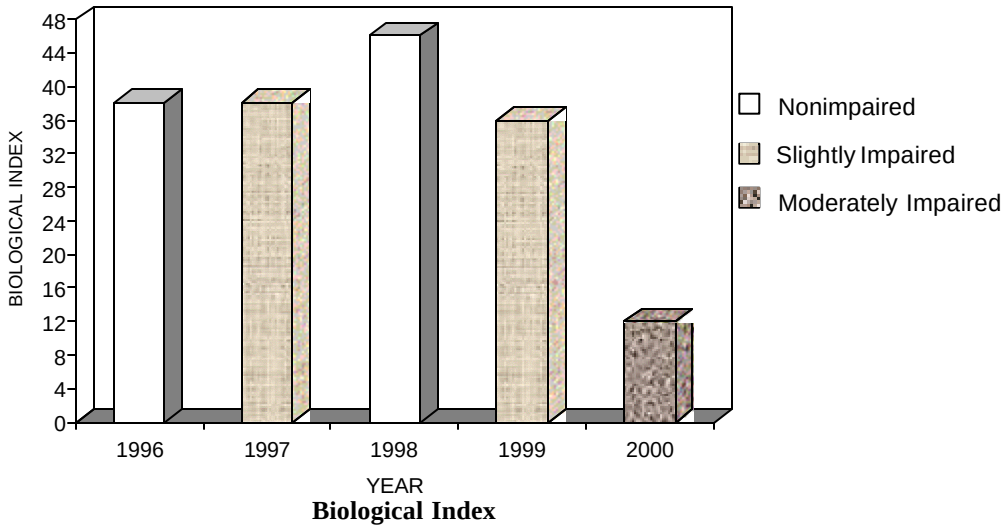
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/26/00 | 31 | DNO3 | | | | | | | |

| **Biological and Habitat Summary** | |
|---|---|
| Number of Taxa | 17 |
| Diversity Index | 2.0 |
| RBP Score | 12 |
| RBP Condition | Moderately Impaired |
| Total Habitat Score | 213 |
| Habitat Condition Category | Excellent |




**Water Quality Index**




**Biological Index**

The water quality does not show significant evidence of degradation. No parameters exceeded water quality standards and dissolved nitrate was the only parameter that exceeded the 90th percentile.

#### North Fork Cowanesque River (NFCR 7.6)

A slightly impaired biological community was present at North Fork Cowanesque River at North Fork, Pa., (NFCR 7.6) in July 2000. The EPT/Chironomidae ratio for this sample was the lowest of the New York-Pennsylvania border streams. SRBC resumed sampling at NFCR 7.6 only recently in 1998 after terminating sampling in July 1992. In 1992, NFCR 7.6 had a nonimpaired biological community; however, the samples in 1998 and 2000 were slightly impaired. NFCR 7.6 was not sampled in 1999 due to drought conditions.

Total aluminum was high in July 2000 and exceeded New York water quality standards. In 1998, levels of iron had exceeded New York water quality standards. The parameters that exceeded the 90th percentile were total and dissolved nitrate, total aluminum, and total and dissolved nitrogen (Table 35). This site was located at a pipeline and adjacent to a cornfield, which may be subject to occasional spraying of herbicides and pesticides.

### Pennsylvania-Maryland Streams

#### Big Branch Deer Creek (BBDC 4.1)

Big Branch Deer Creek at Fawn Grove, Pa., (BBDC 4.1) served as the reference site for the Pennsylvania-Maryland border streams during August 2000. This site had the best combination of biological community and physical habitat of the Pennsylvania-Maryland streams. BBDC 4.1 had the best values for percent dominant taxa and Shannon-Weaver Diversity Index metrics. A large number of organic pollution intolerant taxa inhabited this site including *Antocha*, *Centroptilum* (Ephemeroptera: Baetidae), *Serratella* (Ephemeroptera: Ephemerellidae), *Epeorus*, *Stenonema*, *Isonychia*, *Nigronia*, *Leuctra*, *Acroneuria*, *Agnetina*, *Dolophilodes*, and *Rhyacophila* (Trichoptera: Rhyacophilidae). The biological community has been nonimpaired for the past five years. Water quality was good in Big Branch Deer Creek in August 2000 as in previous years, with no parameters exceeding standards or the 90th percentile (Table 36). The land use for this site is predominantly forest.

#### Conowingo Creek (CNWG 4.4)

Conowingo Creek at Pleasant Grove, Pa., (CNWG 4.4) had a slightly impaired community although the EPT/Chironomidae ratio was the highest at CNWG 4.4 of all the Pennsylvania-Maryland streams. This watershed is in an agricultural area and the habitat at this site was considered supporting. Dissolved oxygen values for August 2000 were below both Pennsylvania and Maryland standards for aquatic life. Water quality analysis indicated that nitrates, aluminum, turbidity, nitrogen, nitrite, solids, manganese, and total sulfates were elevated and dissolved oxygen was reduced (Table 37). As agriculture is the area's prevalent land use, it appears that the stream was enriched by agricultural runoff.

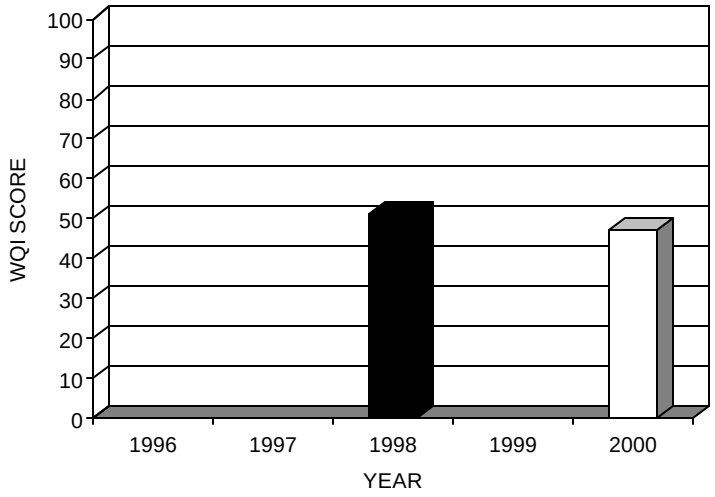
Conowingo Creek had a variety of upward and downward trends. Strong significant increasing trends occurred for total nitrogen and total chloride in both unadjusted and flow-adjusted concentrations. Strong, significant decreasing trends for both unadjusted and flow-adjusted concentrations were found for total phosphorus, total iron, and total aluminum. A strong, significant decreasing trend occurred for unadjusted WQI values, and significant decreasing trends occurred for unadjusted concentrations of total ammonia and total manganese (Table 19).

*Table 35. Water Quality Summary North Fork Cowanesque River at North Fork, Pa.*

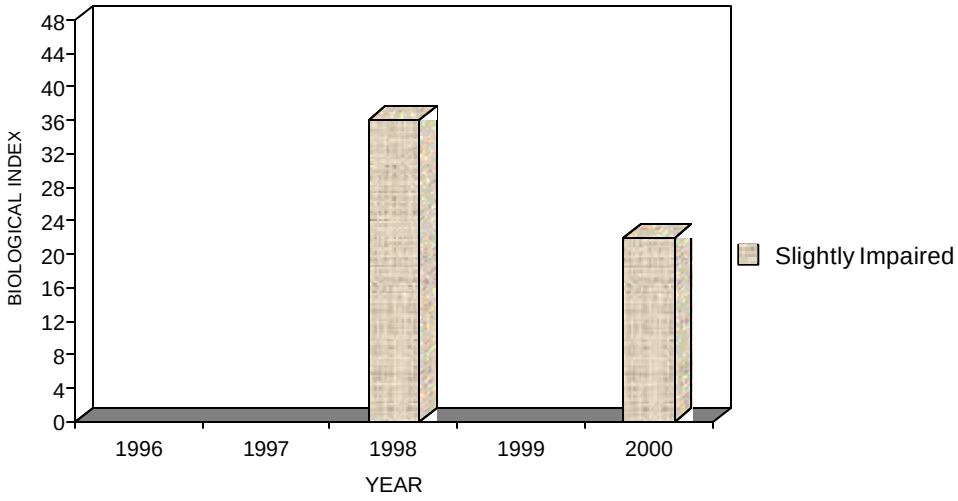
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| TAl | 07/24/00 | 599 µg/l | 100 µg/l | N.Y. aquatic (chronic) |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/24/00 | 46.9 | TNO3 | DNO3 | TAl | TN | DN | | | |

| **Biological and Habitat Summary** | |
|---|---|
| Number of Taxa | 26 |
| Diversity Index | 2.3 |
| RBP Score | 22 |
| RBP Condition | Slightly Impaired |
| Total Habitat Score | 212 |
| Habitat Condition Category | Excellent |




**Water Quality Index**



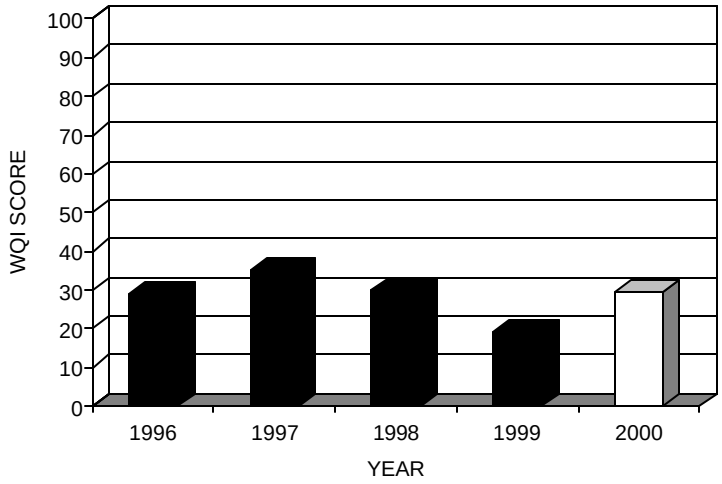

**Biological Index**

***Table 36. Water Quality Summary Big Branch Deer Creek at Fawn Grove, Pa.***

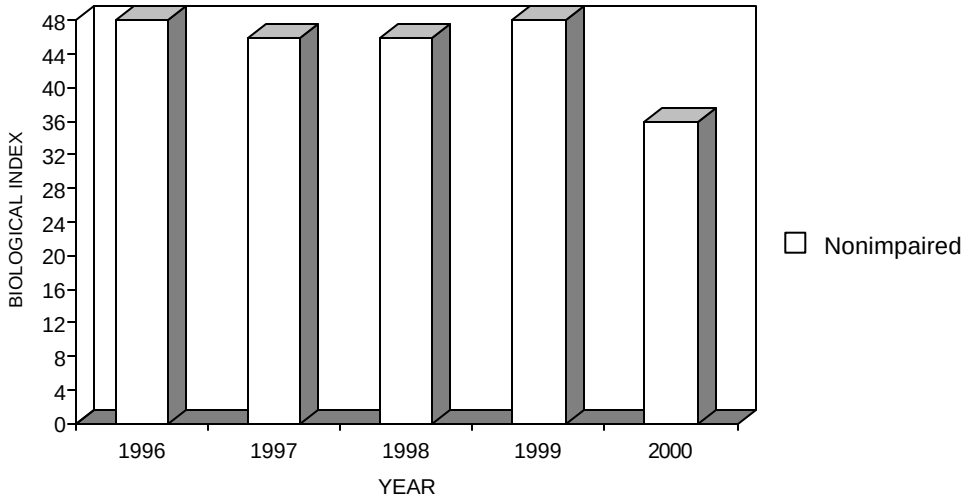
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 08/01/00 | 29.5 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 20 |
| Diversity Index | 2.5 |
| RBP Score | 36 |
| RBP Condition | Reference |
| Total Habitat Score | 206 |
| Habitat Condition Category | Reference |




**Water Quality Index**



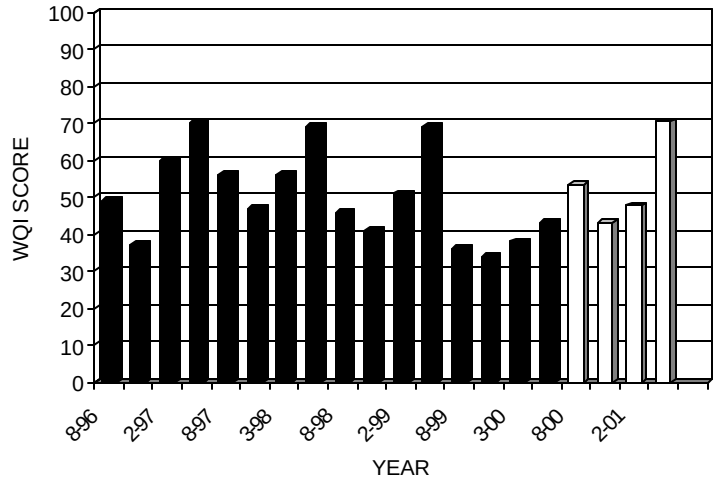

**Biological Index**

***Table 37. Water Quality Summary Conowingo Creek at Pleasant Grove, Pa.***

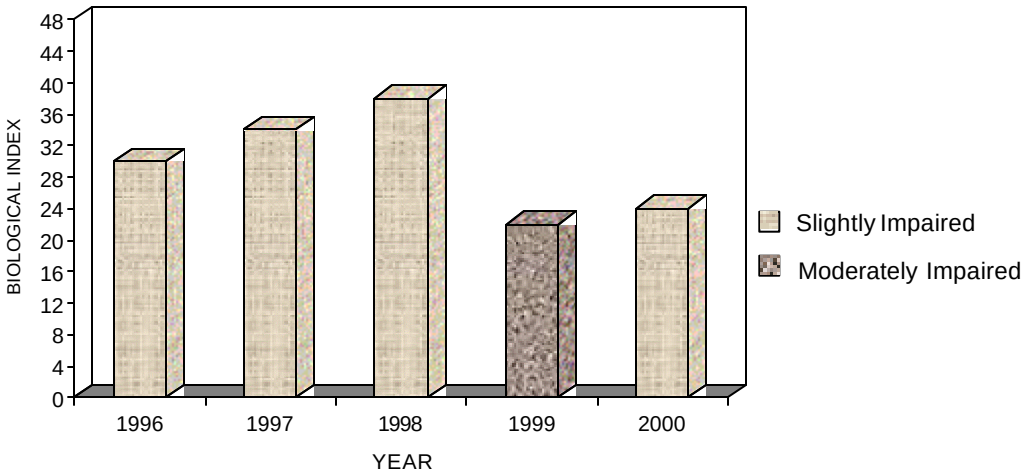
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| DO | 08/03/00 | 4.79 mg/l | 5.0 mg/l | Pa. aquatic life |
| DO | 08/03/00 | 4.79 mg/l | 5.0 mg/l | Md. aquatic life |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 08/03/00 | 53.6 | TNO3 | DNO3 | TAl | TURB | TN | DN | | |
| 11/15/00 | 43.3 | TNO3 | DNO3 | TN | DN | | | | |
| 02/19/01 | 47.7 | DO | TNO3 | DNO3 | TSO4 | TN | DN | | |
| 05/14/01 | 70.4 | TS | DS | TNO2 | DNO2 | TNO3 | DNO3 | DMN | TN |
| | | DN | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 16 |
| Diversity Index | 2.2 |
| RBP III Score | 24 |
| RBP III Condition | Slightly Impaired |
| Total Habitat Score | 181 |
| Habitat Condition Category | Supporting |




**Water Quality Index**




**Biological Index**

### Deer Creek (DEER 44.2)

Deer Creek at Gorsuch Mills, Md., (DEER 44.2) had a slightly impaired macroinvertebrate community for the third consecutive year after having a nonimpaired community for two years. Habitat conditions at the site were considered partially supporting since the sampling site is located adjacent to agricultural activities, which may affect the biological community at DEER 44.2. Water quality at this site was good (Table 38), although dissolved nitrite and dissolved oxygen exceeded the 90$^{th}$ percentile in August 2000 and February 2001, respectively. Deer Creek harbored a diverse macroinvertebrate community including pollution-intolerant taxa such as *Atherix*, *Antocha*, *Epeorus*, *Isonychia*, *Nigronia*, and *Acroneuria*.

Deer Creek showed a mixture of increasing and decreasing trends during the period between 1986 and 2001. Strong, significant upward trends were found for flow-adjusted and unadjusted concentrations of total chloride. Significant increasing trends also occurred in unadjusted concentrations of total sulfate. Strong, significant decreasing trends occurred in both unadjusted and flow-adjusted total phosphorus and total iron and unadjusted total ammonia and total manganese. Significant decreasing trends also were found in unadjusted total aluminum (Table 19).

### Ebaughs Creek (EBAU 1.5)

Ebaughs Creek at Stewartstown, Pa., (EBAU 1.5) had a moderately impaired biological community in August 2000 and had overall poor scores in the biological metrics. For 12 years this site has had either a slightly or moderately impaired biological condition.

Although no parameters exceeded water quality standards, Ebaughs Creek had elevated concentrations of total and dissolved nitrites, dissolved phosphorus, dissolved iron, and dissolved orthophosphates, and low dissolved oxygen (Table 39). The relatively high WQI, low RBP III scores, and the chemical analysis suggested that wastewater discharges might have affected the water quality and the biological community at this site.

Ebaughs Creek had upward and downward water quality trends. Strong, significant increasing trends occurred for unadjusted total chloride, and significant increasing trends occurred for flow-adjusted concentrations of total chloride. Strong, significant decreasing trends were found for both unadjusted and flow-adjusted total iron and unadjusted total ammonia. A significant decreasing trend also was found for flow-adjusted total ammonia (Table 19).

### Falling Branch Deer Creek (FBDC 4.1)

The biological community of Falling Branch Deer Creek at Fawn Grove, Pa., (FBDC 4.1) was designated slightly impaired, an increase from moderately impaired the previous year. This site scored highest in taxonomic richness and EPT Index of all the Pennsylvania-Maryland sites; however, the EPT score was mostly due to numerous Trichopteran taxa. The macroinvertebrate sample was dominated mostly by Chironomidae and *Optioservus* (Coleoptera: Elmidae). There is a large amount of agricultural activity in this small watershed; however, water quality appeared to be good with no parameters exceeding standards or the 90$^{th}$ percentile (Table 40).

### Long Arm Creek (LNGA 2.5)

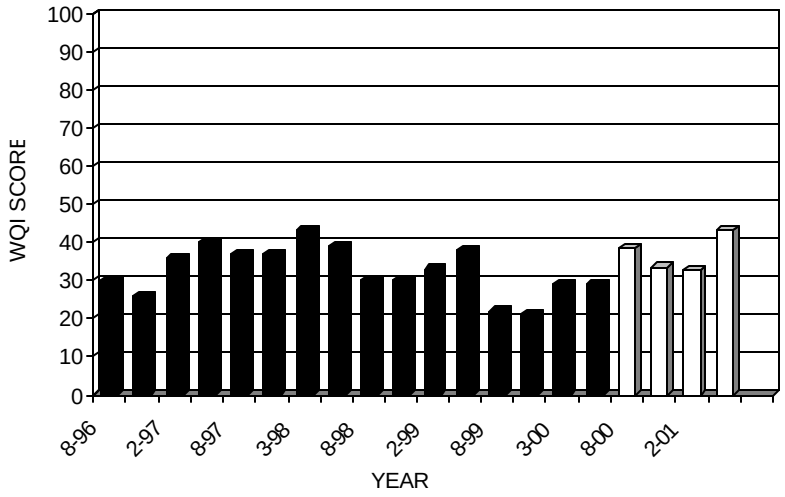
For the sixth consecutive year, Long Arm Creek at Bandanna, Pa., (LNGA 2.5) had a slightly impaired biological community. LNGA 2.5 was located adjacent to agricultural activities, which may have been the source of impairment at this site. The previous habitat assessments noted livestock in the stream, which may have affected the biological community. However, the situation was expected to improve as an organic farm with fewer livestock and reduced access to the stream replaced the previous operation. Significant improvements have not been noted yet. The streambanks were heavily eroded, and heavy amounts of mud and silt were noted in the stream during the July 2000 habitat assessment.

*Table 38. Water Quality Summary Deer Creek at Gorsuch Mills, Md.*

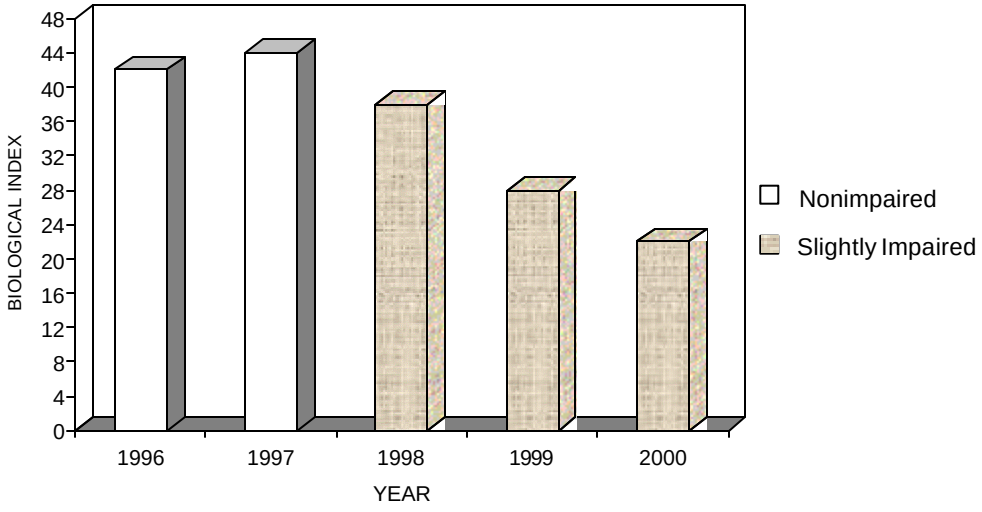
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 08/03/00 | 38.3 | DNO2 | | | | | | | |
| 11/14/00 | 33.5 | None | | | | | | | |
| 02/19/01 | 32.5 | DO | | | | | | | |
| 05/14/01 | 43.2 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 22 |
| Diversity Index | 2.5 |
| RBP Score | 22 |
| RBP Condition | Slightly Impaired |
| Total Habitat Score | 151 |
| Habitat Condition Category | Partially Supporting |




**Water Quality Index**



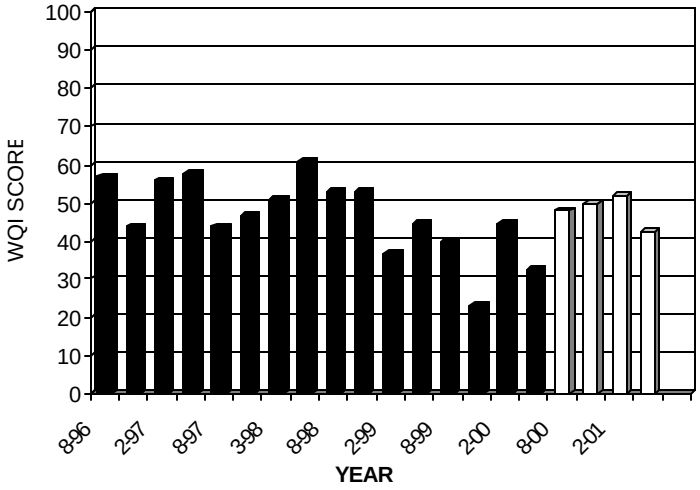

**Biological Index**

*Table 39. Water Quality Summary Ebaughs Creek at Stewartstown, Pa.*

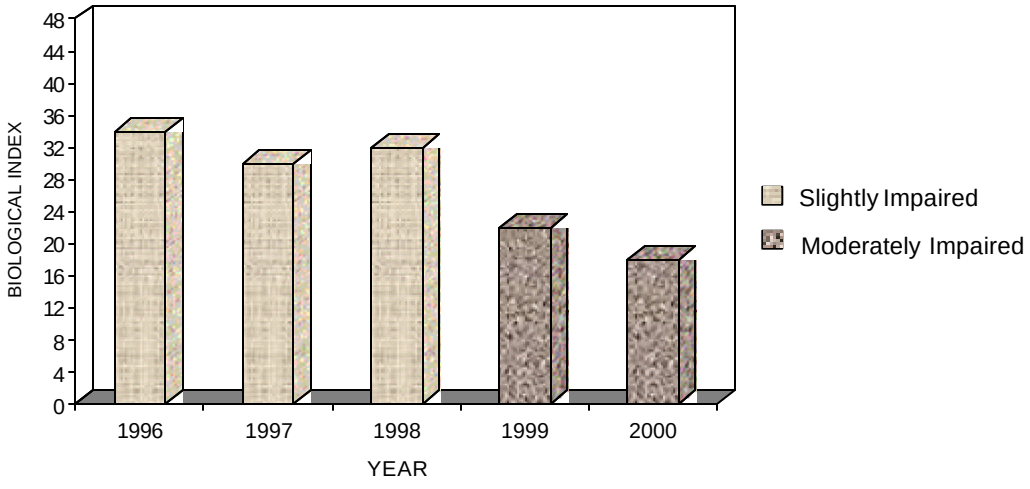
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 08/01/00 | 48.2 | DP | DFe | | | | | | |
| 11/14/00 | 50.1 | DP | DPO4 | | | | | | |
| 02/20/01 | 52 | DO | TNO2 | DNO2 | | | | | |
| 05/14/01 | 42.5 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 14 |
| Diversity Index | 2.1 |
| RBP Score | 18 |
| RBP Condition | Moderately Impaired |
| Total Habitat Score | 194 |
| Habitat Condition Category | Excellent |




**Water Quality Index**



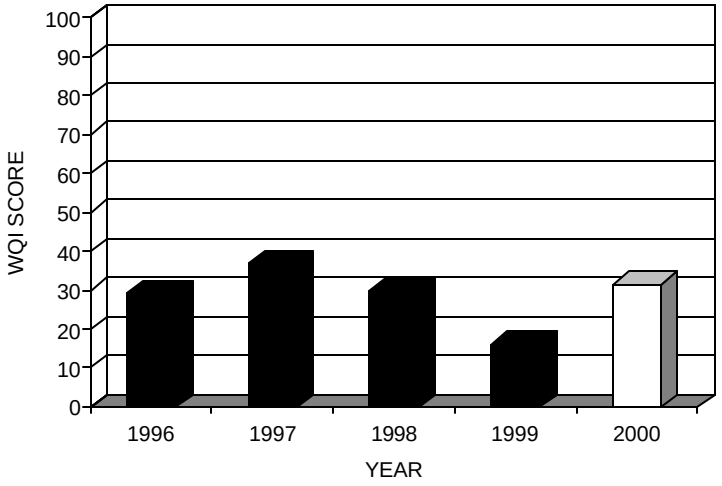

**Biological Index**

***Table 40. Water Quality Summary Falling Branch Deer Creek at Fawn Grove, Pa.***

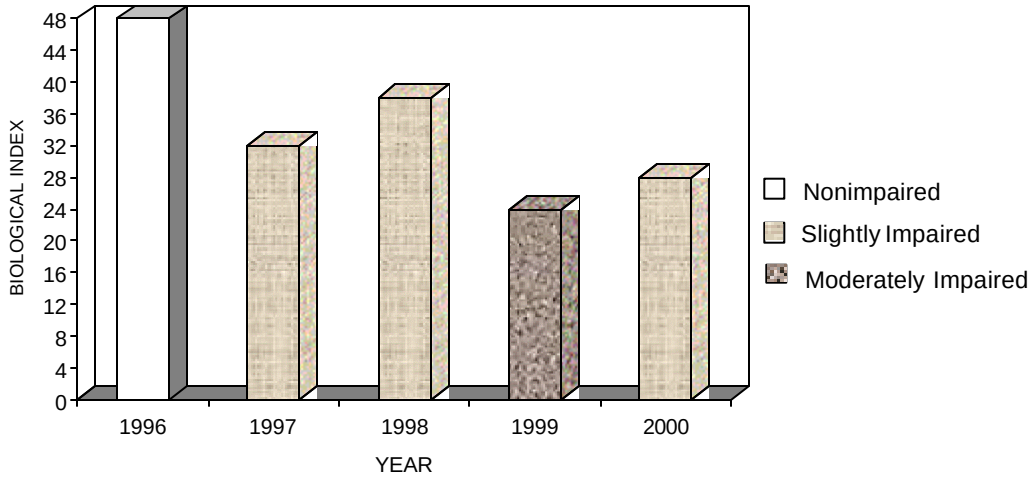
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 08/01/00 | 31.5 | None | | | | | | | |

| **Biological and Habitat Summary** | |
|---|---|
| Number of Taxa | 28 |
| Diversity Index | 2.5 |
| RBP Score | 28 |
| RBP Condition | Slightly Impaired |
| Total Habitat Score | 181 |
| Habitat Condition Category | Supporting |




**Water Quality Index**




**Biological Index**

During the 2000 sampling season, Long Arm Creek was elevated to a Group 1 stream. LNGA 2.5 showed elevated nitrogen values, as did most of the streams in this region. Although no water quality standards were exceeded, total aluminum, dissolved oxygen, dissolved manganese, and turbidity exceeded the 90th percentile at this site (Table 41).

