ASSESSMENT OF INTERSTATE STREAMS IN THE SUSQUEHANNA RIVER BASIN

Monitoring Report No. 26
January 1, 2012 Through December 31, 2012

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Introduction

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 near Cooperstown, N.Y. From there the river flows 444 miles through New York, Pennsylvania, and Maryland before emptying into the Chesapeake Bay at Havre de Grace, Md. Eighty-three streams cross state lines in the basin. Several streams traverse the state borders at multiple points, contributing to 91 total crossings. Of those 91 crossings, 45 streams flow from New York into Pennsylvania, 22 from Pennsylvania into New York, 15 from Pennsylvania into Maryland, and nine from Maryland into Pennsylvania. Many streams are small, and 32 are unnamed.

The Susquehanna River Basin Commission (SRBC) reviews projects that may have interstate impacts on water resources in the Susquehanna River Basin. Established in 1986, SRBC's Interstate Streams Monitoring Program provides data from border streams that are not routinely assessed by state agencies in New York, Maryland, and Pennsylvania. Currently, the state agencies do not monitor 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 U.S. Environmental Protection Agency (USEPA).

The interstate water quality monitoring program includes periodic collection of water and biological samples from interstate streams, as well as assessments of physical habitat. Water quality data are used to: (1) assess compliance with water quality standards, (2) characterize stream quality and seasonal variations, (3) build a database for assessment of water quality trends, (4) identify streams for reporting to USEPA under Section 305(b) of the Clean Water Act, (5) provide information to signatory states for Integrated List purposes and possible Total Maximum Daily Load (TMDL) development, and (6) identify areas for restoration and protection. Biological conditions are assessed using representative benthic macroinvertebrate and fish populations, which provide an indication of the biological health of a stream and serve as indicators of water quality.

SRBC's interstate monitoring program began in April 1986. For the first five years, results were reported based on water-year (from October to the following September). In 1991, SRBC changed the reporting periods to correspond with its fiscal year (from July to the following June). In 2009, SRBC transitioned to a reporting period based on the calendar year (from January to that December). Reports are typically completed the summer of the year following the collection period. Therefore, this report includes data collected between January 1 and December 31, 2012. Beginning in 2007, a web-based format was initiated to provide a more user-friendly product that is easily accessible to government agencies as well as any individuals or groups that may be interested in the condition of these streams and rivers. Recent reports are available on SRBC's web site at http://www.srbc.net/programs/monitoringprotection.htm.

Methods

Field and Laboratory Methods

Sampling Frequency

In 1989, SRBC divided the interstate streams 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. Beginning in 2012, the sampling schedule of the interstate streams project was modified to incorporate an alternating year approach to collecting data along the two borders. Interstate streams will be monitored on an every-other-year basis according to geographic location. Streams along the New York-Pennsylvania border will be sampled in 2012 and every subsequent even-numbered year. Streams along the Pennsylvania-Maryland border will be sampled in 2013 and every subsequent odd-numbered year. Monitoring frequency within the year will follow the existing schedule of quarterly Group 1 sampling and annual sampling of Group 2 and 3 streams. Details for each group are as follows:

Group 1

Streams with impaired water quality or those judged to have a high potential for degradation due to large drainage areas or historical pollution have been assigned to Group 1, which includes 13 sites along the Pennsylvania-New York border and eight sites along the Pennsylvania-Maryland border. Group 1 streams were sampled four times per year, once in each of the following months: February, May, July/August, and October. Water quality samples and field chemistry measurements were taken at each Group 1 site during these months. Macroinvertebrate collections were taken, and habitat assessments were made during the July/August sampling period. From 2009-2011, SRBC sampled the fish community at select Group 1 and 2 sites during the summer sampling period. The large river sites CHEM 12.0, COWN 1.0, SUSQ 289.1, SUSQ 365.0, and TIOG 10.8 were excluded from fish sampling due to sampling difficulties associated with large size.