**Octoraro Creek (OCTO 6.6)**

Although Octoraro Creek at Rising Sun, Md., (OCTO 6.6) had a nonimpaired biological community in August 2000, the water quality evaluation had more parameters exceeding the 90th percentile than the previous year. The February 2001 sample had numerous parameters exceeding the 90th percentile including dissolved oxygen, total and dissolved ammonia, total and dissolved phosphorus, total and dissolved orthophosphate, total organic carbon, dissolved iron, total aluminum, and turbidity (Table 42). The May 2001 sample had total and dissolved solids, and dissolved manganese values that exceeded the 90th percentile. These exceedances may be due to significant agricultural activities and Octoraro Lake located upstream of this site. The WQI bar graph indicates that the WQI for winter (February or March) sampling usually has been higher than the other seasons.

Increasing and decreasing trends were found at OCTO 6.6. Strong, significant increasing trends only occurred for total chloride in both unadjusted and flow-adjusted concentrations. Strong, significant decreasing trends were found in unadjusted total ammonia, total phosphorus, total iron, and total manganese. Significant decreasing trends were evident in total aluminum unadjusted concentrations and unadjusted WQI values (Table 19).

**Scott Creek (SCTT 3.0)**

For the twelfth consecutive year, Scott Creek at Delta, Pa., (SCTT 3.0) had a moderately to severely impaired biological community. During fiscal year 2001, Scott Creek had a severely impaired macroinvertebrate community, with the worst score in all of the metrics for the Pennsylvania-Maryland border streams. There were only seven taxa at SCTT 3.0, and the diversity index value was only 0.8. Chironomidae heavily dominated this sample. Habitat at this site also was nonsupporting.

In January 1998, a fuel spill occurred on Scott Creek in Cardiff, Md. Four to five thousand gallons of home heating fuel spilled into Scott Creek when an attempt was made to steal the fuel. The spill also resulted in a fish kill. Although the fuel spill probably adversely affected the aquatic inhabitants of the stream, Scott Creek has been impaired for many years. A feed mill is located just upstream of SCTT 3.0, and the smell of sewage and anaerobic conditions were noted in the habitat assessment.

SCTT 3.0 appeared to improve in water quality from the previous year. Dissolved oxygen, total iron, dissolved iron, total manganese, and pH exceeded water quality standards numerous times during 1999-2000. In 2000-2001, only dissolved oxygen and dissolved iron exceeded the standards. Dissolved oxygen exceeded Maryland aquatic life standards in August 2000, and Maryland and Pennsylvania aquatic life standards in May 2001. Dissolved iron exceeded Pennsylvania aquatic life standards in May 2001. Additional water quality analysis indicated that Scott Creek had elevated conductivity, ammonia, nitrites, phosphorus, orthophosphates, total organic carbon, total chloride, iron, manganese, solids, and turbidity, and reduced dissolved oxygen (Table 43).

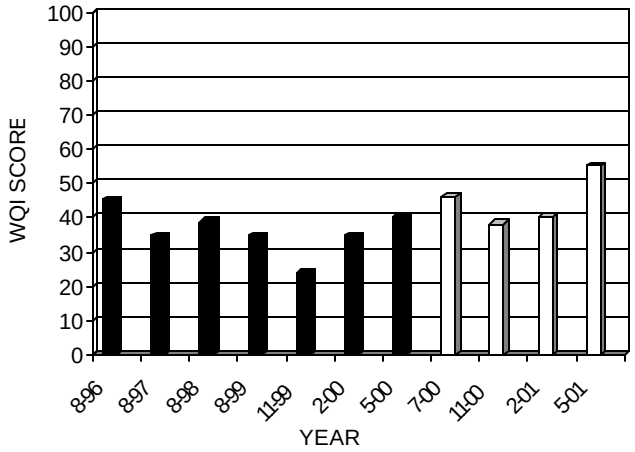
Scott Creek had only significant decreasing trends during fiscal year 2001. Those decreasing trends were in unadjusted concentrations of total sulfate and total manganese, and flow-adjusted concentrations of total nitrogen (Table 19).

***Table 41. Water Quality Summary Long Arm Creek at Bandanna, Pa.***

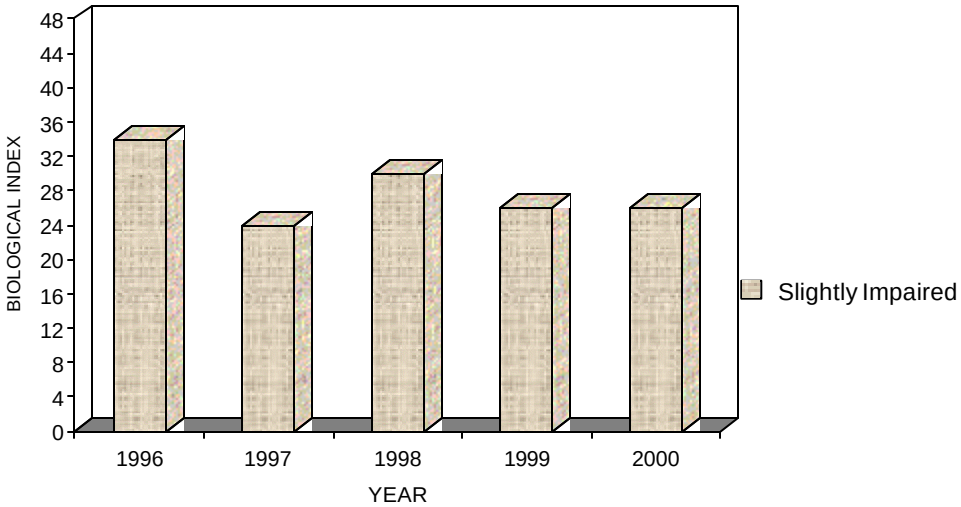
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/31/00 | 45.9 | TAl | | | | | | | |
| 11/14/00 | 38.2 | None | | | | | | | |
| 02/20/01 | 39.9 | DO | | | | | | | |
| 05/14/01 | 55 | DMn | TURB | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 18 |
| Diversity Index | 2.5 |
| RBP III Score | 26 |
| RBP III Condition | Slightly Impaired |
| Total Habitat Score | 171 |
| Habitat Condition Category | Supporting |




**Water Quality Index**



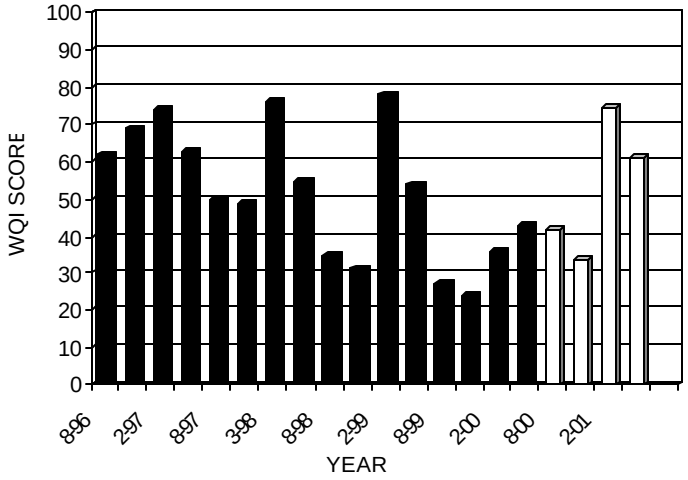

**Biological Index**

***Table 42. Water Quality Summary Octoraro Creek at Rising Sun, Md.***

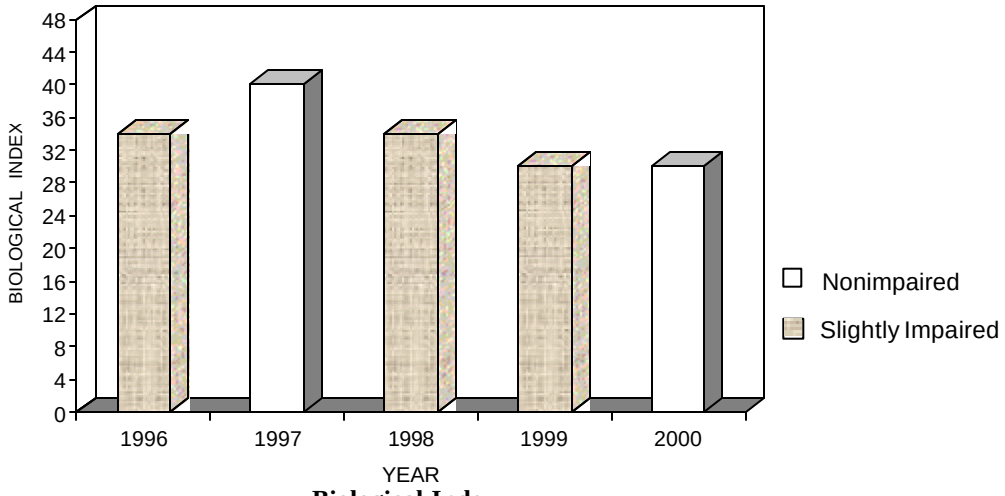
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 08/02/00 | 41.8 | None | | | | | | | |
| 11/15/00 | 34.1 | None | | | | | | | |
| 02/19/01 | 74.4 | DO | TNH3 | DNH3 | TP | DP | TPO4 | DPO4 | TOC |
| | | DFe | TAl | TURB | | | | | |
| 05/14/01 | 61.1 | TS | DS | DMn | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 22 |
| Diversity Index | 2.4 |
| RBP III Score | 30 |
| RBP III Condition | Nonimpaired |
| Total Habitat Score | 191 |
| Habitat Condition Category | Excellent |




**Water Quality Index**



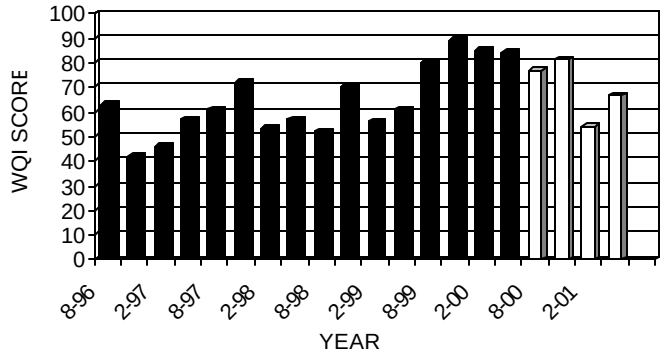

**Biological Index**

***Table 43. Water Quality Summary Scott Creek at Delta, Pa.***

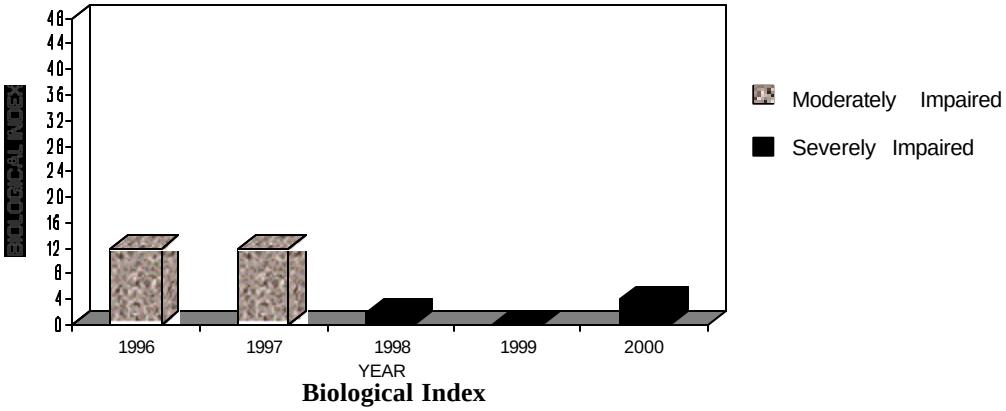
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| DO | 08/02/00 | 4.22 mg/l | 5.0 mg/l | Md. aquatic life |
| DO | 5/14/01 | 4.47 mg/l | 5.0 mg/l | Md. aquatic life |
| DO | 5/14/01 | 4.47 mg/l | 5.0 mg/l | Pa. aquatic life |
| DFe | 5/14/01 | 411 µg/l | 300 µg/l | Pa. aquatic life |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 08/02/00 | 76.7 | COND | TNH3 | DNH3 | TNO2 | TP | TPO4 | DPO4 | TOC | TCl |
| | | TFe | DFe | TMn | DMn | | | | | |
| 11/14/00 | 81.2 | DO | TS | DS | TNH3 | DNH3 | TNO2 | DNO2 | TP | DP |
| | | TPO4 | DPO4 | TOC | TCl | TFe | DFe | TMn | DMn | TURB |
| 02/20/01 | 53.8 | DO | COND | TS | DS | TCl | TMn | DMn | | |
| 05/14/01 | 66.6 | DO | TNH3 | DNH3 | TP | DP | TPO4 | DPO4 | TCl | TFe |
| | | DFe | | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 7 |
| Diversity Index | 0.8 |
| RBP III Score | 4 |
| RBP III Condition | Severely Impaired |
| Total Habitat Score | 163 |
| Habitat Condition Category | Supporting |




**Water Quality Index**




**Biological Index**

The water quality results from 2000-2001 indicate that the sewage treatment plant (downstream of SCTT 3.0) that was constructed to serve the Cardiff-Delta area is helping to reduce some of the pollution problems in this stream. Dissolved oxygen continues to be a problem in this stream, although the values have improved from as low as 2.88 mg/l and 3.36 mg/l in 1999-2000 sampling season to 4.22 mg/l and 4.46 mg/l in 2000-20001. SCTT 3.0 still had the highest individual WQI (81.2) of the streams in this region; however, the WQI values were lower than the previous year. Despite these water quality improvements, the macroinvertebrate population has not yet shown improvement.

#### South Branch Conewago Creek (SBCC 20.4)

South Branch Conewago Creek near Bandanna, Pa., (SBCC 20.4) contained a slightly impaired biological community for the fourth consecutive year. Before this stream was slightly impaired it had served as the Pennsylvania-Maryland reference site for several years. SBCC 20.4 had the best Hilsenhoff score of all the Pennsylvania-Maryland border streams in July 2000. Several pollution-intolerant taxa still inhabited SBCC 20.4, including *Atherix*, *Hexatoma*, *Stenonema*, *Nigronia*, *Leuctra*, *Tallaperla* (Plecoptera: Peltoperlidae), *Acroneuria*, *Isoperla* (Plecoptera: Perlodidae), *Diplectrona* (Trichoptera: Hydropsychidae), *Dolophilodes*, and *Rhyacophila*.

SBCC 20.4 had a low WQI score, and no parameters exceeded standards or the 90$^{th}$ percentile at South Branch Conewago Creek (Table 44). The habitat was rated excellent. The stream was considerably shaded and scored well in epifaunal substrate and vegetated protective cover.

### River Sites

#### Chemung River (CHEM 12.0)

A slightly impaired biological community existed in the Chemung River at Chemung, N.Y., (CHEM 12.0). During the past four years, this site has fluctuated from moderately impaired, to slightly impaired, to nonimpaired. The physical habitat was considered excellent despite the presence of rip-rap and a bridge located upstream.

The only parameter to exceed water quality standards in 2000-2001 was pH. It exceeded New York State standards in July and November. Overall, water quality was relatively poor. Analysis indicated that dissolved oxygen was depressed while conductivity, total sulfate, solids, chloride, phosphorus, nitrogen, nitrites, and nitrates were elevated at CHEM 12.0 (Table 45).

Unadjusted and flow-adjusted total chloride showed a strong, significant increasing trend. All other parameters significantly decreased over the period involved. Strong, significant decreasing trends were found for unadjusted and flow-adjusted total ammonia, total nitrogen, total sulfate, total iron, and total manganese (Table 19).

#### Cowanesque River (COWN 2.2)

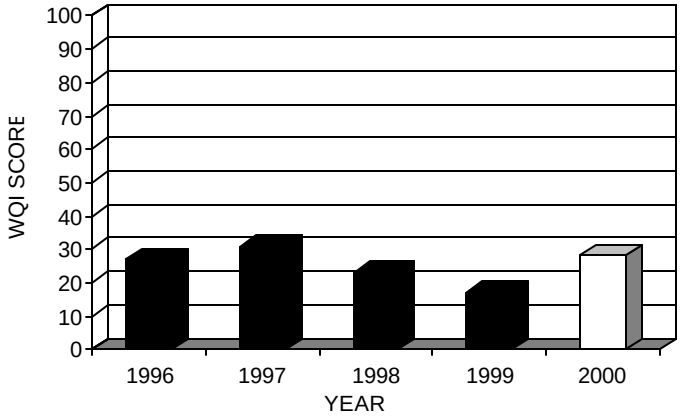
Moderately impaired biological conditions existed on the Cowanesque River downstream of the Cowanesque Reservoir at Lawrenceville, Pa., (COWN 2.2). Moderately to severely impaired conditions have existed at this site for the past nine years of sampling. In the past, increased phytoplankton production in the Cowanesque Reservoir may have caused a shift in the macroinvertebrate community, resulting in a biological population dominated by filter-feeding organisms. Additionally, the bottom discharge dam depressed oxygen levels in the Cowanesque River downstream of the outflow. During July 2000, the site was dominated by Chironomidae, and the rest of the sample consisted of other organic pollution-tolerant taxa such as *Caecidotea* (Isopoda: Asellidae), *Gammarus* (Amphipoda: Gammaridae), *Simulium* (Diptera: Simuliidae), *Caenis* (Ephemeroptera: Caenidae), *Ceratopsyche* (Trichoptera: Hydropsychidae), and *Cheumatopsyche* (Trichoptera: Hydropsychidae). COWN 2.2 had the worst scores in all the metrics for the river sites. There were only seven taxa in July 2000, and a diversity index of 1.3. The RBP condition score (10) was the lowest of the river sites.

***Table 44. Water Quality Summary South Branch Conewago Creek at Bandanna, Pa.***

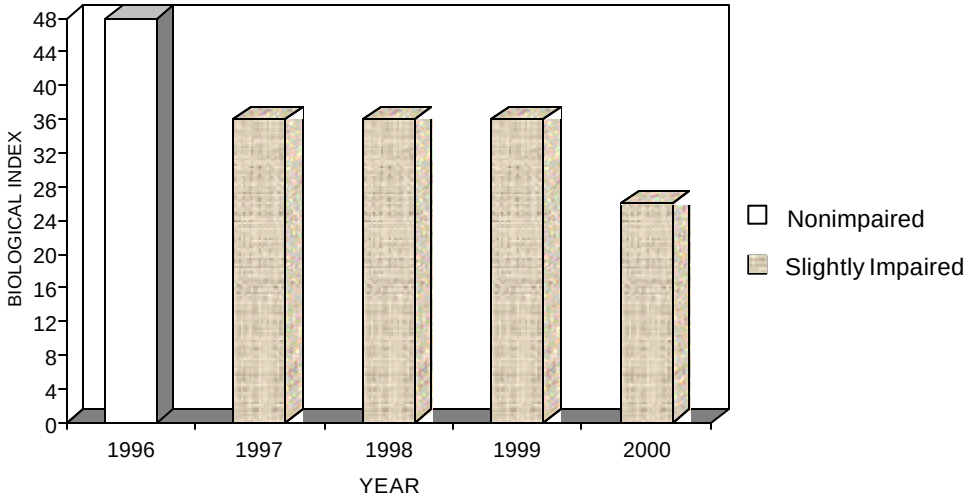
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/31/00 | 28.2 | None | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 17 |
| Diversity Index | 2.3 |
| RBP III Score | 26 |
| RBP III Condition | Slightly Impaired |
| Total Habitat Score | 217 |
| Habitat Condition Category | Excellent |




**Water Quality Index**



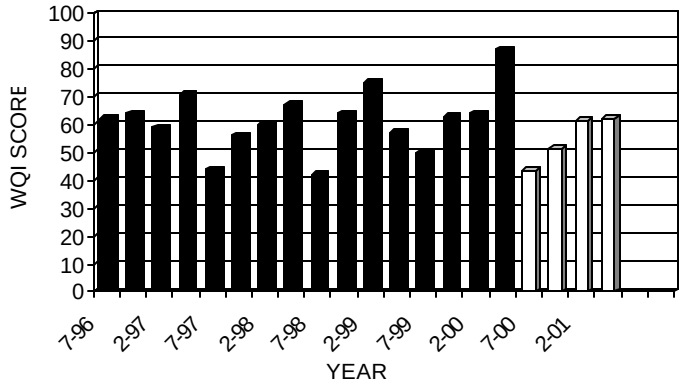

**Biological Index**

***Table 45. Water Quality Summary Chemung River at Chemung, N.Y.***

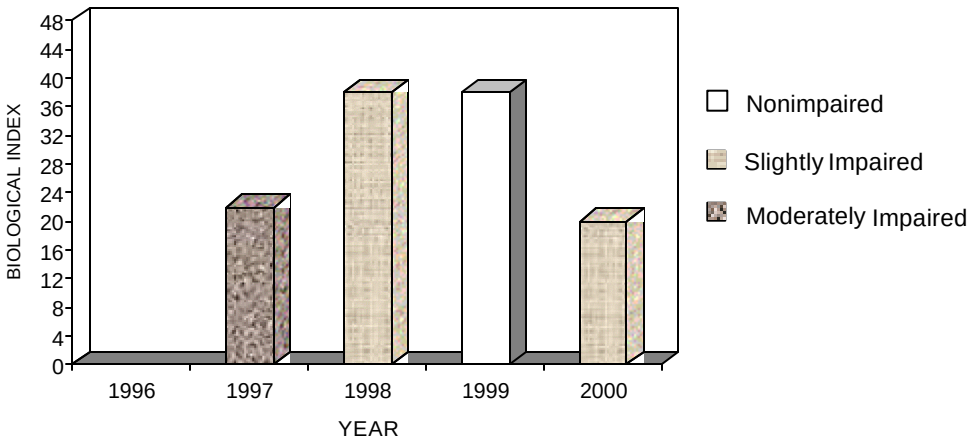
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| pH | 07/25/00 | 8.6 | 6.5 – 8.5 | N.Y. general |
| pH | 11/07/00 | 8.8 | 6.5 – 8.5 | N.Y. general |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/25/00 | 43.6 | COND | TCl | TSO4 | | | | | |
| 11/07/00 | 51.4 | COND | TS | DS | DNO2 | TCl | | | |
| 02/07/01 | 61.6 | COND | TS | DS | TNO3 | DNO3 | TCl | TN | DN |
| 05/08/01 | 62.2 | DO | TS | DS | TP | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 18 |
| Diversity Index | 2.1 |
| RBP Score | 20 |
| RBP Condition | Slightly Impaired |
| Total Habitat Score | 191 |
| Habitat Condition Category | Excellent |




**Water Quality Index**




**Biological Index**

Values for dissolved oxygen and pH exceeded New York water quality standards. Also, dissolved oxygen, ammonia, total organic carbon, manganese, and turbidity exceeded the 90th percentile (Table 46). Total organic carbon exceeded the 90th percentile every season.

A strong, significant increasing trend was found for unadjusted total manganese. Strong, significant decreasing trends occurred for unadjusted and flow-adjusted total nitrogen and unadjusted total sulfate, and a significant downward trend was found for flow-adjusted total sulfate (Table 19).

**Cowanesque River (COWN 1.0)**

A new site was added on the Cowanesque River near the mouth of the stream (COWN 1.0) during the 1999-2000 sampling season to determine the extent of impairment in the river. For the second year, a slightly impaired biological community existed at COWN 1.0. The macroinvertebrate population was slightly improved at COWN 1.0 compared to COWN 2.2. Slightly more sensitive macroinvertebrates were present, although the only organic pollution intolerant taxa present was *Stenonema*. Habitat conditions were considered excellent. Fallen trees and submerged logs were noted in this section.

The pH was high at this site, exceeding the New York and Pennsylvania water quality standards. Total nitrite also exceeded the New York standard in November. Parameters that exceeded the 90th percentile were total organic carbon, total and dissolved nitrite, total and dissolved ammonia, and turbidity (Table 47). The Cowanesque Reservoir and a wastewater treatment plant discharge are located upstream of COWN 1.0.

**Susquehanna River at Windsor, N.Y. (SUSQ 365.0)**

Susquehanna River at Windsor, N.Y. (SUSQ 365.0) was rated as slightly impaired after being rated as nonimpaired in previous years. However, SUSQ 365.0 had the lowest percent dominant score of all the river sites. The habitat of the river had changed from the previous sampling year due to heavy flooding. This could have affected the biological community.

No water quality standards were exceeded during the sampling at SUSQ 365 in fiscal year 2001. However, solids, phosphorus, ortho-phosphates, total sulfate, and nitrates were elevated (Table 48) at this site.

Several strong, significant decreasing trends occurred at SUSQ 365.0. These downward trends included both unadjusted and flow-adjusted concentrations of total ammonia, total nitrogen, total phosphorus, and total iron. A significant decreasing trend also occurred for flow-adjusted total aluminum. Strong, significant increasing trends also occurred at this site in unadjusted and flow-adjusted concentrations of total chloride (Table 19).

**Susquehanna River at Kirkwood, N.Y. (SUSQ 340.0)**

Nonimpaired conditions existed at Susquehanna River at Kirkwood, N.Y., (SUSQ 340.0) for the third consecutive year. This site had the lowest Hilsenhoff Biological Index score of the river sites Organic pollution-intolerant taxa present at this river site were *Atherix*, *Stenonema*, *Isonychia*, *Ephoron* (Ephemeroptera: Polymitarcyidae), *Acroneuria*, *Agnetina*, *Macrostemum* (Trichoptera: Hydropsychidae), and *Psychomyia* (Trichoptera: Psychomyiidae). Habitat conditions also were considered excellent.

A high pH (9.1) exceeded both New York and Pennsylvania water quality standards in November 2000. Additional water quality analysis indicated that turbidity was elevated during July 2000, dissolved iron was relativelyhigh during February 2001, and dissolved oxygen was depressed during May 2001 (Table 49).