Group 2

Streams judged to have a moderate potential for impacts have been assigned to Group 2, which includes eight sites along the Pennsylvania-New York border and three sites along the Pennsylvania-Maryland border. Water quality samples, field chemistry parameters, benthic macroinvertebrate samples, and physical habitat information were obtained from Group 2 sites once per year, during base flow conditions in the summer months of July or August. As previously mentioned, SRBC sampled the fish community at select Group 2 sites from 2009-2011.

Group 3

Streams judged to have a low potential for impacts have been assigned to Group 3, which includes 21 sites along the Pennsylvania-New York border. No Group 3 sites are located along the Pennsylvania-Maryland border. Macroinvertebrates, water quality parameters, and habitat conditions were assessed at Group 3 sites in May of even-numbered years.

Stream Discharge

Stream discharge was measured at all sites unless high streamflows made access hazardous or impossible. Several sites are located near U.S. Geological Survey (USGS) stream gages, including: the Susquehanna River at Windsor, N.Y. (SUSQ 365.0), the Susquehanna River at Sayre, Pa. (SUSQ 289.1), the Susquehanna River at Conowingo, Md. (SUSQ 10.0), the Chemung River at Chemung, N.Y. (CHEM 12.0), the Tioga River near Lindley, N.Y. (TIOG 10.8), the Cowanesque River at Lawrenceville, Pa. (COWN 1.0), and Octoraro Creek near Richardsmere, Md. (OCTO 6.6). For these sites, recorded stages from USGS gaging stations and ratings curves were used to determine instantaneous discharges measured in cubic feet per second (cfs). Instantaneous discharges for sites not located near USGS gaging stations were measured at the time of sampling, using standard USGS procedures (Buchanan and Somers, 1969) and a FlowTracker.

Water Samples

Water samples were collected at each of the Group 1, Group 2, and Group 3 streams to measure nutrient and metal concentrations. Water samples were collected using a depth-integrated sampler. Composite samples were obtained by collecting several depth-integrated samples across the stream channel and combining them in a churn splitter that was previously rinsed with stream water. Water samples were mixed thoroughly in the churn splitter and collected in one 500-ml bottle, two 250-ml bottles, and two 40-ml vials. The 500-ml sample bottle was used for a raw sample. Each of the 250-ml bottles consisted of a whole water sample, one fixed with 10-percent nitric acid (HNO_3) for metal analysis, and one fixed with 10-percent sulfuric acid (H_2SO_4) for nutrient analysis. The two 40-ml vials were pre-cleaned and fixed with sulfuric acid (H_2SO_4). The vials were filled with sample water and were used to measure total organic carbon (TOC). The samples were chilled on ice and sent to ALS Environmental in Middletown, Pa., within 24 hours of collection.

Field Chemistry

Temperature, dissolved oxygen, conductivity, and pH were measured in the field for all stations. Temperature, dissolved oxygen, conductivity, and pH were measured using a YSI model 6820 V2 multiparameter water quality sonde. Dissolved oxygen and pH probes were calibrated each day prior to sampling. The conductivity probe was calibrated at the beginning of each week.

Macroinvertebrate and Physical Habitat Sampling

Macroinvertebrate samples were collected from Group 1 and Group 2 stations in July and August, while Group 3 stations were sampled in May. The benthic macroinvertebrate community was sampled and assessed to provide an indication of the biological condition of the stream. Macroinvertebrates were defined as aquatic insects and other invertebrates too large to pass through a No. 30 sieve.

Benthic macroinvertebrate samples were analyzed according to 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 D-frame dipnet with 500-micron mesh in the best available habitat in the stream reach. Samples consisted of a composite of six (6) D-frame kicks from riffle areas in the stream reach, with each kick disturbing approximately one (1) square meter immediately upstream of the D-frame net for approximately one (1) minute. The six samples were composited and preserved in 95-percent ethyl alcohol for later laboratory identification and analysis.

In the laboratory, composite samples were sorted into 200-organism subsamples using a gridded pan and a random numbers table. Organisms within the subsample were identified to genus (except Chironomidae and Oligochaeta) and enumerated using taxonomic keys developed by Merrit and Cummins (1996), Peckarsky and others. (1990), and Pennak (1989). Each taxon was assigned an organic pollution tolerance value and a functional feeding category (Chalfant, 2007).