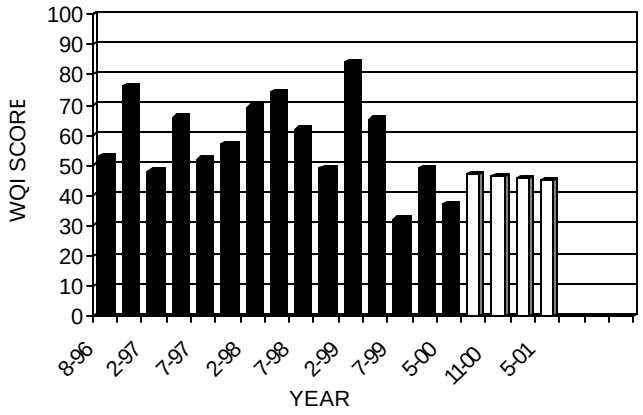
Strong, significant downward trends occurred at SUSQ 340 for several parameters including unadjusted and flow-adjusted concentrations of total ammonia, total nitrogen, total phosphorus, and total iron. However, both unadjusted and

***Table 46. Water Quality Summary Cowanesque River (COWN 2.2) at Lawrenceville, Pa.***

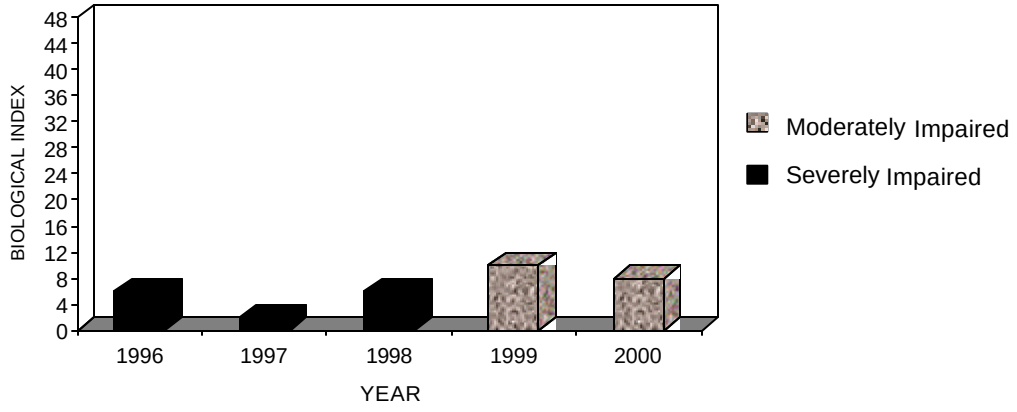
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| DO | 07/24/00 | 4.29 mg/l | 5.0 mg/l | N.Y. trout waters |
| pH | 05/09/01 | 8.7 | 6.5 – 8.5 | N.Y. general |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/24/00 | 47 | DO | TNH3 | DNH3 | TOC | TMn | DMn | | |
| 11/07/00 | 46.4 | DO | TNH3 | DNH3 | TOC | TMn | DMn | TURB | |
| 02/07/01 | 45.6 | TOC | | | | | | | |
| 05/09/01 | 45.1 | TOC | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 7 |
| Diversity Index | 1.3 |
| RBP Score | 8 |
| RBP Condition | Moderately Impaired |
| Total Habitat Score | 170 |
| Habitat Condition Category | Supporting |




**Water Quality Index**



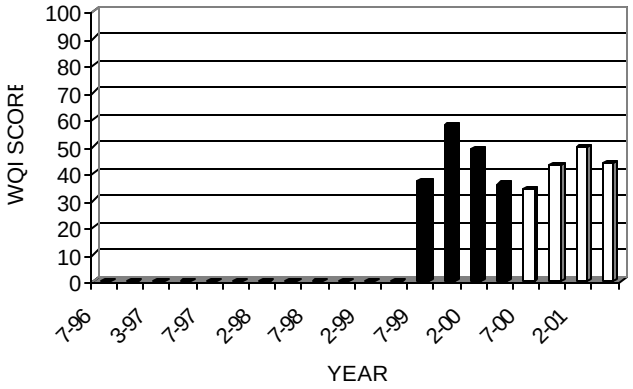

**Biological Index**

***Table 47. Water Quality Summary Cowanesque River (COWN 1.0) at Lawrenceville, Pa.***

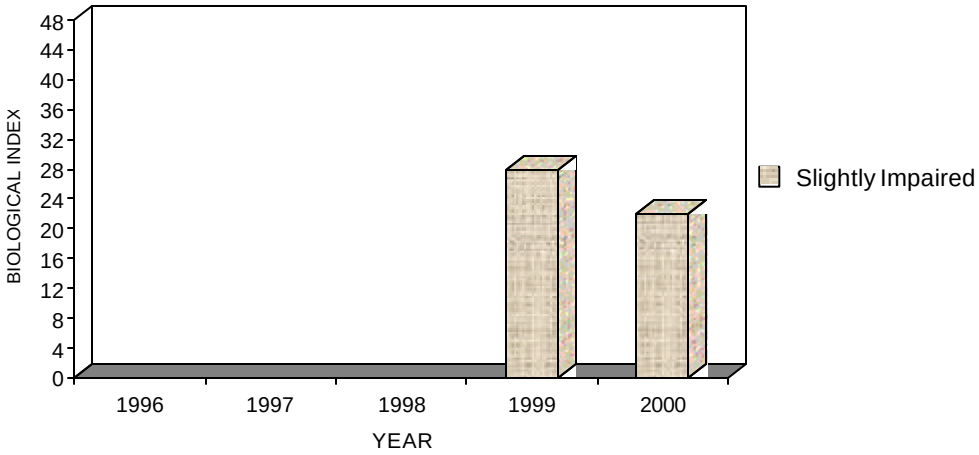
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| TNO2 | 11/07/00 | 0.2 mg/l | 0.02 mg/l | N.Y. aquatic (chronic) |
| pH | 05/09/01 | 9.5 | 6.5 - 8.5 | N.Y. general |
| pH | 05/09/01 | 9.5 | 6.0 – 9.0 | Pa. aquatic life |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/25/00 | 34.1 | TOC | | | | | | | |
| 11/07/00 | 42.9 | TNO2 | DNO2 | TOC | | | | | |
| 02/07/01 | 49.5 | TNH3 | DNH3 | TOC | | | | | |
| 05/09/01 | 43.5 | TOC | TURB | | | | | | |

| **Biological and Habitat Summary** | |
|---|---|
| Number of Taxa | 16 |
| Diversity Index | 2.4 |
| RBP Score | 22 |
| RBP Condition | Slightly Impaired |
| Total Habitat Score | 200 |
| Habitat Condition Category | Excellent |




**Water Quality Index**



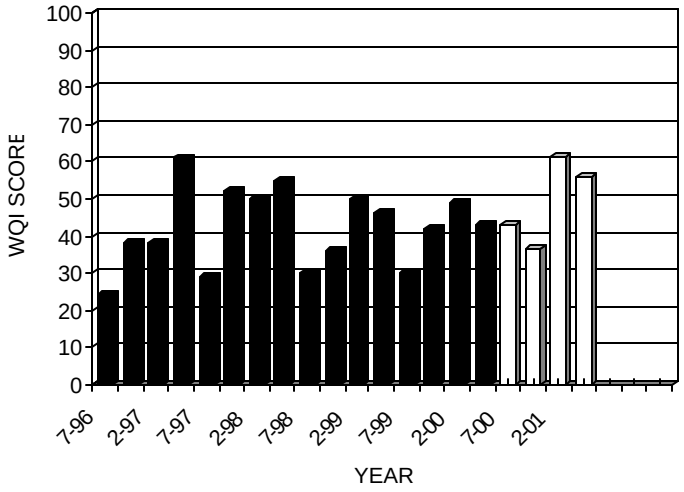

**Biological Index**

***Table 48. Water Quality Summary Susquehanna River at Windsor, N.Y.***

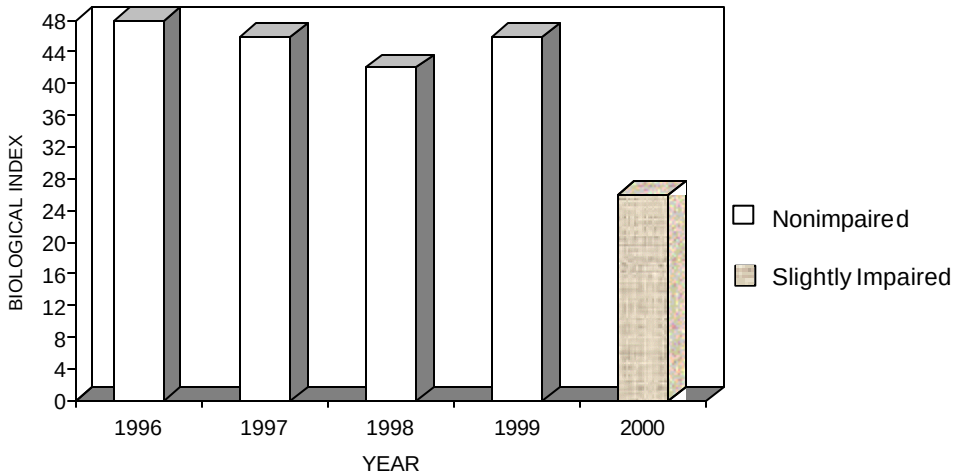
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/26/00 | 42.8 | TS | DS | | | | | | |
| 11/06/00 | 36.5 | None | | | | | | | |
| 02/06/01 | 61.2 | TP | DP | TPO4 | DPO4 | TSO4 | | | |
| 05/07/01 | 56.1 | TNO3 | DNO3 | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 20 |
| Diversity Index | 2.5 |
| RBP Score | 26 |
| RBP Condition | Slightly Impaired |
| Total Habitat Score | 214 |
| Habitat Condition Category | Excellent |




**Water Quality Index**



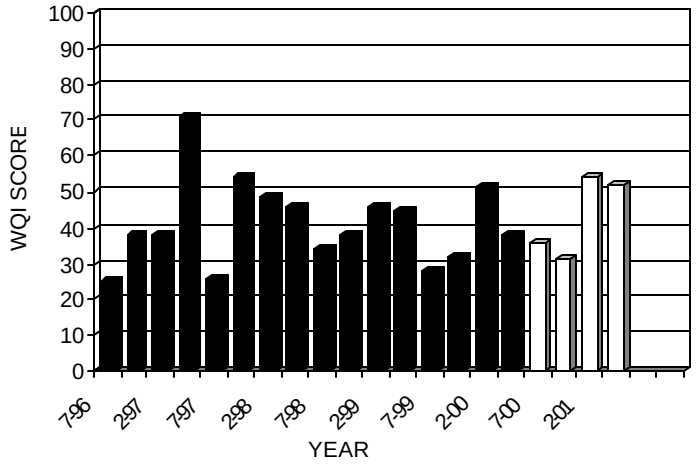

**Biological Index**

***Table 49. Water Quality Summary Susquehanna River at Kirkwood, N.Y.***

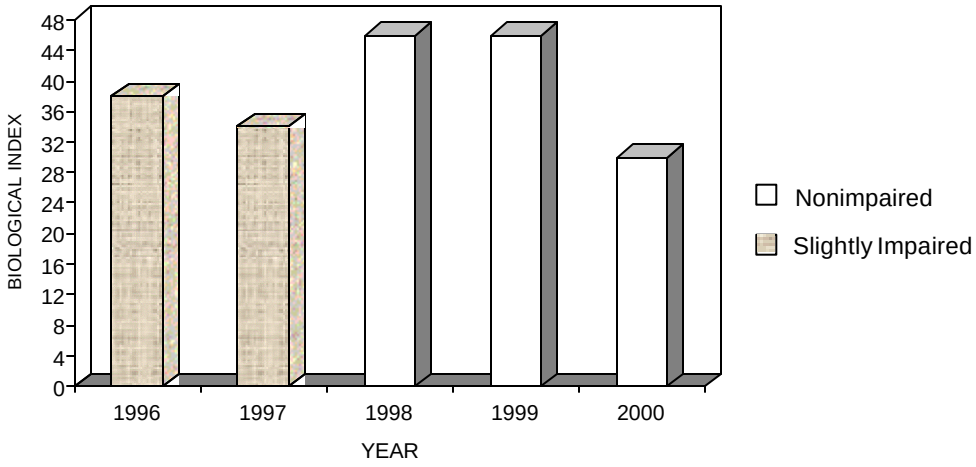
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| pH | 11/06/00 | 9.1 | 6.5 – 8.5 | N.Y. general |
| pH | 11/06/00 | 9.1 | 6.0 – 9.0 | Pa. aquatic life |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/26/00 | 35.7 | TURB | | | | | | | |
| 11/06/00 | 31.6 | None | | | | | | | |
| 02/06/01 | 53.8 | DFe | | | | | | | |
| 05/08/01 | 51.8 | DO | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 22 |
| Diversity Index | 2.5 |
| RBP Score | 30 |
| RBP Condition | Nonimpaired |
| Total Habitat Score | 210 |
| Habitat Condition Category | Excellent |




**Water Quality Index**




**Biological Index**

flow-adjusted total chloride showed a strong, significant increasing trend for the time period (Table 19).

**Susquehanna River at Sayre, Pa. (SUSQ 289.1)**

The Susquehanna River at Sayre, Pa., (SUSQ 289.1) served as the reference site for the river stations in fiscal year 2001. The biological community was nonimpaired, and SUSQ 289.1 had the highest values in taxonomic richness, EPT Index, EPT/Chironomidae ratio, and Shannon-Weaver Diversity Index.

The pH value for November exceeded the New York standards, and additional water quality analysis indicated that nitrogen, nitrites, nitrates, orthophosphates, and turbidity were elevated at this site, while dissolved oxygen was reduced (Table 50).

Strong, significant decreasing trends were found for several parameters at SUSQ 289.1 including both unadjusted and flow-adjusted concentrations of total ammonia, total nitrogen, total phosphorus, total manganese, and total iron, and flow-adjusted total sulfate and total aluminum. Significant decreasing trends occurred for unadjusted concentrations of total aluminum. Also, strong, significant increasing trends occurred for unadjusted and flow-adjusted total chloride (Table 19).

**Susquehanna River at Marietta, Pa. (SUSQ 44.5)**

The Susquehanna River at Marietta, Pa., (SUSQ 44.5) had a nonimpaired biological community in August 1999; however, the flow was too high to safely collect a macroinvertebrate sample on August 3, 2000. Dissolved oxygen was lower than the Maryland water quality standard for aquatic life in August 2000, and total sulfate exceeded the Pennsylvania standard for water supply in November 2000. Water quality analysis indicated that conductivity, solids, sulfate, total iron, total manganese, total phosphorus, total organic carbon, total aluminum, total orthophosphates, and turbidity were elevated at this station (Table 51).

The only increasing trend on this section of the river was a strong, significant trend in unadjusted and flow-adjusted total chloride. Strong, significant downward trends occurred for unadjusted total ammonia and unadjusted and flow-adjusted total iron, total aluminum, and total manganese. Significant decreasing trends were found for flow-adjusted total ammonia, both unadjusted and flow-adjusted total phosphorus, and flow-adjusted total sulfate (Table 19).

**Susquehanna River at Conowingo, Md. (SUSQ 10.0)**

No macroinvertebrate sampling was performed in the Susquehanna River at Conowingo, Md., (SUSQ 10.0) due to deep waters and a lack of riffle habitat. Water quality did not exceed standards at SUSQ 10.0 in fiscal year 2000; however, dissolved oxygen values were lower than Pennsylvania and Maryland standards for aquatic life in August 2000, and values were lower than Maryland standards in May 2001. Dissolved oxygen also exceeded the 90$^{th}$ percentile in addition to conductivity, dissolved solids, total sulfate, and total manganese (Table 52).

At SUSQ 10.0, only downward trends were observed. Significant decreasing trends were found for unadjusted ammonia, nitrogen, and aluminum. Strong, significant downward trends occurred in flow-adjusted total nitrogen and aluminum, unadjusted total phosphorus, and both unadjusted and flow-adjusted total iron and total manganese (Table 19).

**Tioga River (TIOG 10.8)**

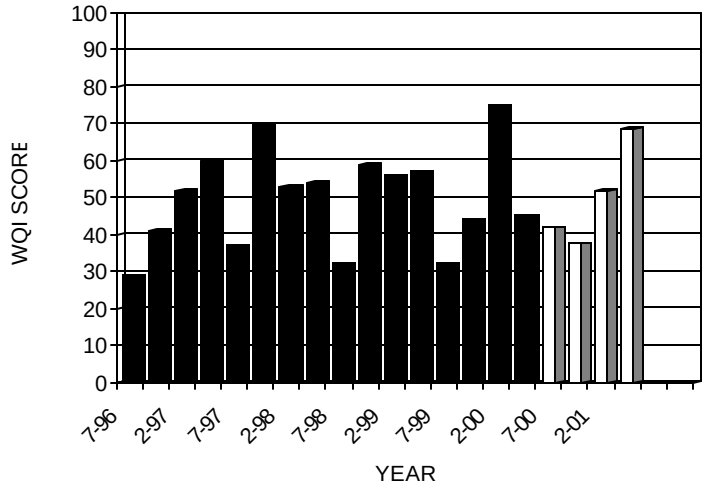
The Tioga River at Lindley, N.Y., (TIOG 10.8) had a slightly impaired biological community during July 2000, and habitat conditions were considered excellent. No parameters exceeded water quality standards; however, total sulfate, dissolved oxygen, total and dissolved manganese, and turbidity exceeded the 90$^{th}$ percentile (Table 53).

*Table 50. Water Quality Summary Susquehanna River at Sayre, Pa.*

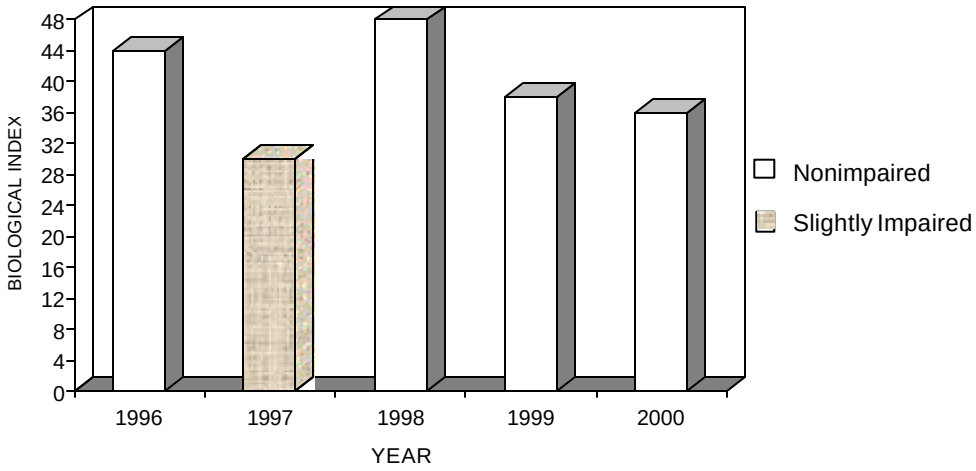
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| pH | 11/06/00 | 8.9 | 6.5 – 8.5 | N.Y. general |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/25/00 | 42 | DN | | | | | | | |
| 11/06/00 | 37.5 | None | | | | | | | |
| 02/06/01 | 51.9 | TNO3 | DNO3 | TN | DN | | | | |
| 05/08/01 | 68.6 | DO | TNO2 | DNO2 | TNO3 | DNO3 | TPO4 | TURB | TN |
| | | DN | | | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 24 |
| Diversity Index | 2.6 |
| RBP Score | 36 |
| RBP Condition | Reference |
| Total Habitat Score | 200 |
| Habitat Condition Category | Reference |




**Water Quality Index**

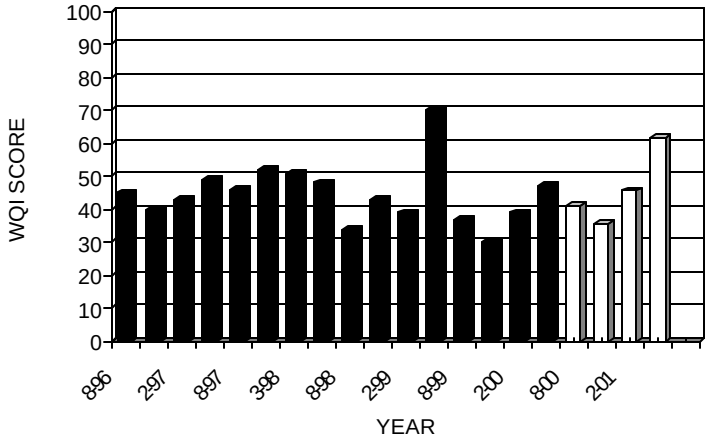



**Biological Index**

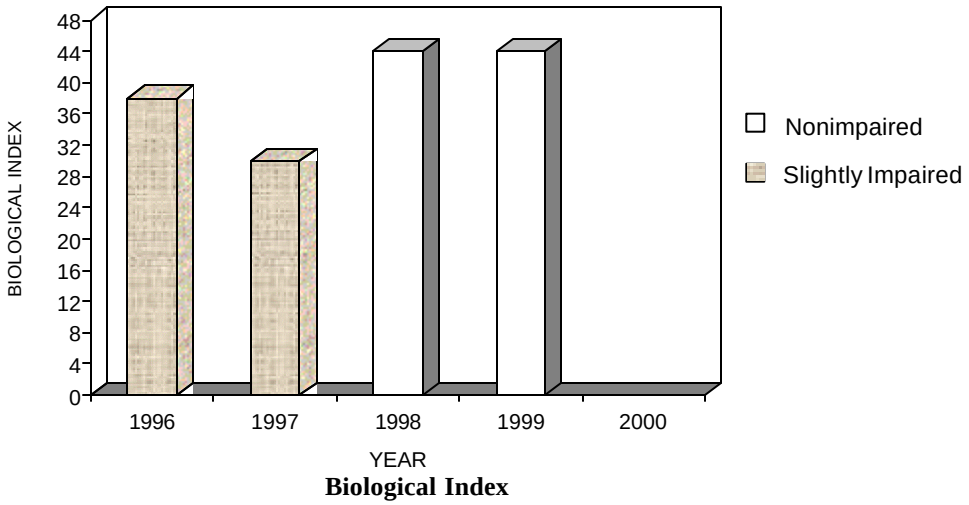
***Table 51. Water Quality Summary Susquehanna River at Marietta, Pa.***

| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| DO | 08/03/00 | 4.46 mg/l | 5.0 mg/l | Md. aquatic life |
| TSO4 | 11/13/00 | 622 mg/l | 250 mg/l | Pa. water supply |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 08/03/00 | 41.1 | COND | TS | DS | TSO4 | | | | |
| 11/13/00 | 35.6 | COND | TSO4 | | | | | | |
| 02/12/01 | 45.7 | TS | DS | TFe | TMn | | | | |
| 05/14/01 | 61.5 | COND | TS | DS | TP | TOC | TSO4 | TMn | TAl |
| | | TPO4 | TURB | | | | | | |




**Water Quality Index**

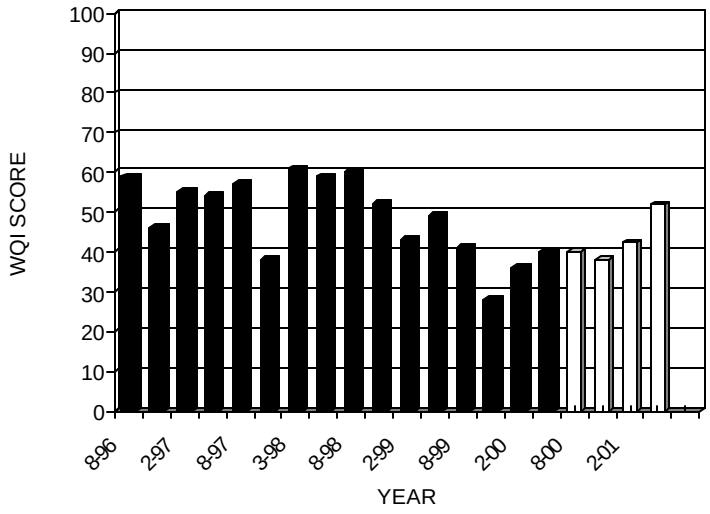



**Biological Index**

***Table 52. Water Quality Summary Susquehanna River at Conowingo, Md.***

| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| DO | 08/02/00 | 3.46 mg/l | 4.0 mg/l | Pa. aquatic life |
| DO | 08/02/00 | 3.46 mg/l | 5.0 mg/l | Md. aquatic life |
| DO | 05/14/01 | 4.08 mg/l | 5.0 mg/l | Md. aquatic life |

| **Date** | **WQI** | **Parameters Exceeding 90th Percentile** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 08/02/00 | 40.2 | DO | COND | DS | TSO4 | | | | |
| 11/15/00 | 38.2 | None | | | | | | | |
| 02/19/01 | 42.3 | DO | TMn | | | | | | |
| 05/14/01 | 51.9 | DO | TSO4 | | | | | | |



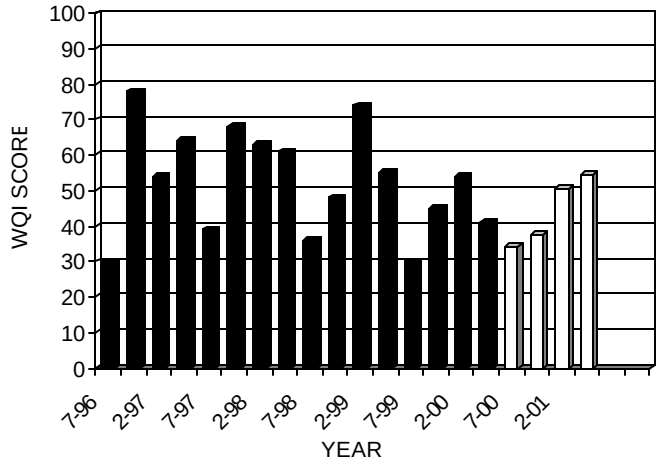

**Water Quality Index**

***Table 53. Water Quality Summary Tioga River at Lindley, N.Y.***

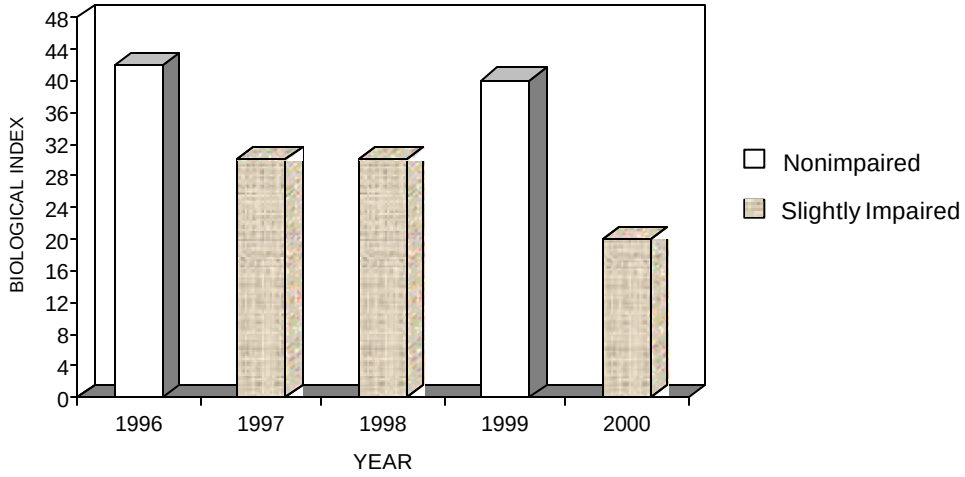
| Parameters Exceeding Standards | | | | |
|---|---|---|---|---|
| **Parameter** | **Date** | **Value** | **Standard** | **State** |
| None | | | | |

| Date | WQI | Parameters Exceeding 90th Percentile | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 07/25/00 | 34.2 | TSO4 | | | | | | | |
| 11/07/00 | 37.6 | DO | TSO4 | | | | | | |
| 02/07/01 | 50.4 | TMn | DMn | | | | | | |
| 05/09/01 | 54.6 | TMn | DMn | TURB | | | | | |

| Biological and Habitat Summary | |
|---|---|
| Number of Taxa | 18 |
| Diversity Index | 2.2 |
| RBP III Score | 20 |
| RBP III Condition | Slightly Impaired |
| Total Habitat Score | 200 |
| Habitat Condition Category | Excellent |




**Water Quality Index**




**Biological Index**

Poor water quality at this site may have been due to acid mine drainage in the headwaters of the Tioga River. The Tioga-Hammond Reservoir, located upstream of TIOG 10.8, alleviated some of the effects of acid mine drainage by buffering the outflow of Tioga Lake with alkaline waters stored in Hammond Lake. However, the effects of the acid mine drainage may still be observed downstream. Poor quality water from the Cowanesque River also may affect the Tioga River downstream of their confluence.

TIOG 10.8 had only one increasing trend and numerous decreasing trends. A significant increase was evident in flow-adjusted aluminum. Strong, significant decreasing trends were found for adjusted and unadjusted total ammonia, total nitrogen, total sulfate, and total manganese, and for unadjusted total phosphorus. A significant decreasing trend occurred in unadjusted total solids and total iron, as well as flow-adjusted total phosphorus (Table 19).

## Group 3 Sites

### Babcock Run (BABC)

During the 2000-2001 sampling season, the macroinvertebrate community of Babcock Run near Cadis, Pa., was designated nonimpaired. Several pollution-intolerant taxa were present in Babcock Run including *Hexatoma*, *Centroptilum*, *Ephemerella* (Ephemeroptera: Ephemerellidae), *Epeorus*, *Leucrocuta* (Ephemeroptera: Heptageniidae), *Stenonema*, *Paraleptophlebia* (Ephemeroptera: Paraleptophlebiidae), *Haploperla*, *Sweltsa*, *Amphinemura* (Plecoptera: Nemouridae), *Leuctra*, and *Isoperla*. Physical habitat conditions were designated supporting, and all field chemistry parameters were normal. The streambed was almost dry at the time of sampling.

### Bill Hess Creek (BILL)

Bill Hess Creek near Nelson, Pa., served as the reference site for the Group 3 streams. The sample taken at Bill Hess Creek had the lowest percent dominant taxa and the highest Shannon-Weaver Diversity Index value of the Group 3 streams. This site also scored high on the EPT Index and the EPT/Chironomidae ratio. Organic pollution-intolerant taxa in the sample were *Hexatoma*, *Ameletus* (Ephemeroptera: Ameletidae), *Centroptilum*, *Ephemerella*, *Epeorus*, *Stenonema*, *Paraleptophlebia*, *Haploperla*, *Amphinemura*, *Leuctra*, *Acroneuria*, *Agnetina*, and *Isoperla*. All field chemistry parameters were within acceptable limits, although conductivity (283 µmhos/cm) was the highest of the Group 3 streams.

### Bird Creek (BIRD)

Bird Creek near Webb Mills, N.Y., was designated moderately impaired. This site had a low EPT Index value due to low numbers of Plecoteran taxa and no Trichopteran taxa. The stream did have several Ephemeropteran taxa including *Ameletus*, *Baetis* (Ephemeroptera: Baetidae), *Drunella* (Ephemeroptera: Ephemerellidae), *Ephemerella*, *Epeorus*, and *Leucrocuta*. The habitat was designated supporting. All field chemistry parameters fell within acceptable ranges.

### Biscuit Hollow (BISC)

Slightly impaired biological conditions existed at Biscuit Hollow near Austinburg, Pa., during this survey. The most abundant taxa present at this site were Chironomidae. The physical habitat at this site was considered partially supporting, with a poor riparian vegetative zone width. Field chemistry parameters were within normal ranges.

### Briggs Hollow Run (BRIG)

Briggs Hollow Run near Nichols, N.Y., was designated moderately impaired during the 2001 sampling season. It had the lowest overall Shannon-Weaver Diversity value (1.52) of all sampling sites. This site had low taxonomic richness (13) and had a high percent dominant taxa value (50 percent) compared to the other sites. The site is dominated by the pollution-tolerant taxa Chironomidae. The physical habitat was designated partially supporting with instream cover, velocity depth regimes, and sediment deposition obtaining the lowest scores. All field chemistry parameters were within acceptable limits.

**Bulkley Brook (BULK)**

Bulkley Brook near Knoxville, Pa., had a slightly impaired biological community and excellent habitat conditions during the 2000-2001 sampling season. The epifaunal substrate and the riparian vegetative zone width received the highest ratings in the habitat assessment. Several pollution intolerant taxa existed at Bulkley Brook including *Ameletus, Epeorus, Leucrocuta, Stenonema, Paraleptophlebia, Nigronia, Sweltsa, Amphinemura, Leuctra, Acroneuria, Isoperla, Dolophilodes, and Rhyacophila.* Field chemistry indicated that all parameters were within acceptable limits.

**Camp Brook (CAMP)**

Camp Brook near Osceola, Pa., had a nonimpaired biological community during the 2001 sampling season. This site had the highest EPT/Chironomidae ratio of all the Group 3 sites (54.5 percent), and the most abundant taxa were *Epeorus*. The physical habitat of the stream was designated partially supporting with poor riparian conditions and velocity/depth regimes. All field chemistry parameters were normal.