Physical habitat conditions at each station were assessed using a slightly modified version of the habitat assessment procedure outlined by Barbour et al. (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 stream was characterized by riffles and runs or by glides and pools.

Fish Sampling

Fish community assessments will be adapted from the RBP manual (Barbour and others, 1999) and from the Maryland Biological Stream Survey (Roth and others, 1998). Electrofishing at wadeable Group 1 and 2 interstate stream stations will occur according to the schedule outlined in Section VIII. Conditions at the time of sampling must be conducive to electrofishing operations. Specifically, flows must be manageable and allow the electrofishing team to traverse the entire width of the stream. Water clarity also must be suitable to allow visual detection of immobilized fish at all depths. Every possible effort will be made regarding trip reconnaissance prior to departure to sampling stations to ensure that ideal conditions are realized.

Electrofishing at all wadeable interstate streams stations will consist of three passes along a stream section equivalent to ten times the average wetted width of the stream channel. The downstream point should be a natural cutoff (e.g., impassable riffles, falls, head of a pool) that

could deter fish from migrating out of the sample reach. If a natural cutoff is not present, then block nets will be deployed to keep fish within the reach. After placing a piece of flagging tape in a visible location at the downstream point, staff will measure five wetted channel widths, in meters, with a tape or rangefinder while walking to the upstream limit of the reach. Sample reach distance may be adjusted if a natural cutoff occurs within ± 5 meter of the measured end point. If there is no natural cutoff at the upstream margin of the reach, block nets will be used. Reach lengths are a minimum of 100 meters if the stream is less than 10 meters in average width and a maximum of 400 meters if the average width is greater than 40 meters.

GPS coordinates for the upstream and downstream limits of the sample reach will be recorded on the data sheet (Appendix). Sampling teams will consist of three or four members. Backpack electrofishing units (battery powered or electrical generated) with two handheld probes will be used or a Smith Root towed barge with two or three anodes depending on stream size and depth. Electrofishing will consist of two or three passes (based on stream location) of the entire width and length of the stream segment selected. Beginning at the downstream limit of the sample reach, the sampling team will proceed upstream covering the entire stream width, using a sinuous pattern when necessary. A concerted effort will be made by each team member to capture every fish sighted over 25mm in length, so that a representative sample is collected. Clock start and stop time, as well as accumulated electrofishing time (shock time), will be recorded on the data sheet.

Nets and holding cages with 0.25-inch mesh netting will be used to prevent escape. All fish will be collected and identified to species in the field, when possible. The first 50 individuals of game fish species will be measured to the nearest millimeter and weighed to the nearest tenth of a gram. Fish that cannot be identified in the field will be preserved in formalin and returned to the laboratory for identification. Digital photographs will be taken of all unknown specimens, as well as voucher (reference) photographs of each species. After processing fish from each pass, all individuals will be returned to the stream at a point downstream of the reach, where fish cannot travel back into the sample reach. All data will be entered into the SRBC's Access database.

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. Additionally, a simple water quality index (WQI) was calculated using procedures established by McMorran (1988). 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 three groups. One group contains stations along the New York-Pennsylvania border (14 stations), another contains stations along the Pennsylvania-Maryland border (nine stations), and the remaining group compares large river stations (five stations). 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 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. WQI scores ranged from 1 to 100, with high WQI scores indicating poor water quality.

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 indices for a stream and compared them to a reference station in the same region to determine the degree of impairment. The metrics used in the survey are summarized in the Appendix. The calculation of the Shannon Diversity Index followed the methods described in Klemm and others (1990), and all other metrics were taken from Barbour and others (1999).