**Cook Hollow (COOK)**

Cook Hollow near Austinburg, Pa., had a nonimpaired biological community. This site scored well in all the metrics and had the highest EPT Index value (18). A number of pollution intolerant taxa existed at this site including *Hexatoma*, *Ameletus*, *Centroptilum*, *Ephemerella*, *Epeorus, Leucrocuta, Stenonema, Paraleptophlebia, Ophiogomphus, Sweltsa, Leuctra, Amphinemura, Acroneuria, Isoperla, Dolophilodes,* and *Rhyacophila.* The habitat was excellent with good vegetative protective cover. Field chemistry parameters were all within acceptable limits.

**Deep Hollow Brook (DEEP)**

The biological community of Deep Hollow Brook near Danville, N.Y., was designated slightly impaired with an excellent physical habitat. This site had the highest number of taxa (25) of all Group 3 sampling sites, although its EPT/Chironomidae ratio value was low (0.66). A beaver dam was located upstream of the sampling site on Deep Hollow Brook, and flows were very low at the time of sampling. Algae covered the streambed, and the dissolved oxygen value was low (4.99 mg/l). Furthermore, the temperature was the highest of all the Group 3 sites (18.2 degrees Celsius), and alkalinity was extremely low with a value of 8 mg/l.

**Denton Creek (DENT)**

Denton Creek near Hickory Grove, Pa., was dry during May 2001. This site is located downstream of Hawkins Pond in New York State.

**Dry Brook (DRYB)**

Dry Brook at Waverly, N.Y., also was dry during May 2001. This stream runs directly through residential and commercial areas in the town of Waverly.

**Little Wappasening Creek (LWAP)**

The biological community of Little Wappasening Creek near Nichols, N.Y., was designated moderately impaired during the 2001 sampling season. The site had low taxonomic richness (13) and Shannon-Weaver Diversity Index (1.76) compared to other Group 3 sites. There were no Trichopteran taxa, although the EPT Index value was moderate due to eight Ephemeropteran taxa and four Plecopteran taxa. The physical habitat was designated nonsupporting due to a heavily altered channel, a large amount of streambank erosion, lack of vegetative protective cover, and a poor riparian vegetative zone. In fact, dredging equipment was found in the stream and timber was being removed from the stream banks. All field chemistry parameters were normal.

**Parks Creek (PARK)**

Parks Creek near Litchfield, N.Y., had a slightly impaired biological community during the 2001 sampling season. The highest percent dominant value of the Group 3 sites was for Parks Creek. The site was dominated by Chironomidae. A number of pollution intolerant taxa existed at

the Parks Creek sampling site though, including *Hexatoma, Ameletus, Centroptilum, Ephemerella, Epeorus, Leucrocuta, Haploperla, Sweltsa, Leuctra, Amphinemura*, and *Isoperla*. The site had a nonsupporting habitat due to heavy channel alteration, condition of the banks, lack of vegetative protective cover on the banks, and poor riparian vegetative zone. All field chemistry parameters were within acceptable ranges.

**Prince Hollow Run (PRIN)**

The biological community of Prince Hollow Run near Cadis, Pa., was designated slightly impaired with a partially supporting habitat. The stream was channelized upstream of the site and the riparian zone was poor. Staff also noted a strong manure smell, the stream bottom was covered in algae, and the stream was almost dry at the time of sampling. The stream still contained a number of taxa with a Hilsenhoff tolerance value of three or less including *Hexatoma, Ameletus, Ephemerella, Epeorus, Leucrocuta, Isonychia, Paraleptophlebia, Ophiogomphus, Haploperla, Sweltsa, Amphinemura,* and *Isoperla.* The pH was high (9.30) and the alkalinity was 0 mg/l.

**Red House/Beagle Hollow Run (REDH)**

Slightly impaired biological conditions existed at Red House/Beagle Hollow Run near Osceola, Pa., during May 2001. Habitat conditions were considered excellent, and all field chemistry parameters were within normal ranges.

**Russell Run (RUSS)**

The biological community of Russell Run near Windham, Pa., was designated moderately impaired with a nonsupporting habitat. The EPT Index (10) and taxa richness (13) at this site were somewhat low. The habitat was nonsupporting due to heavy channel alteration, condition of the banks, lack of vegetative protective cover, and poor riparian zone. The stream had been channelized and the right bank timbered recently. All field chemistry parameters were normal.

**Sackett Creek (SACK)**

The biological condition of Sackett Creek near Nichols, N.Y., was designated slightly impaired and the physical habitat was supporting. The most abundant taxa at this site was the organic pollution intolerant *Epeorus* (39). Cows had access to the stream below the site, so there may be more organic pollution downstream. All field chemistry parameters were within normal ranges.

**Smith Creek (SMIT)**

The biological conditions at Smith Creek near East Lawrence, Pa., were designated moderately impaired while the stream had supporting habitat conditions. This site had the lowest EPT/Chironomidae ratio (0.51), a relatively high percent dominant taxa value (46.2), and a high Hilsenhoff Biotic Index value (4.33). The dominant taxa were Chironomidae. The stream was almost dry at the time of sampling. There were no extreme values in the field chemistry parameters.

**Strait Creek (STRA)**

A nonimpaired biological community existed at Strait Creek near Nelson, Pa. This site scored well in EPT Index, percent dominant taxa, and Shannon-Weaver Diversity Index metrics, and the most abundant taxa was *Paraleptophlebia*. The physical habitat was designated partially supporting due to channelization, condition of banks, lack of vegetative cover on the banks, and poor riparian conditions. All field chemistry parameters were within normal limits.

**White Branch Cowanesque River (WBCO)**

During May 2001, moderately impaired conditions existed at White Branch Cowanesque River near North Fork, Pa. This site had been nonimpaired in May 2000 with a number of pollution-intolerant taxa. The May 2001 sample had the lowest value for taxonomic richness (12) and EPT Index (3), and had the highest value for the Hilsenhoff Biotic Index of all the Group 3 streams. It only had two taxa with Hilsenhoff tolerance values of three or less. Those two taxa

were *Prosimulium* (Diptera: Simuliidae) and *Antocha*. The physical habitat was degraded also from excellent to supporting, with low values for riparian vegetative zone. Extensive grazing and feeding were reported upstream in 2001, where cows had direct access to the stream. Also, it appeared that work was being done on the dam located upstream of this site. Despite these disturbances, field chemistry measurements were within acceptable ranges.

#### White Hollow (WHIT)

White Hollow near Wellsburg, N.Y., had a nonimpaired biological community during May 2001. This site had the lowest Hilsenhoff Biotic Index value (1.52). Macroinvertebrate taxa with a Hilsenhoff tolerance value of three or less included *Prosimulium*, *Hexatoma*, *Ameletus*, *Centroptilum*, *Epeorus*, *Leucrocuta*, *Sweltsa*, *Amphinemura*, *Nemoura* (Plecoptera: Nemouridae), *Leuctra*, *Diura* (Plecoptera: Perlodidae), *Isoperla*, and *Dolophilodes*. Large numbers of organic pollution intolerant *Epeorus* were found in this sample. The physical habitat was designated supporting, and all water chemistry parameters were normal.

## MANAGEMENT IMPLICATIONS

To establish water quality trends and understand biological conditions, long-term studies of this nature are critical. Unfortunately, short-term monitoring studies are too often the rule, due to time and monetary constraints. However, to effectively manage the resources, officials and local interest groups must have a true picture of ecological dynamics and possible problem areas, which can only be obtained through long-term studies such as this one.

Several management implications can be extracted from the chemical water quality, macroinvertebrate community, and physical habitat data collected from sampling areas. A Pearson Product Moment Correlation was performed for each reference category for average WQI score, RBP III score, and physical habitat score. Statistically significant relationships ($p<0.05$) observed among the chemical characteristics, the biological communities, and physical habitats of the interstate streams are described below. These observations, although based on a small sample size, are presented as possible subject areas for future research and as issues to be considered by aquatic resource managers, local interest groups, elected officials, and other policy-makers.

### New York – Pennsylvania Sites

The sites in this reference category have shown and continue to show a large degree of variability in water quality. There was no significant correlation between RBP III score and water chemistry (WQI score), and no significant correlation between RBP III score and habitat. The two previous years showed a significant ($p<0.05$) positive correlation between RBP III score and habitat score; however, that correlation was not observed in the data for 2000-2001. The habitat in the New York-Pennsylvania border streams often is noted to be unstable due to the glacial history of these streams.

### Pennsylvania – Maryland Sites

There was a significant ($p<0.05$) negative correlation between biological score and WQI for the nine Pennsylvania-Maryland border sites from 2000-2001. There were no significant correlations noted during fiscal year 2000; however, during the 1999 fiscal year, a significant negative correlation also existed between the RBP III score and the water chemistry score. Since a high WQI score denotes poor water quality, this indicates that those sites with degraded water quality also had degraded biological communities.

The area surrounding the Pennsylvania-Maryland border sites is largely agricultural. Heavy agricultural activities without proper best management practices often result in streambank erosion and sedimentation, contributing to poor instream habitat quality and to nutrient enrichment. Additionally, nutrient enrichment encourages excessive plant growth, which can depress dissolved oxygen levels during decomposition.

### River Sites

For the seven river sites, there was a significant positive correlation between physical habitat and RBP III scores, indicating that better physical habitats supported better macroinvertebrate communities. There also was a significant positive correlation between physical habitat and RBP III scores in fiscal year 2000. There was no significant correlation between WQI score and total biological scores for the river sites. However, during the fiscal year 1999, a negative correlation existed between WQI score and biological score.

### Group 3 Streams

Only physical habitat and biological scores were considered in the correlation analysis of Group 3 streams, as extensive water quality information was not collected during this sampling season. There was no significant correlation between physical habitat and biological community for the Group 3 sites. A large number of the Group 3 streams tend to dry up during the summers, due to their small size. This may especially be the case in recent years due to a multi-year drought that affected most of the Susquehanna River Basin. Dry conditions may adversely affect the stream and probably caused much of the impairment seen throughout these Group 3 sites.

### Future Study

Future study and remediation efforts should focus on those streams that had severely or moderately impaired macroinvertebrate communities, increasing trends, or exceeded water quality standards. SCTT 3.0 was the only site to have a severely impaired macroinvertebrate community. Moderately impaired biological conditions were found at Russell Run, Bird Creek, Little Wappasening Creek, Smith Creek, Briggs Hollow Run, White Branch Cowanesque River, Ebaughs Creek, Wappasening Creek, Seeley Creek, and the Cowanesque River. Bird Creek is a tributary to Seeley Creek, and Russell Run and Briggs Hollow Run are tributaries to Wappasening Creek. Furthermore, Little Wappasening is located adjacent to Wappasening Creek. Therefore, the watersheds of Seeley Creek and Wappasening Creek should be investigated further.

Increasing trends were noted at sites on the Chemung River (chloride), Conowingo Creek (nitrogen and chloride), Cowanesque River (manganese), Deer Creek (chloride and sulfate), Ebaughs Creek (chloride), Octoraro Creek (chloride), the Susquehanna River (chloride), Tioga River (aluminum), and Troups Creek (phosphorus). These sites should be investigated as to the source of these parameters. It especially should be noted that chloride trends were increasing at numerous sites, and no decreasing trends for this parameter were found. Efforts should be made to determine why chloride trends are increasing.

Those streams that exceeded water quality standards, Apalachin Creek, Cascade Creek, Cayuta Creek, Little Snake Creek, Troups Creek, North Fork Cowanesque River, Conowingo Creek, Scott Creek, Chemung River, Cowanesque River, and the Susquehanna River, should be monitored for future violations. Furthermore, the source of these pollutants should be identified. It is evident that whether water quality standards are exceeded varies across state lines. Problems may arise when the source of these pollutants is in another state.

## CONCLUSIONS

Fifteen (31 percent) of the 48 interstate macroinvertebrate sampling sites contained nonimpaired biological communities. Biological conditions at another 22 sites (46 percent) were slightly impaired, while 10 sites (21 percent) were moderately impaired. One site (2 percent), Scott Creek, was designated severely impaired. Four sites (SUSQ 10.0, SUSQ 44.5, DENT, DRYB) were not sampled using RBP III techniques and, thus, were not averaged into the final scores. Twenty sites (42 percent) had excellent habitats. Nineteen of the sites (40 percent) had supporting habitats, and six sites (12 percent) had partially supporting habitats. Three sites (6 percent) had nonsupporting habitats: Russell Run, Little Wappasening Creek, and Parks Creek.

Overall, interstate streams seemed to achieve their designated uses, and only 38 observations (1.3 percent) of water chemistry parameters exceeded state standards. Dissolved oxygen and pH exceeded standards most frequently with ten violations (26 percent) each. The pH values were all greater than 8.5 or 9.0; none of the violations were for low pH values. Iron also was a significant problem in the interstate streams. Total iron and dissolved iron combined constituted 29 percent of the number exceeding standards. Previous reports have indicated that iron is elevated in the interstate streams. In 1999-2000, total iron was the most frequently exceeded parameter.

Of the New York-Pennsylvania border streams, the biological communities of five (38.5 percent) of these streams were nonimpaired. Six sites (46.2 percent) in the New York-Pennsylvania reference category were slightly impaired, and two streams (15.4 percent) were moderately impaired. Five sites had excellent habitats (38.5 percent) and eight sites (61.5 percent) had supporting habitats. High metal concentrations, particularly total iron, appeared to be the largest source of water quality degradation in this region. The parameters that exceeded New York and Pennsylvania state standards were iron, aluminum, pH, and alkalinity. Iron standards were exceeded at Cascade Creek, Apalachin Creek, and Little Snake Creek. Aluminum standards were exceeded at North Fork Cowanesque River, Troups Creek, and Little Snake Creek. Troups Creek and Cayuta Creek exceeded pH standards, and Cascade Creek and Little Snake Creek exceeded alkalinity standards. Rechannelization of the streambed and removal of instream habitat may have resulted in poor conditions for macroinvertebrate colonization in several streams, including Bentley Creek and Seeley Creek. Wappasening Creek has shown a decreasing biological condition over the past three years. Consideration should be given to changing this stream to a Group 1 stream so it can be more closely monitored for impairment in water quality.

Nonimpaired biological conditions existed at two (22.2 percent) of the nine Pennsylvania-Maryland interstate streams. Of the remaining seven sites, five sites (55.6 percent) were slightly impaired, one site (11.1 percent) was moderately impaired, and one site (11.1 percent) was designated severely impaired. Four (44.4 percent) of the Pennsylvania-Maryland border sites had excellent habitats, and four sites (44.4 percent) had supporting habitats. One site (11.1 percent) had a partially supporting habitat. Elevated nutrient levels, possibly due to agricultural runoff, appeared to affect the water quality of the streams in this region, particularly the levels of dissolved oxygen. The parameters that exceeded Pennsylvania and Maryland water quality standards were dissolved oxygen and iron at Conowingo Creek and Scott Creek. WQI score and RBP III scores showed a significant negative correlation for the Pennsylvania-Maryland border sties, meaning that streams in this region that had higher quality water also had the better biological condition and streams that had worse water quality had degraded biological conditions. The stream (BBDC 4.1) with the highest biological condition score (36) had one of the lowest WQI scores (29.5). Also, the stream (SCTT 3.0) with the lowest biological condition score (4) had the highest WQI score (76.7). Streambank erosion and sedimentation were a problem in the instream habitat for this region.

River sites consisted of nine stations located on the Susquehanna River, Chemung River, Cowanesque River, and Tioga River. One station (SUSQ 10.0) is never sampled for macroinvertebrates due to a lack of riffle habitat at the site. SUSQ 44.5 was not sampled for macroinvertebrates in fiscal year 2001 due to high flow conditions. The biological communities of two sites (28.6 percent) were nonimpaired, four sites (57.1 percent) were slightly impaired, and one site (14.3 percent) was moderately impaired. Six of the sites (85.7 percent) had excellent habitats, and one site (14.3 percent) had supporting habitat. Water quality parameters that exceeded state standards were pH, dissolved oxygen, total nitrite, and total sulfate. The only sites that did not exceed standards were SUSQ 365 and TIOG 10.8. Physical habitat scores and RBP III scores were significantly correlated for the river stations, indicating that those streams with better habitat had better macroinvertebrate populations.

Of the 21 Group 3 sites, two sites (DENT and DRYB) were dry and were not sampled in May 2001. Of the remaining 19 sites, six stations (31.6 percent) were designated nonimpaired. Seven sites (36.8 percent) had slightly impaired biological communities, while six stations (31.6 percent) had moderately impaired conditions. Five (26.3 percent) of the 19 stations sampled had excellent habitat conditions, six (31.6 percent) had supporting habitats, five sites (26.3 percent) had partially supporting habitats, and three sites (15.8 percent) had nonsupporting habitats. There was no significant correlation between physical habitat and biological score during this sampling season.

The Seasonal Kendall nonparametric test for trend was applied to observed concentration and flow-adjusted concentration. Trends were detected ($p<0.10$) for several parameters at individual stations. For each parameter, an overall weighted value was calculated to indicate the strength of the trend in the Susquehanna River Basin over the period 1986 through 2001. Table 54 provides a summary of detected trends and overall direction. The only overall increasing trend was in concentrations of total chlorides. This could be the result of applying salt to remove ice from roads or from the use of chlorine in wastewater treatment and water treatment plants. No overall trends in either unadjusted or flow-adjusted concentrations were evident in total suspended solids, total sulfate, total aluminum, and WQI. All other parameters showed a decreasing trend in either unadjusted or flow-adjusted concentrations. These decreasing trends suggest an improvement in water quality. Total iron showed a particularly strong decreasing trend. Increased efforts have been made in the Susquehanna River Basin over the past few years to remediate abandoned mine drainage problems, a source of iron in streamwater.

The current and historical data contained in this report provide a database that enables SRBC staff and others to better manage water quality, water quantity, and biological resources of interstate streams in the Susquehanna River Basin. The data can be used by SRBC's member states and local interest groups to gain a better understanding of water quality in upstream and downstream areas outside of their jurisdiction. Information in this report can also serve as a starting point for more detailed assessments and remediation efforts that may be planned on these streams.

*Table 54. Summary of Overall Direction of Trends*

| Parameter | Detected Trends | | | | Overall Direction of Concentration Trend | Overall Direction of Flow-Adjusted Concentration Trend |
|---|---|---|---|---|---|---|
| | Concentration | | Flow-Adjusted Concentration | | | |
| | + | - | + | - | | |
| Total Suspended Solids | 0 | 1 | 0 | 0 | None | None |
| Total Ammonia | 0 | 12 | 0 | 8 | Decreasing | None |
| Total Nitrogen | 1 | 9 | 1 | 9 | None | Decreasing |
| Total Phosphorus | 1 | 10 | 0 | 8 | Decreasing | None |
| Total Chloride | 9 | 0 | 9 | 0 | Increasing | Increasing |
| Total Sulfate | 1 | 6 | 0 | 7 | None | None |
| Total Iron | 0 | 12 | 0 | 9 | Decreasing | Decreasing |
| Total Aluminum | 0 | 6 | 1 | 5 | None | None |
| Total Manganese | 1 | 10 | 0 | 6 | Decreasing | None |
| Water Quality Index | 0 | 2 | 0 | 0 | None | None |

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# APPENDIX A

## WATER QUALITY DATA FOR INTERSTATE STREAMS CROSSING THE NEW YORK-PENNSYLVANIA AND PENNSYLVANIA-MARYLAND BORDERS

***Table A1. Water Quality Data for New York-Pennsylvania Border Streams***

| Parameter | Units | APAL 6.9 | BNTY 0.9 | BNTY 0.9 | BNTY 0.9 | BNTY 0.9 | CASC 1.6 | CASC 1.6 | CASC 1.6 |
|---|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20000726 | 20000725 | 20001107 | 20010207 | 20010508 | 20000726 | 20001106 | 20010206 |
| Time | hhmm | 930 | 1200 | 905 | 920 | 1220 | 1530 | 1040 | 1115 |
| Discharge | cfs | 1.87 | 3.411 | 2.396 | 3.78 | 2.804 | NA | 0.173 | 2.115 |
| Temperature | degree C | 18.5 | 21.9 | 4.3 | 1.8 | 13.8 | 18.5 | 4.1 | 0.9 |
| Conductance | umhos/cm | 108 | 242 | 244 | 197 | 174 | 73 | 72 | 48 |
| Dissolved Oxygen | mg/l | 5.2 | 6.95 | 7.98 | 7.73 | 6.19 | 5.38 | 8.42 | 8.25 |
| pH | | 6.9 | 8 | 8.25 | 7.8 | 8.15 | 7.2 | 7.6 | 7.2 |
| Alkalinity | mg/l | 28 | 88 | 100 | 92 | 92 | 26 | 26 | 10 |
| Acidity | mg/l | 8 | 4 | 2 | 6 | 2 | 4 | 6 | 4 |
| Solids, Total | mg/l | 86 | 158 | 192 | 172 | 108 | 168 | 66 | 64 |
| Solids, Dissolved | mg/l | 68 | 138 | 168 | 142 | 108 | 142 | 66 | 64 |
| Ammonia, Total | mg/l | 0.04 | <0.02 | <0.02 | 0.07 | <0.02 | <0.02 | <0.02 | 0.02 |
| Ammonia, Dissolved | mg/l | 0.04 | <0.02 | <0.02 | 0.08 | <0.02 | <0.02 | <0.02 | 0.02 |
| Nitrite, Total | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrite, Dissolved | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrate, Total | mg/l | 0.17 | <0.04 | 0.19 | 0.75 | <0.04 | 0.09 | <0.04 | 0.23 |
| Nitrate, Dissolved | mg/l | 0.17 | <0.04 | 0.18 | 0.74 | 0.08 | 0.08 | 0.05 | 0.22 |
| Nitrogen, Total | mg/l | 0.54 | 0.27 | 0.14 | 1.14 | 0.21 | 0.37 | 0.27 | 0.48 |
| Nitrogen Dissolved | mg/l | 0.48 | 0.29 | 0.16 | 1.07 | 0.21 | 0.37 | 0.18 | 0.4 |
| Phosphorus, Total | mg/l | 0.04 | 0.02 | <0.01 | 0.03 | <0.01 | 0.03 | 0.03 | 0.1 |
| Phosphorus, Dissolved | mg/l | 0.015 | 0.016 | <0.01 | 0.027 | <0.01 | 0.022 | 0.01 | 0.087 |
| Orthophosphate, Total | mg/l | 0.014 | 0.018 | <0.01 | 0.024 | <0.01 | 0.015 | 0.015 | 0.072 |
| Orthophosphate, Dissolved | mg/l | 0.01 | 0.014 | <0.01 | 0.023 | <0.01 | 0.017 | <0.01 | 0.076 |
| Organic Carbon, Total | mg/l | 2.2 | 2.1 | 1.7 | 2.1 | 2.1 | 2.7 | 2.2 | 1.7 |
| Calcium | mg/l | 9.72 | 27.3 | 29.4 | 22.7 | 18.9 | 7.29 | 7.33 | 4.22 |
| Magnesium | mg/l | 3.1 | 6.12 | 6.46 | 5.09 | 3.96 | 2.1 | 2.07 | 1.46 |
| Chloride | mg/l | 5 | 15 | 17 | 17 | 10 | 2 | 3 | 4 |
| Sulfate | mg/l | <20 | <20 | <20 | 24 | <20 | <20 | <20 | <20 |
| Turbidity | ntu | 5.07 | <1 | <1 | <1 | <1 | 4.7 | 2.82 | 2.51 |
| Iron, Total | µg/l | 567 | <20 | <20 | 39 | 87 | 811 | 608 | 181 |
| Iron, Dissolved | µg/l | 150 | <20 | 25 | <20 | <20 | 467 | 275 | 108 |
| Manganese, Total | µg/l | 115 | <10 | <10 | <10 | <10 | 98 | 101 | <10 |
| Manganese, Dissolved | µg/l | 90 | <10 | <10 | <10 | <10 | 48 | 91 | <10 |
| Aluminum, Total | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A1. Water Quality Data for New York-Pennsylvania Border Streams – Continued***

| Parameter | Units | CASC 1.6 | CAYT 1.7 | CAYT 1.7 | CAYT 1.7 | CAYT 1.7 | CHEM 12.0 | CHEM 12.0 | CHEM 12.0 |
|---|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010507 | 20000725 | 20001106 | 20010206 | 20010508 | 20000725 | 20001107 | 20010207 |
| Time | hhmm | 1535 | 1400 | 1505 | 1455 | 1050 | 1300 | 755 | 830 |
| Discharge | cfs | 4.052 | 32.055 | 29.704 | 57.967 | 19.415 | 407 | 352 | 752 |
| Temperature | degree C | 20.6 | 21.6 | 8.2 | 2.6 | 13.3 | 23.4 | 7.9 | 1.8 |
| Conductance | umhos/cm | 62 | 465 | 429 | 324 | 402 | 435 | 464 | 388 |
| Dissolved Oxygen | mg/l | 5.15 | 7.09 | 9.53 | 8.32 | 7.02 | 7.75 | 8.57 | 7.76 |
| pH | | 6.85 | 8.2 | 9 | 8.35 | 8.3 | 8.55 | 8.8 | 8.05 |
| Alkalinity | mg/l | 20 | 124 | 148 | 136 | 140 | 120 | 100 | 76 |
| Acidity | mg/l | 2 | 2 | 0 | 0 | 0 | NA | 0 | 2 |
| Solids, Total | mg/l | 54 | 244 | 292 | 212 | 250 | 306 | 330 | 282 |
| Solids, Dissolved | mg/l | 42 | 222 | 282 | 206 | 234 | 280 | 300 | 278 |
| Ammonia, Total | mg/l | <0.02 | <0.02 | <0.02 | 0.03 | <0.02 | <0.02 | <0.02 | 0.06 |
| Ammonia, Dissolved | mg/l | <0.02 | <0.02 | <0.02 | 0.03 | <0.02 | <0.02 | <0.02 | 0.08 |
| Nitrite, Total | mg/l | <0.01 | <0.01 | 0.01 | 0.02 | 0.02 | <0.01 | 0.02 | 0.01 |
| Nitrite, Dissolved | mg/l | <0.01 | 0.01 | 0.01 | 0.02 | 0.01 | <0.01 | 0.02 | 0.01 |
| Nitrate, Total | mg/l | <0.04 | 1 | 1.4 | 0.79 | 0.67 | 0.19 | 0.68 | 0.98 |
| Nitrate, Dissolved | mg/l | <0.04 | 0.82 | 1.41 | 0.82 | 0.66 | 0.55 | 0.76 | 0.98 |
| Nitrogen, Total | mg/l | <0.064 | 1.49 | 1.79 | 1.15 | 1.18 | 0.93 | 0.86 | 1.44 |
| Nitrogen Dissolved | mg/l | <0.064 | 1.39 | 1.78 | 1.12 | 0.99 | 1.01 | 0.85 | 1.44 |
| Phosphorus, Total | mg/l | 0.02 | 0.22 | 0.3 | 0.17 | 0.04 | 0.06 | 0.08 | 0.12 |
| Phosphorus, Dissolved | mg/l | <0.01 | 0.18 | 0.29 | 0.17 | 0.025 | 0.058 | 0.072 | 0.1 |
| Orthophosphate, Total | mg/l | 0.013 | 0.19 | 0.29 | 0.16 | 0.026 | 0.026 | 0.07 | 0.087 |
| Orthophosphate, Dissolved | mg/l | <0.01 | 0.16 | 0.29 | 0.15 | 0.024 | 0.012 | 0.07 | 0.08 |
| Organic Carbon, Total | mg/l | 2.5 | 2.5 | 2.7 | 2.3 | 2.8 | 4.2 | 3.2 | 3.1 |
| Calcium | mg/l | 5.61 | 39.1 | 43.9 | 30.9 | 37.3 | 41.1 | 48.8 | 40.9 |
| Magnesium | mg/l | 1.67 | 8.34 | 8.2 | 6.61 | 6.43 | 10.6 | 12.4 | 9.44 |
| Chloride | mg/l | 2 | 55 | 50 | 40 | 49 | 51 | 54 | 47 |
| Sulfate | mg/l | <20 | 22 | 31 | 39 | 22.4 | 27 | 27 | 38 |
| Turbidity | ntu | 1.58 | <1 | 1.84 | 1.39 | <1 | 2.47 | 1.3 | 1.55 |
| Iron, Total | µg/l | 500 | 78 | 78 | 123 | 66 | 115 | 67 | 129 |
| Iron, Dissolved | µg/l | 301 | <20 | <20 | 39 | <20 | <20 | 31 | 39 |
| Manganese, Total | µg/l | 86 | 10 | <10 | 11 | <10 | 62 | <10 | 26 |
| Manganese, Dissolved | µg/l | 66 | <10 | <10 | <10 | <10 | <10 | <10 | 22 |
| Aluminum, Total | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A1. Water Quality Data for New York-Pennsylvania Border Streams – Continued***