The 200-organism subsample data were used to generate scores for each of the seven metrics. Scores for metrics 1-4 were converted to a biological condition score, based on the percent similarity of the metric score relative to the metric score of the reference site. Scores for metrics 5-7 were based on set scoring criteria developed for the percentages (Plafkin and others, 1989; Ohio Environmental Protection Agency, 1987b). The sum of the biological condition scores constituted the total biological score for the sample site, and total biological score was used to assign each site to a biological condition category of nonimpaired, slightly impaired, moderately impaired, or severely impaired. Habitat assessment scores of sample sites were compared to those of reference sites to classify each sample into a habitat condition category of excellent, supporting, partially supporting, or nonsupporting.

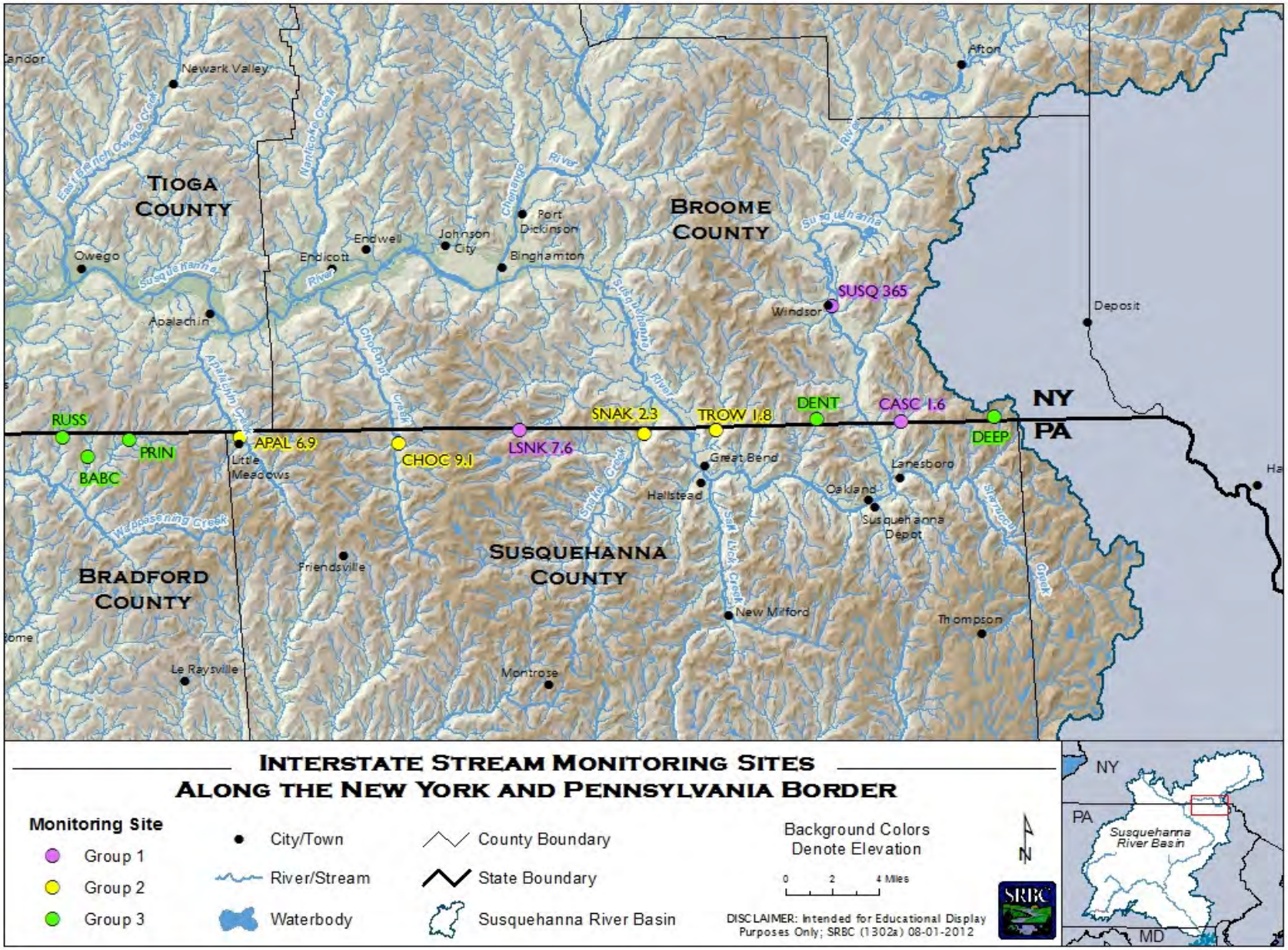
Fish data were analyzed using an adapted version of the Maryland Biological Stream Survey (MBSS) Fish Index of Biological Integrity (IBI) (Roth et al., 1998; Roth and others, 2000; Southerland and others, 2005). Two versions of the Fish IBI were used depending on the location of the stream. All Pennsylvania-Maryland border streams were assessed using the Eastern Piedmont version while Pennsylvania-New York streams were assessed using the Highlands version. The Eastern Piedmont version used contains the following eight metrics: number of native species, number of benthic species, number of intolerant species, percent tolerant fish, percent abundance of dominant species, percent generalists, omnivores and invertivores, percent lithophilic spawners, and number of individuals per square meter. The metric biomass per square meter was omitted from the analysis as biomass data were not available at the time of sampling. The Highlands version used contains the following six metrics: number of benthic species, number of intolerant species, percent tolerant fish, percent generalists, omnivores and invertivores, percent insectivores, and percent lithophilic spawners. Each metric received a score of 1, 3, or 5 based on scoring criteria for each ecoregion (Roth and others, 2000). Metric scores were then averaged and the fish community received a classification of good, fair, poor, or very poor according to the table listed in the Appendix.