| Parameter | Units | CHEM 12.0 | CHOC 9.1 | COWN 2.2 | COWN 2.2 | COWN 2.2 | COWN 2.2 | COWN 1.0 | COWN 1.0 |
|---|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010508 | 20000726 | 20000724 | 20001107 | 20010207 | 20010509 | 20000725 | 20001107 |
| Time | hhmm | 1130 | 1030 | 1400 | 1235 | 1515 | 815 | 900 | 1200 |
| Discharge | cfs | 978 | 6.796 | NA | NA | NA | NA | 31 | 27 |
| Temperature | degree C | 16.2 | 17.3 | 22.1 | 10.7 | 4.2 | 18.4 | 19.1 | 8.8 |
| Conductance | umhos/cm | 350 | 100 | 182 | 220 | 242 | 149 | 195 | 223 |
| Dissolved Oxygen | mg/l | 5.5 | 6.02 | 4.29 | 6.56 | 7.29 | 6.13 | 5.36 | 7.58 |
| pH | | 8.35 | 7 | 7.65 | 7.6 | 7.6 | 8.7 | 7.25 | 8.15 |
| Alkalinity | mg/l | 86 | 28 | 66 | 44 | 40 | 88 | 64 | 58 |
| Acidity | mg/l | 0 | 4 | 8 | 4 | 4 | 0 | 8 | 2 |
| Solids, Total | mg/l | 252 | 84 | 154 | 162 | 196 | 98 | 152 | 164 |
| Solids, Dissolved | mg/l | 238 | 56 | 134 | 162 | 156 | 98 | 128 | 160 |
| Ammonia, Total | mg/l | <0.02 | <0.02 | 0.08 | 0.03 | 0.08 | 0.02 | <0.02 | <0.02 |
| Ammonia, Dissolved | mg/l | <0.02 | <0.02 | 0.08 | 0.03 | 0.08 | <0.02 | <0.02 | <0.02 |
| Nitrite, Total | mg/l | 0.01 | <0.01 | 0.01 | 0.01 | <0.01 | 0.01 | 0.01 | 0.2 |
| Nitrite, Dissolved | mg/l | 0.01 | <0.01 | 0.01 | 0.01 | <0.01 | 0.01 | <0.01 | 0.02 |
| Nitrate, Total | mg/l | 0.46 | 0.23 | 0.12 | 0.17 | 0.57 | 0.26 | 0.29 | 0.15 |
| Nitrate, Dissolved | mg/l | 0.43 | 0.24 | 0.12 | 0.17 | 0.57 | 0.26 | 0.24 | 0.3 |
| Nitrogen, Total | mg/l | 0.67 | 0.56 | 0.86 | 0.4 | 1.09 | 0.64 | 0.85 | 0.48 |
| Nitrogen Dissolved | mg/l | 0.9 | 0.59 | 0.72 | 0.34 | 1.04 | 0.59 | 0.74 | 0.46 |
| Phosphorus, Total | mg/l | 0.04 | 0.02 | 0.04 | 0.01 | 0.07 | 0.02 | 0.04 | 0.03 |
| Phosphorus, Dissolved | mg/l | 0.015 | 0.022 | 0.018 | <0.01 | 0.061 | <0.01 | 0.017 | 0.02 |
| Orthophosphate, Total | mg/l | 0.021 | 0.036 | 0.019 | 0.011 | 0.054 | 0.016 | 0.013 | 0.022 |
| Orthophosphate, Dissolved | mg/l | 0.013 | 0.018 | 0.012 | <0.01 | 0.048 | <0.01 | 0.012 | 0.017 |
| Organic Carbon, Total | mg/l | 3.4 | 2.1 | 5.3 | 4.5 | 3.5 | 4.1 | 5.3 | 4.6 |
| Calcium | mg/l | 35.2 | 8.9 | 19.3 | 24.2 | 26.5 | 16 | 20.5 | 24.2 |
| Magnesium | mg/l | 7.89 | 2.8 | 4.5 | 5.13 | 5.39 | 3.18 | 4.72 | 5.28 |
| Chloride | mg/l | 39 | 7 | 10 | 15 | 21 | 10 | 10 | 17 |
| Sulfate | mg/l | <20 | <20 | <20 | 30 | 22 | 26 | 23 | 22 |
| Turbidity | ntu | 1.97 | 1.78 | 3.83 | 2.74 | 1.69 | 2.02 | 2.95 | 2.02 |
| Iron, Total | µg/l | 137 | 162 | 109 | 166 | 109 | 147 | 87 | 119 |
| Iron, Dissolved | µg/l | <20 | 45 | <20 | 24 | 28 | <20 | 24 | 24 |
| Manganese, Total | µg/l | 38 | 42 | 300 | 168 | 21 | 45 | 90 | 59 |
| Manganese, Dissolved | µg/l | <10 | 29 | 137 | 114 | <10 | 17 | 21 | 30 |
| Aluminum, Total | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A1. Water Quality Data for New York-Pennsylvania Border Streams – Continued***

| Parameter | Units | COWN 1.0 | COWN 1.0 | LSNK 7.6 | LSNK 7.6 | LSNK 7.6 | LSNK 7.6 | NFCR 7.6 | SEEL 10.3 |
|---|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010207 | 20010509 | 20000726 | 20001106 | 20010313 | 20010508 | 20000724 | 20000725 |
| Time | hhmm | 1300 | 915 | 1130 | 1255 | 1450 | 800 | 1115 | 1000 |
| Discharge | cfs | 90 | 85 | 0.706 | 0.621 | 9.401 | 4.484 | 0.358 | 6.646 |
| Temperature | degree C | 3.7 | 19.2 | 19 | 5.3 | 1.9 | 9.7 | 16.2 | 18.1 |
| Conductance | umhos/cm | 234 | 147 | 131 | 145 | 160 | 114 | 166 | 298 |
| Dissolved Oxygen | mg/l | 8.22 | 7.99 | 5.39 | 8.04 | 9.08 | 6.04 | 5.47 | 6.31 |
| pH | | 8.05 | 9.5 | 6.95 | 7.65 | 6.5 | 7 | 7.25 | 7.6 |
| Alkalinity | mg/l | 52 | 72 | 34 | 36 | 12 | 36 | 50 | 118 |
| Acidity | mg/l | 2 | 0 | 8 | 6 | 4 | 8 | 8 | 10 |
| Solids, Total | mg/l | 156 | 56 | 106 | 104 | 116 | 94 | 166 | 190 |
| Solids, Dissolved | mg/l | 108 | 56 | 84 | 100 | 106 | 94 | 152 | 180 |
| Ammonia, Total | mg/l | 0.27 | <0.02 | 0.02 | <0.02 | 0.05 | <0.02 | <0.02 | <0.02 |
| Ammonia, Dissolved | mg/l | 0.2 | <0.02 | 0.02 | <0.02 | 0.05 | <0.02 | <0.02 | <0.02 |
| Nitrite, Total | mg/l | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrite, Dissolved | mg/l | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrate, Total | mg/l | 0.59 | 0.22 | <0.04 | <0.04 | 0.46 | <0.04 | 0.94 | 0.06 |
| Nitrate, Dissolved | mg/l | 0.59 | 0.23 | 0.04 | <0.04 | 0.46 | <0.04 | 0.83 | 0.05 |
| Nitrogen, Total | mg/l | 1.07 | 0.66 | 0.43 | 0.21 | 0.77 | <0.064 | 1.42 | 0.3 |
| Nitrogen Dissolved | mg/l | 1.06 | 0.66 | 0.45 | 0.18 | 0.83 | <0.064 | 1.46 | 0.37 |
| Phosphorus, Total | mg/l | 0.07 | 0.02 | 0.05 | <0.01 | 0.03 | 0.01 | 0.09 | 0.02 |
| Phosphorus, Dissolved | mg/l | 0.057 | 0.01 | 0.039 | <0.01 | <0.01 | <0.01 | 0.047 | 0.011 |
| Orthophosphate, Total | mg/l | 0.052 | 0.016 | 0.023 | <0.01 | 0.019 | 0.012 | 0.061 | 0.016 |
| Orthophosphate, Dissolved | mg/l | 0.049 | 0.01 | 0.018 | <0.01 | <0.01 | <0.01 | 0.02 | 0.013 |
| Organic Carbon, Total | mg/l | 3.5 | 4.4 | 4.2 | 2.7 | 2.6 | 2.6 | 3.5 | 2 |
| Calcium | mg/l | 26.6 | 14.3 | 11.7 | 9.4 | 9.88 | 8.37 | 15.8 | 39.4 |
| Magnesium | mg/l | 5.18 | 2.94 | 3.06 | 2.38 | 2.65 | 2.48 | 5.56 | 6.74 |
| Chloride | mg/l | 21 | 9 | 13 | 23 | 32 | 12 | 9 | 13 |
| Sulfate | mg/l | 24 | 41 | <20 | <20 | <20 | <20 | <20 | <20 |
| Turbidity | ntu | 2.01 | 2.29 | 3.65 | 1.27 | 10.2 | 2.04 | 1.98 | <1 |
| Iron, Total | µg/l | 97 | 103 | 781 | 206 | 484 | 351 | 157 | <20 |
| Iron, Dissolved | µg/l | 32 | <20 | 307 | 139 | 104 | 210 | 40 | <20 |
| Manganese, Total | µg/l | 18 | 23 | 184 | 69 | 74 | 40 | 44 | <10 |
| Manganese, Dissolved | µg/l | 12 | <10 | 148 | 63 | 66 | 35 | 25 | <10 |
| Aluminum, Total | µg/l | <200 | <200 | <200 | <200 | 308 | <200 | 599 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A1. Water Quality Data for New York-Pennsylvania Border Streams – Continued***

| Parameter | Units | SEEL 10.3 | SEEL 10.3 | SEEL 10.3 | SNAK 2.3 | SOUT 7.8 | SUSQ 365.0 | SUSQ 365.0 |
|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20001107 | 20010207 | 20010508 | 20000726 | 20000725 | 20000726 | 20001106 |
| Time | hhmm | 1025 | 1050 | 1345 | 1235 | 1100 | 1630 | 942 |
| Discharge | cfs | 3.894 | 9.68 | 7.751 | 14.157 | 0.942 | 838.7 | 764.4 |
| Temperature | degree C | 8.4 | 4.3 | 15.4 | 18.9 | 20.3 | 20.5 | 6.4 |
| Conductance | umhos/cm | 319 | 307 | 245 | 115 | 187 | 250 | 217 |
| Dissolved Oxygen | mg/l | 6.55 | 5.98 | 6.2 | 6.09 | 5.76 | 5.85 | 7.98 |
| pH | | 8.15 | 7.65 | 8.4 | 7.4 | 7.4 | 7.7 | 8.3 |
| Alkalinity | mg/l | 128 | 110 | 134 | 38 | 56 | 62 | 64 |
| Acidity | mg/l | 2 | 10 | 0 | 4 | 6 | 4 | 0 |
| Solids, Total | mg/l | 224 | 234 | 138 | 94 | 132 | 562 | 148 |
| Solids, Dissolved | mg/l | 218 | 204 | 138 | 80 | 126 | 540 | 148 |
| Ammonia, Total | mg/l | <0.02 | 0.07 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Ammonia, Dissolved | mg/l | <0.02 | 0.08 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Nitrite, Total | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrite, Dissolved | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrate, Total | mg/l | 0.07 | 0.55 | <0.04 | 0.25 | <0.04 | 0.57 | 0.36 |
| Nitrate, Dissolved | mg/l | 0.06 | 0.54 | 0.07 | 0.21 | 0.06 | 0.57 | 1.24 |
| Nitrogen, Total | mg/l | <0.064 | 0.77 | 0.24 | 0.56 | 0.5 | 0.98 | 0.62 |
| Nitrogen Dissolved | mg/l | <0.064 | 0.77 | 0.27 | 0.51 | 0.5 | 0.99 | 0.59 |
| Phosphorus, Total | mg/l | <0.01 | 0.08 | <0.01 | 0.02 | 0.05 | 0.03 | 0.02 |
| Phosphorus, Dissolved | mg/l | <0.01 | 0.076 | <0.01 | 0.019 | 0.042 | 0.016 | <0.01 |
| Orthophosphate, Total | mg/l | <0.01 | 0.065 | <0.01 | 0.01 | 0.022 | 0.032 | <0.01 |
| Orthophosphate, Dissolved | mg/l | <0.01 | 0.065 | <0.01 | 0.01 | 0.012 | 0.015 | <0.01 |
| Organic Carbon, Total | mg/l | 1.2 | 1.4 | 2.5 | 2.8 | 4.5 | 2.9 | 2.9 |
| Calcium | mg/l | 45.5 | 41.4 | 30.9 | 9.65 | 17.5 | 38.6 | 29.6 |
| Magnesium | mg/l | 7.5 | 7.23 | 5.02 | 2.96 | 3.97 | 3.86 | 3.45 |
| Chloride | mg/l | 19 | 22 | 16 | 10 | 15 | 14 | 14 |
| Sulfate | mg/l | <20 | 31 | 48 | <20 | <20 | <20 | 28 |
| Turbidity | ntu | <1 | <1 | <1 | 1.3 | 1.83 | 3.48 | 1.6 |
| Iron, Total | µg/l | 25 | <20 | <20 | 166 | 249 | 188 | 161 |
| Iron, Dissolved | µg/l | <20 | <20 | <20 | <20 | 85 | 27 | 30 |
| Manganese, Total | µg/l | <10 | <10 | <10 | 12 | 54 | 25 | 15 |
| Manganese, Dissolved | µg/l | <10 | <10 | <10 | <10 | 34 | <10 | 11 |
| Aluminum, Total | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A1. Water Quality Data for New York-Pennsylvania Border Streams – Continued***

| Parameter | Units | SUSQ 365.0 | SUSQ 365.0 | SUSQ 340.0 | SUSQ 340.0 | SUSQ 340.0 | SUSQ 340.0 | SUSQ 289.1 | SUSQ 289.1 |
|---|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010206 | 20010507 | 20000726 | 20001106 | 20010206 | 20010508 | 20000725 | 20001106 |
| Time | hhmm | 956 | 1500 | 1345 | 1145 | 1220 | 645 | 1515 | 1350 |
| Discharge | cfs | 5618 | 1555 | 973 | 983 | 2400 | 1650 | 3060 | 2420 |
| Temperature | degree C | 1.1 | 17.7 | 21.7 | 7.8 | 1.4 | 14.8 | 22.9 | 7.8 |
| Conductance | umhos/cm | 200 | 240 | 228 | 208 | 181 | 224 | 276 | 268 |
| Dissolved Oxygen | mg/l | 8.32 | 5.75 | 5.64 | 9.04 | 8.11 | 5.27 | 6.22 | 8.35 |
| pH | | 7.4 | 7.1 | 7.6 | 9.1 | 8.15 | 7.35 | 7.95 | 8.9 |
| Alkalinity | mg/l | 44 | 74 | 64 | 68 | 48 | 52 | 90 | 80 |
| Acidity | mg/l | 6 | 6 | 4 | 0 | 2 | 8 | 4 | 0 |
| Solids, Total | mg/l | 148 | 174 | 180 | 126 | 132 | 140 | 198 | 176 |
| Solids, Dissolved | mg/l | 144 | 160 | 174 | 126 | 126 | 136 | 182 | 176 |
| Ammonia, Total | mg/l | 0.06 | <0.02 | <0.02 | <0.02 | 0.03 | <0.02 | <0.02 | <0.02 |
| Ammonia, Dissolved | mg/l | 0.04 | <0.02 | <0.02 | <0.02 | 0.03 | <0.02 | 0.02 | <0.02 |
| Nitrite, Total | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.02 |
| Nitrite, Dissolved | mg/l | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 |
| Nitrate, Total | mg/l | 0.8 | 0.73 | 0.43 | 0.27 | 0.66 | 0.56 | 0.76 | 0.44 |
| Nitrate, Dissolved | mg/l | 0.77 | 0.75 | 0.44 | 0.27 | 0.68 | 0.57 | 0.7 | 0.46 |
| Nitrogen, Total | mg/l | 1.22 | 0.96 | 0.91 | 0.56 | 0.98 | 0.78 | 1.28 | 0.75 |
| Nitrogen Dissolved | mg/l | 1.17 | 0.77 | 0.78 | 0.46 | 0.98 | 0.61 | 1.33 | 0.72 |
| Phosphorus, Total | mg/l | 0.22 | 0.02 | 0.03 | 0.02 | 0.18 | 0.02 | 0.06 | 0.03 |
| Phosphorus, Dissolved | mg/l | 0.2 | <0.01 | 0.016 | <0.01 | 0.17 | <0.01 | 0.04 | 0.016 |
| Orthophosphate, Total | mg/l | 0.18 | 0.012 | 0.016 | <0.01 | 0.16 | 0.014 | 0.043 | 0.017 |
| Orthophosphate, Dissolved | mg/l | 0.18 | <0.01 | 0.013 | <0.01 | 0.15 | <0.01 | 0.028 | 0.013 |
| Organic Carbon, Total | mg/l | 2.3 | 3.1 | 2.9 | 3.1 | 2 | 2.7 | 3.7 | 3.5 |
| Calcium | mg/l | 23.5 | 32.3 | 31.8 | 28 | 19.5 | 29 | 29.8 | 31.7 |
| Magnesium | mg/l | 3.19 | 3.13 | 3.39 | 3.41 | 3.02 | 3.12 | 5.33 | 4.8 |
| Chloride | mg/l | 22 | 17 | 14 | 14 | 22 | 17 | 21 | 24 |
| Sulfate | mg/l | 70 | 35.9 | <20 | <20 | 39 | 32.1 | <20 | 31 |
| Turbidity | ntu | 2.1 | 1.61 | 4.94 | 1.4 | 2.17 | 2.19 | 1.98 | 1.41 |
| Iron, Total | µg/l | 216 | 159 | 160 | 168 | 214 | 128 | 163 | 116 |
| Iron, Dissolved | µg/l | 85 | 76 | 23 | 39 | 103 | 45 | <20 | 26 |
| Manganese, Total | µg/l | 19 | 23 | 44 | 24 | 16 | 33 | 19 | 10 |
| Manganese, Dissolved | µg/l | 15 | 19 | 11 | 16 | 11 | 15 | <10 | <10 |
| Aluminum, Total | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A1. Water Quality Data for New York-Pennsylvania Border Streams – Continued***

| Parameter | Units | SUSQ 289.1 | SUSQ 289.1 | TIOG 10.8 | TIOG 10.8 | TIOG 10.8 | TIOG 10.8 | TROW 1.8 | TRUP 4.5 |
|---|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010206 | 20010508 | 20000725 | 20001107 | 20010207 | 20010509 | 20000726 | 20000724 |
| Time | hhmm | 1345 | 940 | 815 | 1120 | 1205 | 1000 | 1430 | 1220 |
| Discharge | cfs | 5240 | 3790 | 93.5 | 91.2 | 219.5 | 235.5 | 1.095 | 3.888 |
| Temperature | degree C | 2 | 16.6 | 20.7 | 6.3 | 3.4 | 16.5 | 18.2 | 20.6 |
| Conductance | umhos/cm | 241 | 291 | 209 | 259 | 229 | 159 | 79 | 304 |
| Dissolved Oxygen | mg/l | 8.23 | 5.61 | 5.21 | 6.54 | 7.29 | 6.7 | 5.96 | 5.49 |
| pH | | 7.8 | 8.3 | 7.4 | 7.8 | 7.55 | 8.4 | 7.15 | 8.1 |
| Alkalinity | mg/l | 44 | 30 | 56 | 44 | 50 | 48 | 26 | 118 |
| Acidity | mg/l | 4 | 0 | 6 | 6 | 6 | 0 | 4 | 4 |
| Solids, Total | mg/l | 166 | 188 | 170 | 174 | 172 | 90 | 68 | 216 |
| Solids, Dissolved | mg/l | 160 | 172 | 154 | 166 | 132 | 90 | 46 | 194 |
| Ammonia, Total | mg/l | 0.09 | <0.02 | 0.02 | <0.02 | 0.12 | <0.02 | <0.02 | <0.02 |
| Ammonia, Dissolved | mg/l | 0.09 | <0.02 | 0.02 | <0.02 | 0.1 | <0.02 | <0.02 | <0.02 |
| Nitrite, Total | mg/l | <0.01 | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrite, Dissolved | mg/l | <0.01 | 0.02 | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 | <0.01 |
| Nitrate, Total | mg/l | 0.9 | 0.73 | 0.36 | 0.27 | 0.62 | 0.29 | 0.19 | <0.04 |
| Nitrate, Dissolved | mg/l | 0.91 | 0.82 | 0.35 | 0.31 | 0.6 | 0.29 | 0.2 | 0.8 |
| Nitrogen, Total | mg/l | 1.38 | 1.12 | 0.88 | 0.37 | 0.98 | 0.64 | 0.42 | 0.35 |
| Nitrogen Dissolved | mg/l | 1.33 | 1.15 | 0.8 | 0.35 | 0.98 | 0.61 | 0.42 | 0.42 |
| Phosphorus, Total | mg/l | 0.06 | 0.03 | 0.03 | 0.01 | 0.03 | 0.02 | 0.02 | 0.02 |
| Phosphorus, Dissolved | mg/l | 0.05 | <0.01 | 0.018 | <0.01 | 0.02 | <0.01 | 0.018 | 0.015 |
| Orthophosphate, Total | mg/l | 0.051 | 0.025 | 0.013 | <0.01 | 0.021 | 0.02 | 0.014 | 0.024 |
| Orthophosphate, Dissolved | mg/l | 0.044 | <0.01 | 0.013 | <0.01 | 0.016 | <0.01 | 0.017 | 0.016 |
| Organic Carbon, Total | mg/l | 2.3 | 3.3 | 3.8 | 3.3 | 3 | 3.4 | 1.6 | 2.6 |
| Calcium | mg/l | 25.5 | 36.1 | 21.5 | 28.5 | 24.7 | 15.7 | 6.33 | 34.7 |
| Magnesium | mg/l | 4.28 | 4.98 | 5.05 | 7.42 | 5.73 | 3.75 | 2.14 | 7.8 |
| Chloride | mg/l | 29 | 26 | 10 | 16 | 17 | 9 | 5 | 13 |
| Sulfate | mg/l | 40 | 28.5 | 27 | 43 | 33 | 43 | <20 | 22 |
| Turbidity | ntu | 2.8 | 2.38 | 2.02 | <1 | 2.12 | 2.22 | <1 | 1.84 |
| Iron, Total | µg/l | 213 | 162 | 132 | 93 | 114 | 170 | 27 | 49 |
| Iron, Dissolved | µg/l | 66 | <20 | <20 | 76 | 35 | 31 | 20 | <20 |
| Manganese, Total | µg/l | 13 | 32 | 91 | 58 | 286 | 170 | <10 | <10 |
| Manganese, Dissolved | µg/l | 11 | <10 | <10 | 46 | 242 | 128 | <10 | <10 |
| Aluminum, Total | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A1. Water Quality Data for New York-Pennsylvania Border Streams – Continued***

| Parameter | Units | TRUP 4.5 | TRUP 4.5 | TRUP 4.5 | WAPP 2.6 |
|---|---|---|---|---|---|
| Date | yyyymmdd | 20001107 | 20010207 | 20010509 | 20000726 |
| Time | hhmm | 1400 | 1410 | 650 | 800 |
| Discharge | cfs | 1.783 | 11.414 | 5.592 | 7.481 |
| Temperature | degree C | 4.5 | 1.8 | 18.4 | 18.6 |
| Conductance | umhos/cm | 301 | 251 | 222 | 129 |
| Dissolved Oxygen | mg/l | 8.14 | 8.26 | 5.99 | 5.78 |
| pH | | 8.05 | 8.1 | 8.8 | 7.05 |
| Alkalinity | mg/l | 110 | 86 | 128 | 34 |
| Acidity | mg/l | 4 | 4 | 0 | 6 |
| Solids, Total | mg/l | 196 | 184 | 130 | 114 |
| Solids, Dissolved | mg/l | 192 | 154 | 128 | 100 |
| Ammonia, Total | mg/l | <0.02 | 0.08 | <0.02 | <0.02 |
| Ammonia, Dissolved | mg/l | <0.02 | 0.07 | <0.02 | <0.02 |
| Nitrite, Total | mg/l | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrite, Dissolved | mg/l | <0.01 | <0.01 | <0.01 | <0.01 |
| Nitrate, Total | mg/l | 0.04 | 0.85 | <0.04 | 0.41 |
| Nitrate, Dissolved | mg/l | <0.04 | 0.86 | <0.04 | 0.79 |
| Nitrogen, Total | mg/l | <0.064 | 1.2 | 0.3 | 0.78 |
| Nitrogen Dissolved | mg/l | <0.064 | 1.28 | 0.3 | 1.22 |
| Phosphorus, Total | mg/l | <0.01 | 0.03 | 0.01 | 0.02 |
| Phosphorus, Dissolved | mg/l | <0.01 | 0.029 | <0.01 | 0.018 |
| Orthophosphate, Total | mg/l | <0.01 | 0.04 | 0.015 | 0.014 |
| Orthophosphate, Dissolved | mg/l | <0.01 | 0.02 | <0.01 | 0.011 |
| Organic Carbon, Total | mg/l | 2.6 | 2.3 | 3.5 | 2.4 |
| Calcium | mg/l | 37.5 | 28.9 | 25.4 | 10.2 |
| Magnesium | mg/l | 8.32 | 6.36 | 5.31 | 3.77 |
| Chloride | mg/l | 22 | 25 | 15 | 8 |
| Sulfate | mg/l | 27 | 22 | 43 | <20 |
| Turbidity | ntu | <1 | 5.46 | 2.46 | 1.4 |
| Iron, Total | µg/l | 28 | 268 | 129 | 56 |
| Iron, Dissolved | µg/l | <20 | 32 | <20 | <20 |
| Manganese, Total | µg/l | <10 | <10 | <10 | <10 |
| Manganese, Dissolved | µg/l | <10 | <10 | <10 | <10 |
| Aluminum, Total | µg/l | <200 | 237 | <200 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 |

***Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams***

| Parameter | Units | BBDC 4.1 | CNWG 4.4 | CNWG 4.4 | CNWG 4.4 | CNWG 4.4 | DEER 44.2 | DEER 44.2 | DEER 44.2 |
|---|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20000801 | 20000803 | 20001115 | 20010219 | 20010514 | 20000803 | 20001114 | 20010219 |
| Time | hhmm | 1010 | 1115 | 1050 | 932 | 1505 | 845 | 910 | 1330 |
| Discharge | cfs | 1.505 | 23.024 | 22.809 | 27.59 | 10.948 | 7.607 | 8.762 | 10.37 |
| Temperature | degree C | 17.5 | 23.3 | 9.9 | 1.4 | 15.5 | 21.2 | 8.9 | 2.5 |
| Conductance | umhos/cm | 129 | 235 | 232 | 242 | 236 | 207 | 196 | 212 |
| Dissolved Oxygen | mg/l | 5.78 | 4.79 | 5.95 | 7.36 | 5.28 | 5.02 | 6.4 | 7.51 |
| pH | | 6.55 | 7.2 | 7.2 | 7.6 | 7.35 | 7.4 | 7.4 | 7.65 |
| Alkalinity | mg/l | 24 | 42 | 38 | 36 | 40 | 48 | 58 | 40 |
| Acidity | mg/l | 8 | 10 | 4 | 4 | 4 | 6 | 6 | 4 |
| Solids, Total | mg/l | 112 | 204 | 178 | 88 | 206 | 148 | 148 | 82 |
| Solids, Dissolved | mg/l | 112 | 186 | 178 | 88 | 176 | 140 | 136 | 90 |
| Ammonia, Total | mg/l | <0.02 | 0.04 | <0.02 | 0.03 | 0.03 | 0.03 | <0.02 | <0.02 |
| Ammonia, Dissolved | mg/l | <0.02 | 0.05 | <0.02 | 0.03 | 0.03 | 0.03 | <0.02 | <0.02 |
| Nitrite, Total | mg/l | <0.01 | 0.03 | 0.02 | 0.02 | 0.08 | <0.01 | <0.01 | <0.01 |
| Nitrite, Dissolved | mg/l | <0.01 | 0.03 | 0.02 | 0.02 | 0.08 | 4.01 | <0.01 | <0.01 |
| Nitrate, Total | mg/l | 4.9 | 7.75 | 8.44 | 9.32 | 8.76 | 4.05 | 4.47 | 5.15 |
| Nitrate, Dissolved | mg/l | 5.49 | 7.77 | 8.54 | 9.32 | 8.87 | 3.97 | 4.64 | 5.14 |
| Nitrogen, Total | mg/l | 5.19 | 8.26 | 9.14 | 10.34 | 9.54 | 4.39 | 4.83 | 6.03 |
| Nitrogen Dissolved | mg/l | 5.83 | 8.36 | 9.15 | 10.26 | 9.36 | 4.25 | 4.78 | 5.78 |
| Phosphorus, Total | mg/l | 0.02 | 0.07 | 0.02 | 0.05 | 0.04 | 0.02 | 0.02 | 0.04 |
| Phosphorus, Dissolved | mg/l | 0.021 | 0.044 | 0.015 | 0.039 | 0.017 | 0.01 | 0.013 | 0.023 |
| Orthophosphate, Total | mg/l | 0.012 | 0.039 | 0.01 | 0.037 | 0.027 | 0.02 | 0.018 | 0.024 |
| Orthophosphate, Dissolved | mg/l | <0.01 | 0.028 | 0.01 | 0.031 | 0.012 | <0.01 | 0.013 | 0.025 |
| Organic Carbon, Total | mg/l | 1.2 | 3.1 | 2.3 | 1.9 | 2.3 | 2.1 | 1.7 | 1 |
| Calcium | mg/l | 9.45 | 17.6 | 17.6 | 17 | 18 | 17.5 | 16.8 | 16.4 |
| Magnesium | mg/l | 5.63 | 10.7 | 10.3 | 11.8 | 10 | 6.19 | 5.95 | 5.68 |
| Chloride | mg/l | 11 | 18 | 19 | 21 | 20 | 23 | 23 | 30 |
| Sulfate | mg/l | <20 | <20 | <20 | 45 | <20 | <20 | <20 | <20 |
| Turbidity | ntu | 1.36 | 9.52 | 2.02 | 2.49 | 3.87 | 3.9 | 2.87 | 1.64 |
| Iron, Total | µg/l | 128 | 414 | 138 | 272 | 476 | 165 | 145 | 208 |
| Iron, Dissolved | µg/l | 23 | 44 | 33 | 73 | 78 | 53 | 45 | 35 |
| Manganese, Total | µg/l | 10 | 45 | 10 | 52 | 62 | 31 | 19 | 25 |
| Manganese, Dissolved | µg/l | <10 | 28 | <10 | 48 | 43 | 22 | 16 | 23 |
| Aluminum, Total | µg/l | <200 | 299 | <200 | 214 | 427 | <200 | <200 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams – Continued***

| Parameter | Units | DEER 44.2 | EBAU 1.5 | EBAU 1.5 | EBAU 1.5 | EBAU 1.5 | FBDC 4.1 | LNGA 2.5 | LNGA 2.5 |
|---|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010514 | 20000801 | 20001114 | 20010220 | 20010514 | 20000801 | 20000731 | 20001114 |
| Time | hhmm | 940 | 835 | 1025 | 1025 | 1045 | 1120 | 900 | 750 |
| Discharge | cfs | 9.766 | 6.062 | 5.575 | 7.454 | 7.181 | 1.083 | 2.251 | 0.543 |
| Temperature | degree C | 11.9 | 19.7 | 9.7 | 4 | 11.4 | 19.4 | 19.2 | 9.5 |
| Conductance | umhos/cm | 200 | 194 | 205 | 231 | 180 | 113 | 180 | 181 |
| Dissolved Oxygen | mg/l | 5.37 | 5.44 | 6.07 | 7.37 | 5.58 | 5.52 | 5.34 | 5.99 |
| pH | | 7.3 | 6.9 | 7.1 | 7.4 | 7.25 | 6.8 | 6.85 | 7.1 |
| Alkalinity | mg/l | 44 | 38 | 52 | 28 | 20 | 22 | 38 | 36 |
| Acidity | mg/l | 6 | 12 | 6 | 2 | 4 | 10 | 14 | 8 |
| Solids, Total | mg/l | 152 | 160 | 162 | 164 | 132 | 104 | 148 | 154 |
| Solids, Dissolved | mg/l | 128 | 160 | 144 | 144 | NA | 104 | 134 | 128 |
| Ammonia, Total | mg/l | <0.02 | <0.02 | <0.02 | 0.07 | 0.02 | <0.02 | 0.03 | <0.02 |
| Ammonia, Dissolved | mg/l | <0.02 | <0.02 | <0.02 | 0.07 | <0.02 | <0.02 | 0.03 | <0.02 |
| Nitrite, Total | mg/l | <0.04 | <0.01 | <0.01 | 0.09 | <0.04 | <0.01 | 0.01 | 0.01 |
| Nitrite, Dissolved | mg/l | <0.04 | <0.01 | 0.01 | 0.08 | <0.04 | <0.01 | 0.01 | <0.01 |
| Nitrate, Total | mg/l | 4.91 | 4.9 | 6 | 6.24 | 5.62 | 4.08 | 4.71 | 5.52 |
| Nitrate, Dissolved | mg/l | 4.89 | 4.8 | 5.89 | 6.21 | 5.54 | 4.05 | 4.61 | 5.68 |
| Nitrogen, Total | mg/l | 5.28 | 5.32 | 6.32 | 7.18 | 6.03 | 4.2 | 5.26 | 6.14 |
| Nitrogen Dissolved | mg/l | 5.2 | 5.43 | 6.43 | 7.17 | 5.97 | 4.25 | 4.98 | 6.13 |
| Phosphorus, Total | mg/l | 0.02 | 0.11 | 0.1 | 0.14 | 0.02 | 0.02 | 0.04 | 0.02 |
| Phosphorus, Dissolved | mg/l | <0.01 | 0.12 | 0.075 | 0.12 | 0.015 | 0.013 | 0.03 | 0.01 |
| Orthophosphate, Total | mg/l | 0.011 | 0.056 | 0.078 | 0.11 | 0.017 | <0.01 | 0.027 | 0.016 |
| Orthophosphate, Dissolved | mg/l | <0.01 | 0.034 | 0.078 | 0.12 | 0.013 | <0.01 | 0.013 | <0.01 |
| Organic Carbon, Total | mg/l | 1.3 | 2.5 | 1.9 | 1.8 | 1.5 | 2 | 3.5 | 1.8 |
| Calcium | mg/l | 15.9 | 15.9 | 13.6 | 16.1 | 13.6 | 7.77 | 16.5 | 16.6 |
| Magnesium | mg/l | 6.18 | 5.94 | 5.65 | 5.41 | 5.51 | 4.34 | 6.15 | 5.76 |
| Chloride | mg/l | 25 | 20 | 24 | 35 | 20 | 10 | 16 | 17 |
| Sulfate | mg/l | <20 | <20 | <20 | 28 | <20 | <20 | 22 | <20 |
| Turbidity | ntu | 1.73 | 1.68 | 1.3 | <1 | 1.4 | 2.28 | 8.5 | 5.67 |
| Iron, Total | µg/l | 132 | 377 | 172 | 105 | 175 | 373 | 551 | 279 |
| Iron, Dissolved | µg/l | 47 | 178 | 86 | 43 | 50 | 149 | 77 | 62 |
| Manganese, Total | µg/l | 24 | 63 | 32 | 28 | 26 | 17 | 112 | 43 |
| Manganese, Dissolved | µg/l | 21 | 54 | 29 | 27 | 22 | <10 | 79 | 29 |
| Aluminum, Total | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | 323 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams – Continued***

| Parameter | Units | LNGA 2.5 | LNGA 2.5 | OCTO 6.6 | OCTO 6.6 | OCTO 6.6 | OCTO 6.6 | SBCC 20.4 | SCTT 3.0 |
|---|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010220 | 20010514 | 20000802 | 20001115 | 20010219 | 20010514 | 20000731 | 20000802 |
| Time | hhmm | 850 | 750 | 1200 | 945 | 1105 | 1415 | 1030 | 845 |
| Discharge | cfs | 3.07 | 0.856 | 96.92 | 138.26 | 150.26 | 73.198 | 1.429 | 0.503 |
| Temperature | degree C | 4.5 | 9.1 | 25.3 | 9.7 | 1.8 | 18.2 | 18.8 | 20.1 |
| Conductance | umhos/cm | 180 | 177 | 234 | 239 | 220 | 237 | 136 | 324 |
| Dissolved Oxygen | mg/l | 6.79 | 5.64 | 5.52 | 6.72 | 7.22 | 5.14 | 5.66 | 4.22 |
| pH | | 7.35 | 7.1 | 7.75 | 7.75 | 7.6 | 7.8 | 7.2 | 7.05 |
| Alkalinity | mg/l | 24 | 36 | 52 | 34 | 44 | 30 | 42 | 88 |
| Acidity | mg/l | 2 | 6 | 4 | 2 | 4 | 2 | 4 | 12 |
| Solids, Total | mg/l | 144 | 180 | 180 | 166 | 134 | 204 | 114 | 208 |
| Solids, Dissolved | mg/l | 120 | 158 | 166 | 166 | 122 | 192 | 114 | 192 |
| Ammonia, Total | mg/l | <0.02 | 0.02 | 0.02 | <0.02 | 0.55 | 0.02 | 0.02 | 0.76 |
| Ammonia, Dissolved | mg/l | 0.02 | 0.02 | 0.03 | <0.02 | 0.53 | 0.02 | <0.02 | 0.76 |
| Nitrite, Total | mg/l | <0.04 | <0.04 | 0.02 | 0.02 | 0.05 | 0.07 | <0.01 | 0.26 |
| Nitrite, Dissolved | mg/l | <0.04 | <0.04 | 0.01 | 0.01 | 0.05 | 0.06 | <0.01 | 0.22 |
| Nitrate, Total | mg/l | 6.69 | 6.54 | 5 | 4.78 | 5.06 | 5.55 | 1.52 | 1.36 |
| Nitrate, Dissolved | mg/l | 6.71 | 6.69 | 4.91 | 4.67 | 5.14 | 5.52 | 1.6 | 1.57 |
| Nitrogen, Total | mg/l | 7.42 | 6.77 | 5.57 | 5.79 | 6.77 | 6.43 | 1.86 | 3.06 |
| Nitrogen Dissolved | mg/l | 7.39 | 6.64 | 5.34 | 5.2 | 6.7 | 6.16 | 1.9 | 3.15 |
| Phosphorus, Total | mg/l | 0.02 | 0.03 | 0.11 | 0.02 | 0.26 | 0.04 | 0.02 | 0.27 |
| Phosphorus, Dissolved | mg/l | 0.022 | <0.01 | 0.074 | <0.01 | 0.25 | 0.02 | 0.01 | 0.1 |
| Orthophosphate, Total | mg/l | 0.028 | 0.02 | 0.063 | <0.01 | 0.22 | 0.026 | 0.014 | 0.17 |
| Orthophosphate, Dissolved | mg/l | 0.026 | <0.01 | 0.026 | <0.01 | 0.22 | 0.014 | <0.01 | 0.053 |
| Organic Carbon, Total | mg/l | 1.5 | 2 | 3.3 | 3 | 4.5 | 2.8 | 2.4 | 4.3 |
| Calcium | mg/l | 16.1 | 15.6 | 18.7 | 19.5 | 15.9 | 20.3 | 15 | 28.8 |
| Magnesium | mg/l | 6.03 | 6.17 | 11.7 | 10.2 | 8.18 | 9.97 | 4.15 | 13.1 |
| Chloride | mg/l | 18 | 16 | 17 | 17 | 19 | 18 | 9 | 37 |
| Sulfate | mg/l | 21 | 22.1 | 24 | 29 | 35 | 21.3 | <20 | 26 |
| Turbidity | ntu | 2.24 | 4.53 | 1.61 | 1.38 | 5.87 | 2.82 | 3.87 | 4.67 |
| Iron, Total | µg/l | 225 | 309 | 107 | 89 | 383 | 252 | 375 | 941 |
| Iron, Dissolved | µg/l | 42 | 57 | <20 | 32 | 151 | 44 | 127 | 170 |
| Manganese, Total | µg/l | 33 | 55 | 30 | <10 | 70 | 74 | 33 | 194 |
| Manganese, Dissolved | µg/l | 33 | 44 | 11 | <10 | 63 | 44 | 18 | 158 |
| Aluminum, Total | µg/l | <200 | 337 | <200 | <200 | 292 | 245 | <200 | <200 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | <200 | <200 | <200 | <200 |

***Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams – Continued***

| Parameter | Units | SCTT 3.0 | SCTT 3.0 | SCTT 3.0 | SUSQ 44.5 | SUSQ 44.5 | SUSQ 44.5 | SUSQ 44.5 |
|---|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20001114 | 20010220 | 20010514 | 20000803 | 200011113 | 20010212 | 20010514 |
| Time | hhmm | 1200 | 1200 | 1215 | 1315 | 1200 | 1250 | 1615 |
| Discharge | cfs | 0.369 | 0.747 | 1.058 | 26200 | 12100 | 33800 | 14700 |
| Temperature | degree C | 10.2 | 5 | 12.9 | 28.2 | 12.6 | 4.5 | 19.8 |
| Conductance | umhos/cm | 300 | 392 | 255 | 294 | 339 | 289 | 327 |
| Dissolved Oxygen | mg/l | 5.15 | 7.11 | 4.47 | 4.46 | N/A | N/A | 5.03 |
| pH | | 7.15 | 7.45 | 7.1 | 7.75 | 7.4 | 7.9 | 8.2 |
| Alkalinity | mg/l | 140 | 44 | 40 | 70 | 64 | 50 | 78 |
| Acidity | mg/l | 8 | 2 | 14 | 6 | 6 | 2 | 2 |
| Solids, Total | mg/l | 226 | 268 | 176 | 242 | 182 | 254 | 218 |
| Solids, Dissolved | mg/l | 214 | 242 | 156 | 226 | 166 | 254 | 182 |
| Ammonia, Total | mg/l | 0.23 | 0.09 | 0.08 | 0.05 | 0.03 | 0.21 | <0.02 |
| Ammonia, Dissolved | mg/l | 0.25 | 0.09 | 0.08 | 0.05 | 0.03 | 0.2 | <0.02 |
| Nitrite, Total | mg/l | 0.06 | <0.04 | <0.04 | 0.02 | 0.01 | 0.02 | <0.04 |
| Nitrite, Dissolved | mg/l | 0.05 | <0.04 | <0.04 | 0.02 | 0.02 | 0.02 | <0.04 |
| Nitrate, Total | mg/l | 1.13 | 3.54 | 1.98 | 1.35 | 0.81 | 1.79 | 0.88 |
| Nitrate, Dissolved | mg/l | 1.16 | 3.49 | 2 | 1.4 | 0.85 | 1.77 | 0.92 |
| Nitrogen, Total | mg/l | 0.98 | 4.02 | 2.54 | 1.9 | 1.25 | 2.32 | 1.65 |
| Nitrogen Dissolved | mg/l | 2.16 | 4.11 | 2.54 | 1.84 | 1.18 | 2.22 | 1.34 |
| Phosphorus, Total | mg/l | 0.13 | 0.04 | 0.05 | 0.06 | 0.04 | 0.09 | 0.05 |
| Phosphorus, Dissolved | mg/l | 0.081 | 0.025 | 0.03 | 0.036 | 0.02 | 0.047 | <0.01 |
| Orthophosphate, Total | mg/l | 0.094 | 0.023 | 0.04 | 0.032 | 0.021 | 0.042 | 0.036 |
| Orthophosphate, Dissolved | mg/l | 0.074 | 0.028 | 0.031 | 0.015 | 0.021 | 0.039 | <0.01 |
| Organic Carbon, Total | mg/l | 5.6 | 2.1 | 1.7 | 3.4 | 2.7 | 2.5 | 3.4 |
| Calcium | mg/l | 26.4 | 27 | 18.7 | 31 | 32.4 | 26.1 | 36.5 |
| Magnesium | mg/l | 12.5 | 17.7 | 9.58 | 8.95 | 9.66 | 7.18 | 9.03 |
| Chloride | mg/l | 33 | 60 | 34 | 17 | 23 | 29 | 26 |
| Sulfate | mg/l | 33 | 38 | <20 | 45 | 622 | 32 | 43.2 |
| Turbidity | ntu | 8.69 | 1.83 | 1.83 | 6.37 | 3.05 | 2.82 | 4.82 |
| Iron, Total | µg/l | 660 | 233 | 711 | 286 | 526 | 734 | 329 |
| Iron, Dissolved | µg/l | 237 | 93 | 411 | <20 | <20 | 60 | 21 |
| Manganese, Total | µg/l | 144 | 147 | 31 | 60 | 21.2 | 145 | 163 |
| Manganese, Dissolved | µg/l | 130 | 142 | 28 | 25 | 11 | 67.9 | 34 |
| Aluminum, Total | µg/l | <200 | <200 | 249 | 250 | 52.9 | 145 | 1350 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 | 10.9 | 17.1 | <200 |

***Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams – Continued***

| Parameter | Units | SUSQ 10.0 | SUSQ 10.0 | SUSQ 10.0 | SUSQ 10.0 |
|---|---|---|---|---|---|
| Date | yyyymmdd | 20000802 | 20001115 | 20010219 | 20010514 |
| Time | hhmm | 1000 | 815 | 1200 | 1305 |
| Discharge | cfs | 6060 | 30800 | 66300 | 11100 |
| Temperature | degree C | 27.4 | 13.8 | 4.5 | 22 |
| Conductance | umhos/cm | 297 | 298 | 243 | 251 |
| Dissolved Oxygen | mg/l | 3.46 | 5.82 | 6.88 | 4.08 |
| pH | | 7.05 | 7.65 | 7.6 | 8.05 |
| Alkalinity | mg/l | 66 | 78 | 32 | 82 |
| Acidity | mg/l | 6 | 6 | 4 | 2 |
| Solids, Total | mg/l | 216 | 182 | 130 | 170 |
| Solids, Dissolved | mg/l | 210 | 170 | 118 | 164 |
| Ammonia, Total | mg/l | 0.07 | 0.05 | 0.09 | 0.06 |
| Ammonia, Dissolved | mg/l | 0.07 | 0.05 | 0.09 | 0.06 |
| Nitrite, Total | mg/l | 0.09 | 0.02 | 0.02 | <0.04 |
| Nitrite, Dissolved | mg/l | 0.07 | 0.02 | 0.01 | <0.04 |
| Nitrate, Total | mg/l | 1.05 | 0.95 | 1.41 | 0.81 |
| Nitrate, Dissolved | mg/l | 1.04 | 0.96 | 1.43 | 0.8 |
| Nitrogen, Total | mg/l | 1.66 | 1.58 | 1.89 | 1.42 |
| Nitrogen Dissolved | mg/l | 1.63 | 1.52 | 1.94 | 1.31 |
| Phosphorus, Total | mg/l | 0.07 | 0.07 | 0.05 | 0.03 |
| Phosphorus, Dissolved | mg/l | 0.019 | 0.025 | 0.03 | <0.01 |
| Orthophosphate, Total | mg/l | 0.029 | 0.02 | 0.042 | 0.02 |
| Orthophosphate, Dissolved | mg/l | 0.017 | 0.02 | 0.029 | <0.01 |
| Organic Carbon, Total | mg/l | 2.7 | 3.3 | 2.3 | 2.6 |
| Calcium | mg/l | 30 | 29.4 | 22.8 | 26.6 |
| Magnesium | mg/l | 9.44 | 8.8 | 6.07 | 6.75 |
| Chloride | mg/l | 21 | 21 | 26 | 18 |
| Sulfate | mg/l | 41 | 68 | 34 | 41.9 |
| Turbidity | ntu | 2.7 | 4.35 | 4.69 | 2.63 |
| Iron, Total | µg/l | 201 | 231 | 472 | 252 |
| Iron, Dissolved | µg/l | <20 | 32 | 66 | 120 |
| Manganese, Total | µg/l | 134 | 55 | 143 | 128 |
| Manganese, Dissolved | µg/l | 24 | <10 | 112 | 11 |
| Aluminum, Total | µg/l | <200 | <200 | <200 | 479 |
| Aluminum, Dissolved | µg/l | <200 | <200 | <200 | <200 |

*Table A3. Water Quality Data for Group 3 Streams*

| Parameter | Units | Cook Hollow Run | Babcock Run | Bill Hess Creek | Bird Creek | Biscuit Hollow Run | Briggs Hollow Run |
|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010501 | 20010507 | 20010502 | 20010502 | 20010501 | 20010507 |
| Time | hhmm | 1230 | 1320 | 940 | 1310 | 1330 | 1145 |
| Temperature | degree C | 13.6 | 12.4 | 10.8 | 13.8 | 15.2 | 10.6 |
| pH | | 6.65 | 7.00 | 6.75 | 6.85 | 6.30 | 7.45 |
| Dissolved Oxygen | mg/l | 5.97 | 6.23 | 6.46 | 6.34 | 5.09 | 6.07 |
| Conductivity | umhos/cm | 127 | 123 | 283 | 150 | 149 | 214 |
| Alkalinity | mg/l | 52.0 | 24.0 | 62.0 | 38.0 | 46.0 | 48.0 |
| Acidity | mg/l | 10.0 | 4.0 | 6.0 | 6.0 | 8.0 | 6.0 |

| Parameter | Units | Bulkley Brook | Camp Brook | Deep Hollow Brook | Little Wappasening Creek | Parks Creek | Prince Hollow Run |
|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010501 | 20010502 | 20010507 | 20010507 | 20010507 | 20010507 |
| Time | hhmm | 1435 | 830 | 1630 | 1100 | 900 | 1410 |
| Temperature | degree C | 15.6 | 10.7 | 18.2 | 11.4 | 10.2 | 16.8 |
| pH | | 6.50 | 6.85 | 6.70 | 7.30 | 7.10 | 9.30 |
| Dissolved Oxygen | mg/l | 5.38 | 6.45 | 4.99 | 6.12 | 6.67 | 7.51 |
| Conductivity | umhos/cm | 81 | 226 | 53 | 185 | 137 | 121 |
| Alkalinity | mg/l | 26.0 | 44.0 | 8.0 | 44.0 | 30.0 | 42.0 |
| Acidity | mg/l | 6.0 | 4.0 | 4.0 | 4.0 | 4.0 | 0.0 |

| Parameter | Units | Red House Run | Russell Run | Sackett Creek | Smith Creek | Strait Creek | White Branch Cowanesque River |
|---|---|---|---|---|---|---|---|
| Date | yyyymmdd | 20010502 | 20010507 | 20010507 | 20010502 | 20010502 | 20010501 |
| Time | hhmm | 715 | 1235 | 1000 | 1140 | 1035 | 1135 |
| Temperature | degree C | 9.6 | 14.8 | 11.3 | 11.9 | 11.8 | 15.2 |
| pH | | 6.55 | 7.75 | 7.50 | 6.35 | 6.80 | 6.60 |
| Dissolved Oxygen | mg/l | 6.1 | 6.48 | 6.18 | 5.99 | 6.43 | 6.37 |
| Conductivity | umhos/cm | 73 | 144 | 199 | 150 | 193 | 171 |
| Alkalinity | mg/l | 20.0 | 42.0 | 30.0 | 42.0 | 48.0 | 28.0 |
| Acidity | mg/l | 4.0 | 2.0 | 2.0 | 4.0 | 4.0 | 4.0 |

***Table A3. Water Quality Data for Group 3 Streams -- Continued***

| Parameter | Units | White Hollow |
|---|---|---|
| Date | yyyymmdd | 20010502 |
| Time | hhmm | 1445 |
| Temperature | degree C | 10.6 |
| pH | | 6.60 |
| Dissolved Oxygen | mg/l | 6.23 |
| Conductivity | umhos/cm | 137 |
| Alkalinity | mg/l | 26.0 |
| Acidity | mg/l | 6.0 |

# APPENDIX B

## ORGANIC POLLUTION–TOLERANCE AND FUNCTIONAL FEEDING GROUP DESIGNATIONS OF BENTHIC MACROINVERTEBRATE TAXA

| Class: Order | Family | Family/Genus | Organic Pollution Tolerance Value | Functional Feeding Group Designation |
|---|---|---|---|---|
| Amphipoda | Gammaridae | *Gammarus* | 6 | SH |
| Arachnoidea | Hydracarina | *Hydracarina* | 7 | P |
| Coleoptera | Dytiscidae | *Agabus* | 5 | P |
| | Elmidae | *Optioservus* | 4 | SC |
| | | *Oulimnius* | 5 | SC |
| | | *Stenelmis* | 5 | SC |
| | Gyrinidae | *Dineutus* | 4 | P |
| | Hydrophilidae | *Laccobius* | 5 | P |
| | Psephenidae | *Ectopria* | 5 | SC |
| | | *Psephenus* | 4 | SC |
| | Ptilodactylidae | *Anchytarsus* | 5 | SH |
| | Scirtidae | *Cyphon* | 8 | SC |
| Decapoda | Cambaridae | *female* | 6 | SH |
| | | *Cambarus bartonii bartonii* | 6 | SH |
| | | *Orconectes obscurus* | 6 | SH |
| | | *Procambarus acutus acutus* | 6 | SH |
| Diptera | Athericidae | *Atherix* | 2 | P |
| | Ceratopogonidae | *Bezzia* | 6 | P |
| | Chironomidae | *Chironomidae* | 6 | CG |
| | Empididae | *Chelifera* | 6 | P |
| | | *Hemerodromia* | 6 | P |
| | Simuliidae | *Prosimulium* | 2 | FC |
| | | *Simulium* | 6 | FC |
| | | *Twinnia* | 6 | SC |
| | Tabanidae | *Tabanus* | 5 | P |
| | Tipulidae | *Antocha* | 3 | CG |
| | | *Dicranota* | 3 | P |
| | | *Hexatoma* | 2 | P |
| | | *Leptotarsus* | 4 | SH |
| | | *Tipula* | 4 | SH |
| Ephemeroptera | Ameletidae | *Ameletus* | 0 | CG |
| | Baetidae | *Acentrella* | 4 | CG |
| | | *Baetis* | 6 | CG |
| | | *Centroptilum* | 2 | CG |
| | | *Heterocleon* | 2 | SC |
| | Caenidae | *Caenis* | 7 | CG |
| | Ephemerellidae | *Drunella* | 1 | SC |
| | | *Ephemerella* | 1 | SC |

| Class: Order | Family | Family/Genus | Organic Pollution Tolerance Value | Functional Feeding Group Designation |
|---|---|---|---|---|
| | | *Eurylophella* | 4 | CG |
| | | *Serratella* | 2 | CG |
| | Ephemeridae | *Ephemera* | 2 | CG |
| | Heptageniidae | *Epeorus* | 0 | CG |
| | | *Heptagenia* | 4 | SC |
| | | *Leucrocuta* | 1 | SC |
| | | *Stenacron* | 4 | CG |
| | | *Stenonema* | 3 | SC |
| | Isonychiidae | *Isonychia* | 3 | FC |
| | Leptophlebiidae | *Habrophlebiodes* | 6 | SC |
| | | *Paraleptophlebia* | 1 | CG |
| | Polymitarcyidae | *Ephoron* | 2 | CG |
| | Potamanthidae | *Anthopotamus* | 4 | FC |
| | Tricorythidae | *Tricorythodes* | 4 | CG |
| Gastropoda | Lymnaeidae | *Stagnicola* | 7 | SC |
| | Physidae | *Physella* | 8 | SC |
| | Pleuroceridae | *Leptotoxis* | 7 | SC |
| Isopoda | Asellidae | *Caecidotea* | 6 | SH |
| Megaloptera | Corydalidae | *Corydalus* | 4 | P |
| | | *Nigronia* | 2 | P |
| | Sialidae | *Sialis* | 6 | P |
| Odonata | Aeshnidae | *Boyeria* | 2 | P |
| | Gomphidae | *Dromogomphus* | 4 | P |
| | | *Ophiogomphus* | 1 | P |
| | | *Lanthus* | 5 | P |
| | | *Stylogomphus* | 4 | P |
| Oligochaeta | Nadidae | Nadidae | 8 | CG |
| | Lumbricidae | Lumbricidae | 8 | CG |
| | Lumbriculidae | Lumbriculidae | 8 | CG |
| Pelecypoda | Corbiculidae | *Corbicula fluminea* | 4 | FC |
| | Sphaeriidae | *Pisidium* | 8 | FC |
| Plecoptera | Chloroperlidae | *Haploperla* | 0 | P |
| | | *Suwallia* | 0 | P |
| | | *Sweltsa* | 0 | P |
| | Nemouridae | *Amphinemura* | 3 | SH |
| | | *Nemoura* | 1 | SH |
| | Leuctridae | *Leuctra* | 0 | SH |
| | Peltoperlidae | *Tallaperla* | 0 | SH |
| | Perlidae | *Acroneuria* | 0 | P |
| | | *Agnetina* | 2 | P |
| | | *Eccoptura* | 2 | P |
| | | *Neoperla* | 3 | P |
| | | *Paragnetina* | 1 | P |

| Class: Order | Family | Family/Genus | Organic Pollution Tolerance Value | Functional Feeding Group Designation |
|---|---|---|---|---|
| Plecoptera | Perlidae | *Perlesta* | 4 | P |
| | Perlodidae | *Clioperla* | 2 | P |
| | | *Diura* | 2 | SC |
| | | *Isoperla* | 2 | P |
| | Pteronarcyidae | *Pteronarcys* | 0 | SH |
| Trichoptera | Glossosomatidae | *Glossosoma* | 0 | SC |
| | Hydropsychidae | *Ceratopsyche* | 5 | FC |
| | | *Cheumatopsyche* | 6 | FC |
| | | *Diplectrona* | 0 | FC |
| | | *Hydropsyche* | 5 | FC |
| | | *Macrostemum* | 3 | FC |
| | Hydroptilidae | *Hydroptila* | 6 | SC |
| | Lepidostomatidae | *Lepidostoma* | 1 | SH |
| | Limnephilidae | *Goera* | 0 | SC |
| | Philopotamidae | *Chimarra* | 4 | FC |
| | | *Dolophilodes* | 0 | FC |
| | | *Wormaldia* | 0 | FC |
| | Polycentropodidae | *Polycentropus* | 6 | P |
| | Psychomyiidae | *Psychomyia* | 2 | CG |
| | Rhyacophilidae | *Rhyacophila* | 1 | P |

# APPENDIX C

## MACROINVERTEBRATE DATA FOR INTERSTATE STREAMS CROSSING THE NEW YORK-PENNSYLVANIA AND PENNSYLVANIA-MARYLAND BORDERS

***Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams***

| Class: Order | Family | Family/*Genus* | APAL 6.9 | BNTY 0.9 | CASC 1.6 | CAYT 1.7 | CHOC 9.1 |
|---|---|---|---|---|---|---|---|
| Arachnoidea | Hydracarina | Hydracarina | | | | | 1 |
| Coleoptera | Elmidae | *Optioservus* | 10 | | 4 | 11 | |
| | | *Oulimnius* | | | | | 21 |
| | | *Stenelmis* | 40 | 10 | | 25 | 8 |
| | Psephenidae | *Psephenus* | 15 | 5 | | 17 | 17 |
| Decapoda | Cambaridae | *Cambarus bartonii bartonii* | | | 2 | | |
| | | *Orconectes obscurus* | | | | 1 | |
| Diptera | Athericidae | *Atherix* | | 8 | | | 1 |
| | Ceratopogonidae | *Bezzia* | | | | | 1 |
| | Chironomidae | Chironomidae | 22 | 51 | 70 | 56 | 39 |
| | Empididae | *Hemerodromia* | 3 | 3 | | | |
| | Simuliidae | *Simulium* | 5 | 1 | | | 2 |
| | | *Twinnia* | | | 1 | | |
| | Tipulidae | *Dicranota* | 2 | | 4 | | 2 |
| | | *Hexatoma* | 4 | 1 | 4 | 4 | 4 |
| Ephemeroptera | Baetidae | *Acentrella* | 2 | | | | 7 |
| | | *Baetis* | 2 | 8 | | 19 | 24 |
| | Ephemerellidae | *Serratella* | 1 | | | | |
| | Heptageniidae | *Epeorus* | | 1 | 4 | | |
| | | *Stenacron* | | | | 1 | |
| | | *Stenonema* | | 4 | 2 | 1 | 3 |
| | Isonychiidae | *Isonychia* | 16 | | 2 | 3 | 16 |
| | Leptophlebiidae | *Paraleptophlebia* | | 1 | | | |
| | Tricorythidae | *Tricorythodes* | | 4 | | | |
| Megaloptera | Corydalidae | *Corydalus* | 2 | | | | |
| | | *Nigronia* | 5 | | 6 | | 2 |
| | Sialidae | *Sialis* | 1 | | | | |
| Odonata | Aeshnidae | *Boyeria* | | | 2 | | |
| | Gomphidae | *Dromogomphus* | | | 1 | | |
| | | *Ophiogomphus* | 3 | | | 1 | 1 |
| Plecoptera | Chloroperlidae | *Haploperla* | | | 1 | | |
| | | *Suwallia* | | | 1 | | |
| | | *Sweltsa* | 3 | 1 | 4 | | 4 |
| | Leuctridae | *Leuctra* | 1 | 1 | | | 3 |
| | Perlidae | *Acroneuria* | 1 | | 15 | | 4 |
| | | *Agnetina* | 1 | 2 | | | 3 |
| | | *Neoperla* | | 1 | | | |
| | Pteronarcyidae | *Pteronarcys* | | | 2 | | |

***Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued***

| Class: Order | Family | Family/*Genus* | APAL 6.9 | BNTY 0.9 | CASC 1.6 | CAYT 1.7 | CHOC 9.1 |
|---|---|---|---|---|---|---|---|
| Trichoptera | Hydropsychidae | *Ceratopsyche* | 7 | 33 | 5 | 8 | 19 |
| | | *Cheumatopsyche* | 25 | 4 | 17 | 1 | |
| | | *Hydropsyche* | 10 | | 28 | | |
| | Philopotamidae | *Chimarra* | 39 | 1 | 1 | 3 | 12 |
| | | *Dolophilodes* | | 1 | 5 | | |
| | | *Wormaldia* | | | 2 | | |

***Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued***

| Class: Order | Family | Family/*Genus* | LSNK 7.6 | NFCR 7.6 | SEEL 10.3 | SNAK 2.3 | SOUT 7.8 | TROW 1.8 |
|---|---|---|---|---|---|---|---|---|
| Coleoptera | Elmidae | *Optioservus* | 4 | 6 | | 3 | | |
| | | *Stenelmis* | 1 | 1 | 1 | | 3 | 17 |
| | Hydrophilidae | *Laccobius* | | 2 | | | | |
| | Psephenidae | *Psephenus* | 6 | 18 | 4 | 6 | 26 | |
| Decapoda | Cambaridae | *female* | | 1 | | | | |
| Diptera | Athericidae | *Atherix* | 1 | | 3 | 2 | 1 | 1 |
| | Chironomidae | Chironomidae | 51 | 66 | 93 | 41 | 69 | 78 |
| | Empididae | *Hemerodromia* | 1 | | 2 | 1 | | |
| | Simuliidae | *Simulium* | 2 | 1 | 5 | | 5 | 1 |
| | Tabanidae | *Tabanus* | | | | | 1 | |
| | Tipulidae | *Antocha* | | 1 | | | | |
| | | *Dicranota* | 2 | 14 | | | | |
| | | *Hexatoma* | | 10 | 9 | | | 8 |
| | | *Leptotarsus* | | 1 | | | | |
| Ephemeroptera | Baetidae | *Acentrella* | | 1 | | 1 | | 1 |
| | | *Baetis* | 10 | 12 | 4 | 19 | 13 | 34 |
| | Heptageniidae | *Epeorus* | | 1 | | 6 | | 31 |
| | | *Heptagenia* | | 1 | | | | |
| | | *Stenonema* | | 1 | | 1 | 6 | |
| | Isonychiidae | *Isonychia* | 25 | | 8 | 22 | 15 | |
| | Leptophlebiidae | *Habrophlebiodes* | | 1 | | | | |
| | | *Paraleptophlebia* | | 4 | | | | |
| | Tricorythidae | *Tricorythodes* | | | 3 | | | |
| Gastropoda | Lymnaeidae | *Stagnicola* | | | | | 1 | |
| Megaloptera | Corydalidae | *Corydalus* | | | | | 2 | |
| | | *Nigronia* | 7 | 8 | | 1 | | 1 |
| Odonata | Aeshnidae | *Boyeria* | 1 | | | | | |
| | Gomphidae | *Ophiogomphus* | | | 4 | | | |
| Oligochaeta | Nadidae | Nadidae | | | | 2 | | 1 |
| | Lumbricidae | Lumbricidae | | | | 2 | | |
| Plecoptera | Chloroperlidae | *Suwallia* | | | | | | 1 |
| | | *Sweltsa* | 2 | | | | | 1 |
| | Leuctridae | *Leuctra* | 4 | 7 | | | 1 | |

***Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued***

| Class: Order | Family | Family/*Genus* | LSNK 7.6 | NFCR 7.6 | SEEL 10.3 | SNAK 2.3 | SOUT 7.8 | TROW 1.8 |
|---|---|---|---|---|---|---|---|---|
| | Perlidae | *Acroneuria* | 19 | | 2 | 4 | 3 | 4 |
| | | *Agnetina* | | 2 | | | | 10 |
| | | *Neoperla* | | | | | | 3 |
| | | *Paragnetina* | 1 | | | 1 | 1 | |
| | Pteronarcyidae | *Pteronarcys* | 1 | | | | | |
| Trichoptera | Hydropsychidae | *Ceratopsyche* | 5 | 3 | 44 | 25 | 12 | 15 |
| | | *Cheumatopsyche* | 9 | | 10 | 5 | 23 | 3 |
| | | *Hydropsyche* | 13 | | 1 | | 4 | |
| | Philopotamidae | *Chimarra* | 3 | | | 6 | 27 | 1 |
| | | *Dolophilodes* | 13 | | | 19 | | |
| | | *Wormaldia* | 1 | | | | | 1 |
| | Polycentropodidae | *Polycentropus* | | | | | | 2 |

***Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued***

| Class: Order | Family | Family/*Genus* | TRUP 4.5 | WAPP 2.6 |
|---|---|---|---|---|
| Coleoptera | Elmidae | *Optioservus* | | 1 |
| | | *Stenelmis* | 6 | |
| | Psephenidae | *Psephenus* | 11 | 3 |
| Diptera | Athericidae | *Atherix* | 2 | |
| | Chironomidae | Chironomidae | 17 | 65 |
| | Tabanidae | *Tabanus* | 1 | |
| | Tipulidae | *Antocha* | 1 | |
| | | *Dicranota* | 1 | |
| | | *Hexatoma* | 3 | 4 |
| Ephemeroptera | Baetidae | *Acentrella* | | 1 |
| | | *Baetis* | 1 | 15 |
| | Heptageniidae | *Heptagenia* | | 1 |
| | | *Stenonema* | 2 | 6 |
| | Isonychiidae | *Isonychia* | 2 | 20 |
| | Tricorythidae | *Tricorythodes* | 1 | |
| Megaloptera | Corydalidae | *Nigronia* | 1 | |
| Odonata | Gomphidae | *Lanthus* | | 1 |
| Oligochaeta | Nadidae | Nadidae | | 3 |
| Plecoptera | Chloroperlidae | *Sweltsa* | | 1 |
| | Perlidae | *Neoperla* | 25 | |
| Trichoptera | Hydropsychidae | *Ceratopsyche* | 29 | 12 |
| | | *Cheumatopsyche* | 14 | 7 |
| | | *Hydropsyche* | 1 | |
| | Philopotamidae | *Chimarra* | | 4 |
| | | *Dolophilodes* | | 2 |

***Table C2. Macroinvertebrate Data for Pennsylvania-Maryland Border Streams***

| Class: Order | Family | Family/*Genus* | BBDC 4.1 | CNWG 4.4 | DEER 44.5 | EBAU 1.5 | FBDC 4.1 |
|---|---|---|---|---|---|---|---|
| Coleoptera | Elmidae | *Optioservus* | 29 | | 18 | 31 | 50 |
| | | *Oulimnius* | | | | | 1 |
| | | *Stenelmis* | | 53 | 35 | 1 | 5 |
| | Psephenidae | *Psephenus* | | | 11 | 5 | |
| | Ptilodactylidae | *Anchytarsus* | 2 | | | | |
| Decapoda | Cambaridae | *Cambarus bartonii bartonii* | | | | | 1 |
| Diptera | Athericidae | *Atherix* | | 1 | 6 | | |
| | Chironomidae | Chironomidae | 23 | 7 | 45 | 27 | 54 |
| | Empididae | *Chelifera* | | | | 1 | |
| | Simuliidae | *Simulium* | | 1 | 1 | | |
| | Tipulidae | *Antocha* | 3 | | 16 | 7 | 5 |
| | | *Tipula* | | | | 1 | 1 |
| Ephemeroptera | Baetidae | *Baetis* | 1 | 8 | 9 | 5 | 9 |
| | | *Centroptilum* | 1 | 4 | | | |
| | Ephemerellidae | *Serratella* | 3 | 2 | | | 1 |
| | Heptageniidae | *Epeorus* | 5 | | 1 | | |
| | | *Heptagenia* | | 2 | | | |
| | | *Stenonema* | 1 | 16 | | | 2 |
| | Isonychiidae | *Isonychia* | 12 | 7 | 12 | 1 | |
| Megaloptera | Corydalidae | *Corydalus* | | 8 | | | |
| | | *Nigronia* | 3 | 3 | 1 | | 9 |
| | Sialidae | *Sialis* | | | 1 | | |
| Odonata | Aeshnidae | *Boyeria* | | | | | 3 |
| | Gomphidae | *Lanthus* | | | 1 | | 6 |
| Pelecypoda | Corbiculidae | *Corbicula fluminea* | | 1 | | | |
| Plecoptera | Leuctridae | *Leuctra* | 11 | | | 2 | 14 |
| | Perlidae | *Acroneuria* | 12 | | 6 | 2 | 4 |
| | | *Agnetina* | 3 | | | | |
| | | *Eccoptura* | | | | | 8 |
| | | *Perlesta* | | | 1 | | 1 |
| Trichoptera | Glossosomatidae | *Glossosoma* | | | | | 2 |
| | Hydropsychidae | *Ceratopsyche* | 17 | 15 | 15 | 22 | 4 |
| | | *Cheumatopsyche* | 13 | 19 | 25 | 9 | 13 |
| | | *Diplectrona* | | | | | 1 |
| | | *Hydropsyche* | 3 | 12 | 1 | 8 | 2 |
| | Hydroptilidae | *Hydroptila* | | | | | 1 |
| | Limnephilidae | *Goera* | | | | | 1 |
| | Philopotamidae | *Chimarra* | | | 5 | | |
| | | *Dolophilodes* | 14 | | | | |
| | | *Wormaldia* | | | | | 1 |
| | Polycentropodidae | *Polycentropus* | 1 | | | | |
| | Rhyacophilidae | *Rhyacophila* | 2 | | | | |

***Table C2. Macroinvertebrate Data for Pennsylvania-Maryland Border Streams—Continued***

| Class: Order | Family | Family/*Genus* | LNGA 2.5 | OCTO 6.6 | SBCC 20.4 | SCTT 3.0 |
|---|---|---|---|---|---|---|
| Amphipoda | Gammaridae | *Gammarus* | | 10 | | |
| Arachnoidea | Hydracarina | Hydracarina | | | 1 | |
| Coleoptera | Dytiscidae | *Agabus* | | | | 6 |
| | Elmidae | *Optioservus* | 12 | 1 | | |
| | | *Oulimnius* | 6 | | 5 | |
| | | *Stenelmis* | 18 | 1 | | |
| | | *Psephenus* | 1 | 7 | | |
| | Scirtidae | *Cyphon* | 1 | | | |
| Diptera | Athericidae | *Atherix* | | | 3 | |
| | Chironomidae | Chironomidae | 6 | 11 | 27 | 145 |
| | Empididae | *Chelifera* | 1 | | | |
| | Simuliidae | *Simulium* | | | | 22 |
| | Tipulidae | *Antocha* | 7 | 4 | | |
| | | *Dicranota* | 4 | | | |
| | | *Hexatoma* | 3 | | 7 | |
| | | *Tipula* | | | | 4 |
| Ephemeroptera | Baetidae | *Baetis* | | 5 | | |
| | | *Heterocleon* | | 28 | | |
| | Ephemerellidae | *Serratella* | | 6 | | |
| | Heptageniidae | *Stenonema* | | 9 | 4 | |
| | Isonychiidae | *Isonychia* | | 1 | | |
| Megaloptera | Corydalidae | *Corydalus* | | 1 | | |
| | | *Nigronia* | 1 | | 4 | |
| | Sialidae | *Sialis* | | | 1 | |
| Oligochaeta | Nadidae | Nadidae | | | | 4 |
| | Lumbricidae | Lumbricidae | | 1 | | 3 |
| Pelecypoda | Corbiculidae | *Corbicula fluminea* | | 2 | | |
| Plecoptera | Leuctridae | *Leuctra* | 4 | | 23 | |
| | Peltoperlidae | *Tallaperla* | | | 3 | |
| | Perlidae | *Acroneuria* | | | 6 | |
| | Perlodidae | *Isoperla* | | | 7 | |
| Trichoptera | Hydropsychidae | *Ceratopsyche* | 5 | 42 | 3 | |
| | | *Cheumatopsyche* | 2 | 23 | | |
| | | *Diplectrona* | | | 2 | |
| | | *Hydropsyche* | 22 | 1 | | 1 |
| | Lepidostomatidae | *Lepidostoma* | | 1 | | |
| | Philopotamidae | *Chimarra* | 10 | 6 | | |
| | | *Dolophilodes* | | | 32 | |
| | Rhyacophilidae | *Rhyacophila* | | | 2 | |

***Table C3. Macroinvertebrate Data for River Sites***

| Class: Order | Family | Family/*Genus* | CHEM 12.0 | COWN 1.0 | COWN 2.2 | SUSQ 289.1 |
|---|---|---|---|---|---|---|
| Amphipoda | Gammaridae | *Gammarus* | | 7 | 10 | |
| Coleoptera | Elmidae | *Optioservus* | | 3 | | 1 |
| | | *Stenelmis* | 17 | 27 | | 22 |
| | Gyrinidae | *Dineutus* | | | | 1 |
| | Psephenidae | *Psephenus* | 2 | 2 | | 16 |
| Decapoda | Cambaridae | *Procambarus acutus acutus* | | | | 1 |
| Diptera | Athericidae | *Atherix* | 1 | | | |
| | Chironomidae | Chironomidae | 15 | 17 | 97 | 5 |
| | Empididae | *Hemerodromia* | | 2 | | |
| | Simuliidae | *Simulium* | 4 | 12 | 12 | |
| | Tipulidae | *Tipula* | | | | |
| Ephemeroptera | Baetidae | *Acentrella* | | 3 | | |
| | | *Baetis* | 4 | 10 | | 15 |
| | Caenidae | *Caenis* | | | 1 | 1 |
| | Heptageniidae | *Heptagenia* | | | | 3 |
| | | *Stenonema* | 4 | 11 | | 4 |
| | Isonychiidae | *Isonychia* | 23 | | | 23 |
| | Leptophlebiidae | *Paraleptophlebia* | 1 | | | |
| | Polymitarcyidae | *Ephoron* | | | | 3 |
| | Potamanthidae | *Anthopotamus* | | | | 1 |
| Gastropoda | Physidae | *Physella* | 3 | | | |
| | Pleuroceridae | *Leptotoxis* | | | | |
| Isopoda | Asellidae | *Caecidotea* | | 12 | 34 | |
| Megaloptera | Corydalidae | *Corydalus* | 2 | 1 | | |
| | Sialidae | *Sialis* | 1 | | | |
| Odonata | Gomphidae | *Stylogomphus* | 1 | | | |
| Oligochaeta | Nadidae | Nadidae | | | | |
| | Lumbriculidae | Lumbriculidae | 1 | | | |
| Pelecypoda | Sphaeriidae | *Pisidium* | | | | 1 |
| Plecoptera | Perlidae | *Acroneuria* | | | | |
| | | *Agnetina* | | | | 2 |
| Trichoptera | Hydropsychidae | *Ceratopsyche* | | 28 | 4 | 3 |
| | | *Cheumatopsyche* | 57 | 11 | 14 | 16 |
| | | *Hydropsyche* | 3 | 3 | | 1 |
| | | *Macrostemum* | 4 | | | 2 |
| | Philopotamidae | *Chimarra* | 31 | 6 | | 22 |
| | Psychomyiidae | *Psychomyia* | | | | |

***Table C3. Macroinvertebrate Data for River Sites—Continued***

| Class: Order | Family | Family/*Genus* | SUSQ 340.0 | SUSQ 365.0 | TIOG 10.8 |
|---|---|---|---|---|---|
| Amphipoda | Gammaridae | *Gammarus* | 1 | 2 | |
| Coleoptera | Elmidae | *Optioservus* | | | |
| | | *Stenelmis* | 39 | 14 | 1 |
| | Gyrinidae | *Dineutus* | 7 | 7 | |
| | Psephenidae | *Psephenus* | 10 | 13 | |
| Decapoda | Cambaridae | *Procambarus acutus acutus* | | | |
| Diptera | Athericidae | *Atherix* | 1 | | 1 |
| | Chironomidae | Chironomidae | 6 | 17 | 37 |
| | Empididae | *Hemerodromia* | | | 1 |
| | Simuliidae | *Simulium* | 1 | | 3 |
| | Tipulidae | *Tipula* | | 1 | |
| Ephemeroptera | Baetidae | *Acentrella* | | 5 | |
| | | *Baetis* | 6 | 16 | 2 |
| | Caenidae | *Caenis* | | 1 | |
| | Heptageniidae | *Heptagenia* | | 1 | |
| | | *Stenonema* | 1 | 3 | 5 |
| | Isonychiidae | *Isonychia* | 10 | 1 | 1 |
| | Leptophlebiidae | *Paraleptophlebia* | | | |
| | Polymitarcyidae | *Ephoron* | 5 | 5 | |
| | Potamanthidae | *Anthopotamus* | | | |
| Gastropoda | Physidae | *Physella* | | | |
| | Pleuroceridae | *Leptotoxis* | | 6 | |
| Isopoda | Asellidae | *Caecidotea* | | | |
| Megaloptera | Corydalidae | *Corydalus* | | 1 | 6 |
| | Sialidae | *Sialis* | | | |
| Odonata | Gomphidae | *Stylogomphus* | | | |
| Oligochaeta | Nadidae | Nadidae | | | 3 |
| | Lumbriculidae | Lumbriculidae | | | |
| Pelecypoda | Sphaeriidae | *Pisidium* | | | 2 |
| Plecoptera | Perlidae | *Acroneuria* | 4 | 1 | |
| | | *Agnetina* | 7 | 15 | 1 |
| Trichoptera | Hydropsychidae | *Ceratopsyche* | 6 | 2 | 25 |
| | | *Cheumatopsyche* | 20 | | 7 |
| | | *Hydropsyche* | 1 | 1 | |
| | | *Macrostemum* | 2 | | 19 |
| | Philopotamidae | *Chimarra* | 11 | 3 | 38 |
| | Psychomyiidae | *Psychomyia* | 1 | | |

***Table C4. Macroinvertebrate Data for Group 3 Sites***

| Class: Order | Family | Family/*Genus* | BABC | BILL | BIRD | BISC | BRIG |
|---|---|---|---|---|---|---|---|
| Coleoptera | Elmidae | *Stenelmis* | | 1 | | | |
| | Psephenidae | *Psephenus* | | 6 | 1 | | |
| Decapoda | Cambaridae | *Orconectes obscurus* | 1 | | | | |
| Diptera | Chironomidae | Chironomidae | 65 | 15 | 54 | 45 | 72 |
| | Empididae | *Chelifera* | | | | | |
| | | *Hemerodromia* | | | 2 | | |
| | Simuliidae | *Simulium* | 1 | 1 | 1 | 1 | |
| | Tabanidae | *Tabanus* | 2 | | | | |
| | Tipulidae | *Hexatoma* | 3 | 10 | 8 | | 4 |
| Ephemeroptera | Ameletidae | *Ameletus* | | 5 | 6 | 9 | 1 |
| | Baetidae | *Acentrella* | 5 | 10 | | | 1 |
| | | *Baetis* | 17 | 16 | 2 | 7 | |
| | | *Centroptilum* | 1 | 5 | | 4 | 1 |
| | Ephemerellidae | *Drunella* | | | 6 | | |
| | | *Ephemerella* | 2 | 4 | 2 | 3 | |
| | Heptageniidae | *Epeorus* | 2 | 8 | 31 | 17 | 38 |
| | | *Heptagenia* | 2 | | | | |
| | | *Leucrocuta* | 3 | | 4 | 17 | |
| | | *Stenacron* | | | | | 2 |
| | | *Stenonema* | 4 | 1 | | | |
| | Leptophlebiidae | *Paraleptophlebia* | 31 | 31 | | | |
| Plecoptera | Chloroperlidae | *Haploperla* | 4 | 1 | | | 4 |
| | | *Sweltsa* | 18 | | 1 | 26 | 13 |
| | Nemouridae | *Amphinemura* | 13 | 10 | 7 | 2 | 1 |
| | Leuctridae | *Leuctra* | 30 | 3 | | | 3 |
| | Perlidae | *Acroneuria* | | 1 | 1 | | |
| | | *Agnetina* | | 3 | | | |
| | Perlodidae | *Clioperla* | | | | 1 | |
| | | *Isoperla* | 5 | 7 | 2 | 4 | 4 |
| Trichoptera | Hydropsychidae | *Ceratopsyche* | | 3 | | | |
| | | *Cheumatopsyche* | | 1 | | 2 | |
| | Philopotamidae | *Dolophilodes* | | | | 2 | |
| | Polycentropodidae | *Polycentropus* | 2 | | | | |
| | Rhyacophilidae | *Rhyacophila* | | | | | 1 |

***Table C4. Macroinvertebrate Data for Group 3 Sites—Continued***

| Class: Order | Family | Family/*Genus* | BULK | CAMP | COOK | DEEP | LWAP |
|---|---|---|---|---|---|---|---|
| Coleoptera | Elmidae | *Optioservus* | | | | 2 | |
| | Psephenidae | *Psephenus* | | | 1 | | |
| | Ptilodactylidae | *Anchytarsus* | | | | 2 | |
| Decapoda | Cambaridae | *Orconectes obscurus* | 2 | 1 | 2 | 1 | |
| Diptera | Ceratopogonidae | *Bezzia* | 1 | | | 1 | |
| | Chironomidae | Chironomidae | 50 | 2 | 42 | 53 | 66 |
| | Empididae | *Chelifera* | 3 | | | 7 | |
| | Simuliidae | *Simulium* | 1 | 3 | | 1 | |
| | Tipulidae | *Antocha* | | | | 2 | |
| | | *Dicranota* | | | | 9 | |
| | | *Hexatoma* | | 14 | 2 | 4 | |
| Ephemeroptera | Ameletidae | *Ameletus* | 1 | 1 | 6 | | 3 |
| | Baetidae | *Acentrella* | | | 3 | 1 | 14 |
| | | *Baetis* | | 7 | 5 | | 6 |
| | | *Centroptilum* | | | 3 | | |
| | Ephemerellidae | *Drunella* | | 1 | | | |
| | | *Ephemerella* | | 12 | 5 | 3 | 2 |
| | | *Eurylophella* | | | | 1 | 1 |
| | Ephemeridae | *Ephemera* | | | | 5 | |
| | Heptageniidae | *Epeorus* | 17 | 39 | 15 | 1 | 18 |
| | | *Leucrocuta* | 3 | | 14 | | 12 |
| | | *Stenacron* | | | | 2 | |
| | | *Stenonema* | 4 | 2 | 2 | 4 | |
| | Leptophlebiidae | *Paraleptophlebia* | 5 | 3 | 1 | 7 | 1 |
| Megaloptera | Corydalidae | *Nigronia* | 1 | | | 5 | |
| Odonata | Gomphidae | *Ophiogomphus* | | | 1 | | |
| Plecoptera | Chloroperlidae | *Sweltsa* | 11 | 3 | 31 | | 19 |
| | Nemouridae | *Amphinemura* | 26 | 2 | 2 | | 1 |
| | Leuctridae | *Leuctra* | 5 | 4 | 1 | | |
| | Perlidae | *Acroneuria* | 6 | 2 | 2 | 2 | 1 |
| | | *Agnetina* | | 5 | | | |
| | Perlodidae | *Isoperla* | 1 | 20 | 4 | | 1 |
| Trichoptera | Hydropsychidae | *Ceratopsyche* | | 5 | | | |
| | | *Cheumatopsyche* | | | 3 | | |
| | | *Diplectrona* | | | | 2 | |
| | | *Hydropsyche* | | 3 | 2 | 1 | |
| | Philopotamidae | *Chimarra* | | | | 2 | |
| | | *Dolophilodes* | 3 | | 1 | | |
| | Polycentropodidae | *Polycentropus* | | | | 1 | |
| | Rhyacophilidae | *Rhyacophila* | 8 | | 1 | 3 | |

***Table C4. Macroinvertebrate Data for Group 3 Sites—Continued***

| Class: Order | Family | Family/*Genus* | PARK | PRIN | REDH | RUSS | SACK |
|---|---|---|---|---|---|---|---|
| Coleoptera | Elmidae | *Stenelmis* | | 1 | | | |
| | Psephenidae | *Psephenus* | | 2 | | | |
| Diptera | Chironomidae | Chironomidae | 74 | 47 | 54 | 56 | 19 |
| | Simuliidae | *Simulium* | 1 | 17 | 1 | 3 | 5 |
| | Tipulidae | *Dicranota* | | | 1 | | |
| | | *Hexatoma* | 4 | 1 | 11 | 1 | 6 |
| Ephemeroptera | Ameletidae | *Ameletus* | 1 | 1 | 2 | 4 | 1 |
| | Baetidae | *Acentrella* | | 1 | | 2 | 11 |
| | | *Baetis* | 6 | 4 | | | |
| | | *Centroptilum* | 3 | | | | 3 |
| | Ephemerellidae | *Ephemerella* | 1 | 7 | 1 | | |
| | | *Eurylophella* | | | | | 1 |
| | Heptageniidae | *Epeorus* | 23 | 7 | | 17 | 39 |
| | | *Leucrocuta* | 5 | 8 | 1 | | 7 |
| | Isonychiidae | *Isonychia* | | 1 | | | |
| | Leptophlebiidae | *Paraleptophlebia* | | 5 | | 1 | 7 |
| | Tricorythidae | *Tricorythodes* | | 1 | | | |
| Odonata | Gomphidae | *Ophiogomphus* | | 1 | | | |
| | | *Stylogomphus* | | | 1 | | |
| Plecoptera | Chloroperlidae | *Haploperla* | 1 | 3 | | 14 | 6 |
| | | *Sweltsa* | 6 | 3 | 38 | 26 | 10 |
| | Nemouridae | *Amphinemura* | 5 | 5 | 3 | 6 | 3 |
| | Leuctridae | *Leuctra* | 4 | | 9 | 6 | |
| | Perlodidae | *Diura* | | | 5 | | |
| | | *Isoperla* | 3 | 2 | 1 | | 3 |
| Trichoptera | Hydropsychidae | *Ceratopsyche* | 1 | 2 | | | |
| | | *Cheumatopsyche* | 1 | | 2 | | |
| | | *Diplectrona* | | | | 1 | |
| | | *Hydropsyche* | 2 | | | | |
| | Philopotamidae | *Dolophilodes* | | | 19 | | |
| | Polycentropodidae | *Polycentropus* | | | 1 | | |
| | Rhyacophilidae | *Rhyacophila* | | | 1 | 1 | |

***Table C4. Macroinvertebrate Data for Group 3 Sites—Continued***

| Class: Order | Family | Family/*Genus* | SMIT | STRA | WBCO | WHIT |
|---|---|---|---|---|---|---|
| Coleoptera | Elmidae | *Optioservus* | 33 | | 1 | |
| | | *Stenelmis* | | | 3 | |
| | Psephenidae | *Ectopria* | 1 | | | |
| | | *Psephenus* | | 15 | | |
| Decapoda | Cambaridae | *Orconectes obscurus* | | 1 | | |
| Diptera | Ceratopogonidae | *Bezzia* | 1 | | 1 | 1 |
| | Chironomidae | Chironomidae | 61 | 19 | 32 | 18 |
| | Simuliidae | *Prosimulium* | | | 37 | 1 |
| | | *Simulium* | | 4 | | |
| | Tipulidae | *Antocha* | | | 1 | |
| | | *Dicranota* | 1 | | | |
| | | *Hexatoma* | 3 | 10 | | 13 |
| | | *Tipula* | | | 2 | |
| Ephemeroptera | Ameletidae | *Ameletus* | 1 | 2 | | 1 |
| | Baetidae | *Baetis* | | 12 | | 1 |
| | | *Centroptilum* | | 3 | | 3 |
| | Ephemerellidae | *Ephemerella* | | 5 | | |
| | Ephemeridae | *Ephemera* | 2 | | | |
| | Heptageniidae | *Epeorus* | | 9 | | 45 |
| | | *Leucrocuta* | 3 | 3 | | 2 |
| | | *Stenacron* | 2 | | | |
| | | *Stenonema* | | 1 | | |
| | Leptophlebiidae | *Paraleptophlebia* | 4 | 34 | | |
| Gastropoda | Physidae | *Physella* | | | 1 | |
| Megaloptera | Sialidae | *Sialis* | 1 | | | |
| Oligochaeta | Lumbriculidae | Lumbriculidae | | | 5 | |
| Plecoptera | Chloroperlidae | *Sweltsa* | | 3 | | 20 |
| | Nemouridae | *Amphinemura* | 2 | 7 | | 7 |
| | | *Nemoura* | | | | 15 |
| | Leuctridae | *Leuctra* | 7 | | | 2 |
| | Perlidae | *Acroneuria* | 2 | 1 | | |
| | | *Agnetina* | | 2 | | |
| | | *Eccoptura* | 1 | | | |
| | Perlodidae | *Diura* | | | | 5 |
| | | *Isoperla* | | 12 | | 1 |
| Trichoptera | Hydropsychidae | *Ceratopsyche* | | 6 | 9 | |
| | | *Cheumatopsyche* | 3 | 1 | 10 | |
| | | *Hydropsyche* | | | 17 | |
| | Philopotamidae | *Chimarra* | | 2 | | |
| | | *Dolophilodes* | 1 | | | 2 |
| | Polycentropodidae | *Polycentropus* | | 1 | | |
| | Rhyacophilidae | *Rhyacophila* | 3 | | | |

# APPENDIX D

# WATER CLASSIFICATION AND BEST USAGE RELATIONSHIPS

**New York:**

The New York State water quality classifications are summarized from Water Quality Regulations for Surface Waters and Groundwaters, 6NYCRR Parts 700-705, effective September 1, 1991, New York State Department of Environmental Conservation, Division of Water, Albany, New York. Only classifications that are used in this report will be described in this section. The classes are as follows:

**Class A:**

(a) The best usages of Class A waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish propagation and survival.