List of New York-Pennsylvania Interstate Streams (sampled in 2012)

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, NY	3	Monitor for potential impacts
BISC	Biscuit Hollow, Austinburg, PA	3	Monitor for potential impacts
BNTY 0.9	Bentley Creek, Wellsburg, NY	1	Monitor for potential water quality impacts
BRIG	Briggs Hollow, Nichols, NY	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, NY	1	Municipal discharge from Waverly, NY
CHEM 12.0	Chemung River, Chemung, NY	1	Municipal and industrial discharges from Elmira, NY
CHOC 9.1	Choconut Creek, Vestal Center, NY	2	Monitor for potential water quality impacts
COOK	Cook Hollow, Austinburg, PA	3	Monitor for potential impacts
COWN 1.0	Cowanesque River, Lawrenceville, PA	1	Recovery zone from upstream flood control reservoir
DEEP	Deep Hollow Brook, Danville, NY	3	Monitor for potential impacts
DENT	Denton Creek, Hickory Grove, PA	3	Monitor for potential impacts
DRYB	Dry Brook, Waverly, NY	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, NY	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, NY	3	Monitor for potential impacts
PRIN	Prince Hollow Run, Cadis, PA	3	Monitor for potential impacts
REDH	Redhouse Run, Osceola, PA (formerly Beagle Hollow Run)	3	Monitor for potential impacts
RUSS	Russell Run, Windham, PA	3	Monitor for potential impacts
SACK	Sackett Creek, Nichols, NY	3	Monitor for potential impacts
SEEL 10.3	Seeley Creek, Seeley Creek, NY	1	Monitor for potential water quality impacts
SMIT	Unnamed tributary to 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, NY	1	Large drainage area (1,882 sq. mi.); municipal discharges from Cooperstown, Sidney, Bainbridge, and Oneonta
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, NY	1	Pollution from abandoned 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, NY	2	Monitor for potential water quality impacts
WBCO	White Branch Cowanesque River, North Fork, PA	3	Monitor for potential impacts
WHIT	White Hollow, Wellsburg, NY	3	Monitor for potential impacts

List of Pennsylvania-Maryland Interstate Streams (not sampled in 2012)