(b) This classification may be given to those waters that, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to reduce naturally present impurities, meet or will meet New York State Department of Health drinking water standards and are or will be considered safe and satisfactory for drinking water purposes.

**Class B:** The best usages of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

**Class C:** The best usage of Class C waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

**Class D:** The best usage of these waters is fishing. Due to such natural conditions as intermittence of flow, water conditions not conducive to propagation of game fishery, or streambed conditions, the waters will not support fish propagation. These waters shall be suitable for fish survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

**(T):** Suffix added to classes where trout survival is an additional best use to the use classification.

**Pennsylvania:**

The Pennsylvania state water quality classifications are summarized from Water Quality Standards of the Department's Rules and Regulations, 25 Pa. Code, Chapter 93.3-5, effective November 2000, Pennsylvania Department of Environmental Protection, Division of Water Quality Assessment and Standards, Harrisburg, Pennsylvania. All surface waters must meet protected water uses for aquatic life (warm water fishes), water supply (potable, industrial, livestock, and wildlife), and recreation (boating, fishing, water contact sports, and aesthetics). Only classifications that are used in this report will be described in this section. The use classifications are as follows:

**CWF** – Cold Water Fishes: Maintenance and/or propagation of fish species including the family Salmonidae and additional flora and fauna, which are indigenous to a cold water habitat.

**WWF** – Warm Water Fishes: Maintenance and propagation of fish species and additional flora and fauna that are indigenous to a warm water habitat.

**TSF** – Trout Stocked Fishery: Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna that are indigenous to a warm water habitat.

**MF** – Migratory Fishes: Passage, maintenance and propagation of anadromous and catadromous fishes and other fishes that ascend to flowing waters to complete their life cycle. The MF designation is in addition to other designations when appropriate.

**Maryland:**

The Maryland State water quality classifications are summarized from Water Quality Regulations for Designated Uses, COMAR 26.08.02, Effective August 2000, Maryland Department of the Environment, Annapolis, Maryland. All surface waters must protect public health or welfare; enhance the quality of water; protect aquatic resources; and serve the purposes of the Federal Act. Only classifications that are used in this report will be described in this section. The designated use classifications are as follows:

**I-P** – Protection of fish and aquatic life and contact recreation (fishable/swimmable), and Use I-P, which includes drinking water supply.

**III-P** – Natural trout waters and Use III-P, which includes a drinking water supply.

**IV-P** – Recreational trout waters and Use IV-P, which includes drinking water.

# APPENDIX E

# STATISTICAL TREND RESULTS BY PARAMETER

***Table E1. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Suspended Solids***

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | 1.000 | 0.000 | -0.002 | 0.000 | 177 | 0.540 | -1.793 | -0.076 | 21.709 |
| Chemung River | 0.238 | 1.984 | 0.125 | 0.855 | 232 | 0.537 | 0.909 | 0.053 | -67.018 |
| Conowingo Creek | 0.609 | 0.666 | 0.016 | 0.399 | 167 | 0.520 | 0.658 | 0.058 | NA |
| Cowanesque River | 0.121 | 1.734 | 0.199 | 1.398 | 124 | 0.599 | 0.997 | 0.096 | -34.718 |
| Deer Creek | 0.140 | 1.445 | 0.042 | 1.103 | 131 | 0.122 | 1.375 | 0.072 | NA |
| Ebaugh Creek | 0.307 | 2.013 | 0.179 | 1.227 | 164 | 1.000 | 0.025 | 0.008 | -0.171 |
| Octoraro Creek | 0.692 | 0.562 | -0.060 | 0.323 | 174 | 0.592 | 0.637 | -0.015 | -8.092 |
| Scott Creek | 0.835 | -2.005 | 0.018 | -0.938 | 214 | 0.800 | 0.466 | 0.115 | 41.204 |
| Susquehanna River 10.0 | 0.478 | 1.004 | -0.009 | 0.577 | 174 | 1.000 | 0.059 | -0.131 | 5.267 |
| Susquehanna River 44.5 | 0.216 | 3.099 | 0.145 | 1.694 | 183 | 0.731 | -0.557 | -0.009 | 5.045 |
| Susquehanna River 289.1 | 0.888 | 0.000 | 0.012 | 0.000 | 156 | 0.501 | -0.516 | -0.074 | -17.398 |
| Susquehanna River 340 | 0.353 | 0.803 | 0.103 | 0.637 | 126 | 0.575 | 0.360 | 0.068 | -12.283 |
| Susquehanna River 365 | 0.340 | 0.630 | 0.099 | 0.478 | 132 | 0.190 | 1.298 | 0.122 | -35.673 |
| Tioga River | 0.097 | -1.630 | -0.162 | -1.165 | 140 | 0.286 | -1.494 | -0.122 | 37.641 |
| Troups Creek | 0.147 | 1.989 | 0.167 | 1.198 | 166 | 0.403 | 0.738 | 0.117 | -72.375 |

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

*Table E2. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Ammonia*

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | <0.001 | -0.002 | -0.383 | -6.677 | 0.030 | 0.006 | -0.002 | -0.274 | 28.568 |
| Chemung River | <0.001 | -0.003 | -0.329 | -8.362 | 0.040 | 0.002 | -0.004 | -0.212 | 84.639 |
| Conowingo Creek | 0.059 | -0.002 | -0.200 | -4.765 | 0.040 | 0.880 | 0.000 | -0.053 | -0.632 |
| Cowanesque River | 0.271 | -0.002 | -0.143 | -2.776 | 0.060 | 0.136 | -0.003 | -0.209 | NA |
| Deer Creek | 0.005 | -0.002 | -0.355 | -5.084 | 0.030 | 0.125 | 0.001 | -0.256 | 29.853 |
| Ebaugh Creek | 0.002 | -0.003 | -0.288 | -6.703 | 0.050 | 0.058 | -0.003 | -0.122 | 36.049 |
| Octoraro Creek | 0.005 | -0.003 | -0.210 | -6.409 | 0.040 | 0.972 | -0.001 | 0.160 | 11.095 |
| Scott Creek | 1.000 | 0.000 | -0.044 | 0.000 | 0.170 | 0.971 | 0.000 | 0.003 | 1.156 |
| Susquehanna River 10.0 | 0.064 | -0.002 | -0.113 | -2.386 | 0.070 | 0.220 | 0.002 | -0.059 | 13.181 |
| Susquehanna River 44.5 | 0.020 | -0.002 | -0.126 | -4.435 | 0.050 | 0.066 | -0.002 | -0.107 | 52.321 |
| Susquehanna River 289.1 | 0.003 | -0.003 | -0.280 | -5.741 | 0.050 | 0.030 | -0.003 | -0.201 | 46.190 |
| Susquehanna River 340 | <0.001 | -0.002 | -0.343 | -7.413 | 0.030 | <0.001 | -0.002 | -0.358 | 13.445 |
| Susquehanna River 365 | <0.001 | -0.002 | -0.309 | -6.715 | 0.030 | <0.001 | -0.002 | -0.363 | 34.373 |
| Tioga River | <0.001 | -0.003 | -0.359 | -6.245 | 0.060 | <0.001 | -0.003 | -0.319 | 54.566 |
| Troups Creek | 0.684 | 0.000 | -0.045 | 0.000 | 0.020 | 0.778 | 0.000 | 0.038 | -11.159 |

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

***Table E3. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Nitrogen***

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | 0.079 | -0.023 | -0.171 | -2.668 | 0.877 | 0.011 | -0.045 | -0.279 | 65.322 |
| Chemung River | 0.011 | -0.028 | -0.246 | -2.497 | 1.138 | 0.009 | -0.029 | -0.253 | -54.725 |
| Conowingo Creek | <0.001 | 0.170 | 0.468 | 2.100 | 8.110 | <0.001 | 0.169 | 0.443 | NA |
| Cowanesque River | <0.001 | -0.058 | -0.422 | -6.932 | 0.830 | 0.044 | -0.029 | -0.275 | -82.955 |
| Deer Creek | 0.138 | 0.035 | 0.129 | 0.704 | 4.923 | 0.527 | 0.014 | 0.073 | 20.670 |
| Ebaugh Creek | 0.978 | -0.002 | 0.026 | -0.029 | 6.152 | 0.158 | 0.041 | -0.049 | -29.293 |
| Octoraro Creek | 0.212 | 0.081 | 0.073 | 1.418 | 5.720 | 0.781 | 0.010 | -0.046 | -18.163 |
| Scott Creek | 0.368 | -0.045 | -0.127 | -1.980 | 2.296 | 0.065 | -0.105 | -0.209 | 52.803 |
| Susquehanna River 10.0 | 0.063 | -0.033 | -0.264 | -2.123 | 1546 | 0.039 | -0.028 | -0.247 | NA |
| Susquehanna River 44.5 | 0.759 | -0.009 | -0.029 | -0.751 | 1.256 | 0.738 | -0.005 | -0.018 | -11.828 |
| Susquehanna River 289.1 | 0.003 | -0.030 | -0.287 | -3.051 | 0.980 | <0.001 | -0.030 | -0.329 | NA |
| Susquehanna River 340 | 0.004 | -0.024 | -0.284 | -3.049 | 0.790 | 0.003 | -0.023 | -0.285 | NA |
| Susquehanna River 365 | <0.001 | -0.029 | -0.340 | -3.433 | 0.852 | 0.001 | -0.025 | -0.374 | NA |
| Tioga River | 0.001 | -0.036 | -0.313 | -4.502 | 0.806 | 0.001 | -0.030 | -0.310 | NA |
| Troups Creek | 0.002 | -0.034 | -0.337 | -7.416 | 0.454 | 1.000 | -0.001 | -0.003 | 1.349 |

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

***Table E4. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Phosphorus***

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | 0.006 | -0.004 | -0.177 | -4.450 | 0.090 | 0.065 | -0.005 | -0.200 | 42.846 |
| Chemung River | 0.344 | -0.001 | -0.089 | -1.767 | 0.070 | 0.104 | -0.002 | -0.162 | 37.408 |
| Conowingo Creek | 0.001 | -0.004 | -0.284 | -5.180 | 0.070 | 0.015 | -0.003 | -0.189 | 65.711 |
| Cowanesque River | 0.200 | 0.000 | -0.128 | 0.000 | 0.030 | 0.188 | -0.001 | -0.203 | NA |
| Deer Creek | 0.006 | -0.002 | -0.228 | -5.119 | 0.030 | 0.026 | -0.001 | -0.193 | 30.729 |
| Ebaugh Creek | 0.204 | -0.001 | -0.089 | -2.767 | 0.040 | 0.577 | -0.001 | 0.003 | 12.880 |
| Octoraro Creek | 0.009 | -0.004 | -0.203 | -5.000 | 0.080 | 0.111 | -0.003 | -0.115 | 15.015 |
| Scott Creek | 0.117 | -0.003 | -0.107 | -3.645 | 0.090 | 0.295 | -0.006 | 0.039 | 58.126 |
| Susquehanna River 10.0 | 0.005 | -0.002 | -0.201 | -3.355 | 0.050 | 0.135 | -0.001 | -0.101 | NA |
| Susquehanna River 44.5 | 0.060 | -0.002 | -0.136 | -3.331 | 0.060 | 0.051 | -0.002 | -0.156 | NA |
| Susquehanna River 289.1 | <0.001 | -0.003 | -0.321 | -5.016 | 0.050 | <0.001 | -0.002 | -0.338 | -71.688 |
| Susquehanna River 340 | <0.001 | -0.002 | -0.325 | -5.003 | 0.040 | 0.001 | -0.002 | -0.304 | NA |
| Susquehanna River 365 | <0.001 | -0.001 | -0.318 | -3.596 | 0.040 | 0.011 | -0.002 | -0.254 | 43.216 |
| Tioga River | 0.018 | -0.001 | -0.219 | -2.778 | 0.030 | 0.051 | -0.001 | -0.194 | 39.126 |
| Troups Creek | 0.090 | 0.000 | -0.182 | 0.000 | 0.020 | 0.397 | 0.000 | -0.086 | -29.924 |

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

*Table E5. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Chloride*

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | 0.173 | 0.602 | 0.133 | 2.410 | 25.0 | 0.671 | 0.237 | 0.060 | -9.818 |
| Chemung River | 0.005 | 1.156 | 0.265 | 3.988 | 29.0 | <0.001 | 0.788 | 0.432 | 49.389 |
| Conowingo Creek | <0.001 | 0.228 | 0.517 | 1.427 | 16.0 | <0.001 | 0.225 | 0.474 | NA |
| Cowanesque River | 0.335 | 0.125 | 0.160 | 1.252 | 10.0 | 0.599 | -0.103 | -0.003 | 26.124 |
| Deer Creek | <0.001 | 0.414 | 0.427 | 2.433 | 17.0 | <0.001 | 0.420 | 0.491 | NA |
| Ebaugh Creek | 0.002 | 1.823 | 0.329 | 7.148 | 25.5 | 0.066 | 1.815 | 0.207 | -30.172 |
| Octoraro Creek | <0.001 | 0.181 | 0.469 | 1.296 | 14.0 | <0.001 | 0.184 | 0.440 | NA |
| Scott Creek | 0.889 | 0.000 | 0.083 | 0.000 | 37.0 | 0.971 | 0.016 | 0.112 | 1.417 |
| Susquehanna River 10.0 | 0.158 | 0.227 | 0.180 | 1.568 | 14.5 | 0.143 | 0.264 | 0.179 | NA |
| Susquehanna River 44.5 | 0.022 | 0.402 | 0.276 | 2.679 | 15.0 | 0.026 | 0.194 | 0.298 | NA |
| Susquehanna River 289.1 | <0.001 | 0.749 | 0.320 | 4.681 | 16.0 | <0.001 | 0.490 | 0.356 | NA |
| Susquehanna River 340 | <0.001 | 0.419 | 0.357 | 4.191 | 10.0 | <0.001 | 0.343 | 0.453 | NA |
| Susquehanna River 365 | <0.001 | 0.379 | 0.359 | 3.789 | 10.0 | 0.005 | 0.287 | 0.315 | -58.282 |
| Tioga River | 0.863 | 0.000 | -0.015 | 0.000 | 10.0 | 0.921 | -0.007 | -0.012 | 6.373 |
| Troups Creek | 0.212 | 0.332 | 0.140 | 2.373 | 14.0 | 1.000 | -0.063 | 0.003 | 9.300 |

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

*Table E6. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Sulfate*

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | 0.031 | -0.763 | -0.210 | -3.179 | 24 | 0.039 | -0.938 | -0.209 | NA |
| Chemung River | <0.001 | -1.020 | -0.340 | -3.518 | 29 | <0.001 | -1.020 | -0.413 | NA |
| Conowingo Creek | 0.269 | -0.125 | -0.053 | -0.892 | 14 | 0.292 | -0.232 | -0.087 | 72.132 |
| Cowanesque River | <0.001 | -1.391 | -0.408 | -6.050 | 23 | 0.054 | -0.977 | -0.218 | NA |
| Deer Creek | 0.094 | 0.000 | 0.202 | 0.000 | 10 | 0.321 | 0.059 | 0.102 | -38.259 |
| Ebaugh Creek | 0.229 | 0.000 | 0.204 | 0.000 | 10 | 0.366 | 0.075 | 0.232 | 19.601 |
| Octoraro Creek | 0.841 | 0.000 | 0.067 | 0.000 | 21 | 1.000 | -0.021 | 0.071 | 2.413 |
| Scott Creek | 0.095 | -0.713 | -0.117 | -2.971 | 24 | 0.120 | -0.559 | -0.114 | NA |
| Susquehanna River 10.0 | 0.344 | -0.338 | -0.079 | -0.927 | 36.5 | 0.698 | -0.238 | -0.028 | 7.974 |
| Susquehanna River 44.5 | 0.802 | -0.255 | -0.089 | -0.594 | 43 | 0.058 | -0.704 | -0.295 | 27.180 |
| Susquehanna River 289.1 | 0.104 | -0.500 | -0.161 | -2.776 | 18 | 0.038 | -0.466 | -0.206 | 37.383 |
| Susquehanna River 340 | 0.198 | -0.331 | -0.133 | -1.948 | 17 | 0.162 | -0.380 | -0.142 | 43.963 |
| Susquehanna River 365 | 0.673 | 0.000 | -0.036 | 0.000 | 16 | 0.627 | -0.110 | -0.033 | 25.856 |
| Tioga River | <0.001 | -1.753 | -0.452 | -4.494 | 39 | <0.001 | -1.792 | -0.495 | NA |
| Troups Creek | 0.013 | -0.807 | -0.277 | -3.670 | 22 | 0.011 | -0.685 | -0.285 | NA |

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

*Table E7. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Iron*

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | <0.001 | -22.568 | -0.367 | -13.045 | 173 | 0.202 | -7.924 | -0.126 | NA |
| Chemung River | <0.001 | -29.127 | -0.417 | -11.426 | 259 | 0.002 | -43.051 | -0.295 | 26.779 |
| Conowingo Creek | <0.001 | -50.325 | -0.410 | -12.550 | 401 | 0.011 | -24.534 | -0.242 | 27.501 |
| Cowanesque River | 0.505 | 7.204 | 0.078 | 3.118 | 231 | 0.381 | 13.673 | 0.106 | -35.832 |
| Deer Creek | <0.001 | -28.091 | -0.493 | -14.296 | 196.5 | 0.044 | -15.649 | -0.162 | 26.896 |
| Ebaugh Creek | <0.001 | -32.001 | -0.539 | -14.480 | 221 | <0.001 | -20.412 | -0.367 | 48.483 |
| Octoraro Creek | <0.001 | -40.861 | -0.407 | -10.215 | 400 | 0.238 | -10.117 | -0.034 | NA |
| Scott Creek | 0.464 | -17.272 | -0.027 | -3.539 | 488 | 0.404 | -34.392 | -0.075 | 44.747 |
| Susquehanna River 10.0 | <0.001 | -43.940 | -0.492 | -9.319 | 471.5 | 0.001 | -62.073 | -0.378 | 64.661 |
| Susquehanna River 44.5 | 0.001 | -38.286 | -0.367 | -7.349 | 521 | 0.035 | -28.217 | -0.286 | 27.422 |
| Susquehanna River 289.1 | <0.001 | -39.020 | -0.430 | -15.992 | 244 | <0.001 | -60.826 | -0.404 | 46.237 |
| Susquehanna River 340 | <0.001 | -32.841 | -0.377 | -10.947 | 300 | 0.008 | -39.465 | -0.255 | 20.547 |
| Susquehanna River 365 | <0.001 | -21.880 | -0.334 | -8.717 | 251 | 0.001 | -30.118 | -0.336 | NA |
| Tioga River | 0.067 | -14.265 | -0.175 | -5.895 | 242 | 0.862 | -2.257 | -0.019 | 3.720 |
| Troups Creek | 0.472 | -3.426 | -0.083 | -1.888 | 181.5 | 0.778 | -1.591 | -0.029 | 11.041 |

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

***Table E8. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Aluminum***

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | 0.278 | -1.199 | -0.105 | -1.199 | 100 | 0.302 | -3.329 | -0.093 | NA |
| Chemung River | 0.643 | 0.000 | -0.049 | 0.000 | 190 | 0.629 | -1.387 | -0.056 | 4.244 |
| Conowingo Creek | <0.001 | -27.982 | -0.344 | -11.238 | 249 | 0.007 | -20.332 | -0.250 | 24.125 |
| Cowanesque River | 0.500 | 2.416 | 0.068 | 1.046 | 231 | 0.430 | 7.626 | 0.112 | NA |
| Deer Creek | 0.092 | -1.799 | -0.163 | -1.799 | 100 | 0.351 | -3.822 | -0.135 | 9.172 |
| Ebaugh Creek | 0.294 | 0.000 | -0.106 | 0.000 | 100 | 0.157 | -6.351 | -0.202 | 30.880 |
| Octoraro Creek | 0.079 | -12.652 | -0.163 | -4.866 | 260 | 0.405 | -10.809 | -0.041 | 16.828 |
| Scott Creek | 0.278 | 0.000 | 0.078 | 0.000 | 100 | 0.856 | -0.572 | -0.095 | 5.977 |
| Susquehanna River 10.0 | 0.057 | -11.775 | -0.249 | -4.556 | 258.5 | 0.027 | -15.490 | -0.301 | 78.158 |
| Susquehanna River 44.5 | 0.015 | -19.644 | -0.257 | -6.830 | 287.6 | 0.035 | -21.004 | -0.248 | 49.849 |
| Susquehanna River 289.1 | 0.071 | -6.699 | -0.168 | -3.917 | 171 | 0.030 | -8.484 | -0.202 | 31.543 |
| Susquehanna River 340 | 0.197 | -4.151 | -0.119 | -2.749 | 151 | 0.398 | -3.167 | -0.080 | 20.119 |
| Susquehanna River 365 | 0.219 | -1.560 | -0.110 | -1.560 | 100 | 0.063 | -8.442 | -0.190 | 52.271 |
| Tioga River | 0.526 | 1.789 | 0.067 | 1.028 | 174 | 0.097 | 5.130 | 0.162 | -59.262 |
| Troups Creek | 0.944 | 0.000 | -0.011 | 0.000 | 136.5 | 0.572 | 2.627 | 0.068 | -22.660 |

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

*Table E9. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Manganese*

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | <0.001 | -1.095 | -0.383 | -7.301 | 15 | 0.018 | -0.596 | -0.240 | 80.293 |
| Chemung River | <0.001 | -2.954 | -0.327 | -4.161 | 71 | 0.003 | -2.945 | -0.292 | 70.886 |
| Conowingo Creek | 0.055 | -1.820 | -0.189 | -3.605 | 50.5 | 0.265 | -0.854 | -0.084 | 13.649 |
| Cowanesque River | 0.032 | 4.980 | 0.233 | 5.533 | 90 | 0.661 | -0.729 | -0.068 | -71.860 |
| Deer Creek | 0.031 | -0.541 | -0.240 | -1.933 | 28 | 0.240 | -0.303 | -0.179 | -67.027 |
| Ebaugh Creek | 0.465 | -0.495 | -0.079 | -1.394 | 35.5 | 0.140 | -0.835 | -0.173 | 12.099 |
| Octoraro Creek | 0.018 | -1.616 | -0.218 | -2.992 | 54 | 0.111 | -2.493 | -0.062 | NA |
| Scott Creek | 0.075 | -8.562 | -0.167 | -5.689 | 150.5 | 0.231 | -10.689 | 0.041 | 37.277 |
| Susquehanna River 10.0 | 0.004 | -3.406 | -0.310 | -2.580 | 132 | 0.029 | -2.469 | -0.256 | -93.128 |
| Susquehanna River 44.5 | 0.011 | -4.987 | -0.302 | -4.138 | 120.5 | 0.012 | -4.296 | -0.338 | 49.863 |
| Susquehanna River 289.1 | 0.015 | -0.992 | -0.233 | -3.815 | 26 | 0.016 | -0.905 | -0.235 | 19.070 |
| Susquehanna River 340 | 0.716 | -0.077 | -0.043 | -0.208 | 37 | 0.596 | -0.306 | -0.057 | 10.870 |
| Susquehanna River 365 | 0.111 | -0.381 | -0.157 | -1.523 | 25 | 0.797 | -0.099 | -0.044 | 72.106 |
| Tioga River | <0.001 | -17.389 | -0.368 | -7.012 | 248 | 0.003 | -14.858 | -0.286 | NA |
| Troups Creek | 0.476 | 0.000 | -0.091 | 0.000 | 12 | 0.585 | -0.303 | -0.061 | 19.257 |

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

*Table E10. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Water Quality Index*

| Station | Concentrations | | | | | Flow-Adjusted Concentrations | | | |
|---|---|---|---|---|---|---|---|---|---|
| | P | b | Tau | % Slope | Median | P | b | Tau | % Slope |
| Cayuta Creek | 0.747 | -0.301 | -0.044 | -0.573 | 52.5 | 0.246 | -0.534 | -0.130 | 81.604 |
| Chemung River | 0.270 | -0.404 | -0.138 | -0.652 | 62 | 0.199 | -0.480 | -0.157 | -60.386 |
| Conowingo Creek | 0.028 | -1.011 | -0.341 | -1.944 | 52 | 0.639 | -0.462 | -0.136 | 35.913 |
| Cowanesque River | 0.258 | 0.819 | 0.131 | 1.707 | 48 | 0.784 | 0.248 | -0.011 | -9.610 |
| Deer Creek | 1.000 | 0.000 | -0.144 | 0.000 | 32.5 | 0.448 | 0.445 | -0.103 | -29.247 |
| Ebaugh Creek | 0.408 | 0.500 | 0.090 | 1.041 | 48 | 0.139 | 0.571 | 0.186 | NA |
| Octoraro Creek | 0.095 | -0.927 | -0.196 | -1.749 | 53 | 0.631 | -0.256 | -0.024 | -44.141 |
| Scott Creek | 0.773 | -0.091 | 0.007 | -0.139 | 66 | 0.970 | 0.046 | 0.005 | NA |
| Susquehanna River 10.0 | 0.450 | -0.498 | -0.168 | -1.071 | 46.5 | 0.223 | -0.574 | -0.209 | NA |
| Susquehanna River 44.5 | 0.200 | -0.617 | -0.185 | -1.341 | 46 | 0.107 | -0.783 | -0.196 | NA |
| Susquehanna River 289.1 | 0.777 | -0.083 | -0.051 | -0.059 | 52 | 0.511 | -0.355 | -0.090 | 72.515 |
| Susquehanna River 340 | 0.801 | 0.000 | 0.024 | 0.000 | 39 | 0.925 | 0.071 | 0.004 | -3.645 |
| Susquehanna River 365 | 0.518 | 0.262 | 0.054 | 0.624 | 42 | 0.470 | 0.262 | 0.068 | NA |
| Tioga River | 0.730 | -0.262 | -0.054 | -0.504 | 52 | 0.540 | -0.186 | -0.058 | -32.353 |
| Troups Creek | 0.570 | 0.250 | 0.066 | 0.713 | 35 | 0.102 | 0.970 | 0.189 | NA |

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available