Station	Stream and Location	Monitoring Group	Rationale
BBDC 4.1	Big 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
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
FBDC 4.1	Falling Branch Deer Creek, Fawn Grove, PA	2	Monitor for potential water quality impacts
LNGA 2.5	Long Arm Creek, Bandanna, PA	1	Monitor for potential water quality impacts
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
SBCC 20.4	South Branch Conewago Creek, Bandanna, PA	2	Monitor for potential water quality impacts
SCTT 3.0	Scott Creek, Delta, PA	1	Historical pollution due to untreated sewage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Group 2
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Waterbody
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State Boundary
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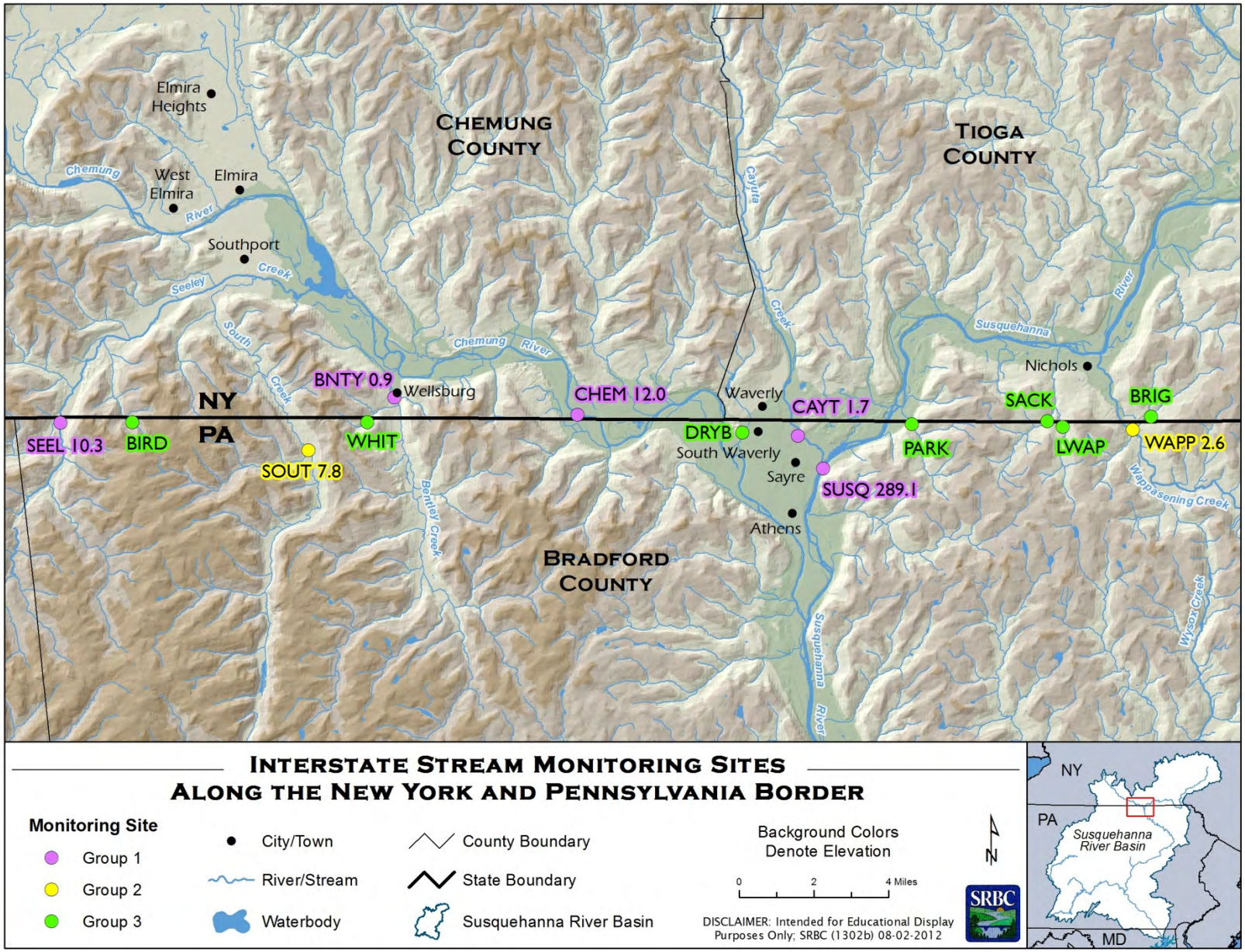
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Bentley Creek
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Wysox Creek
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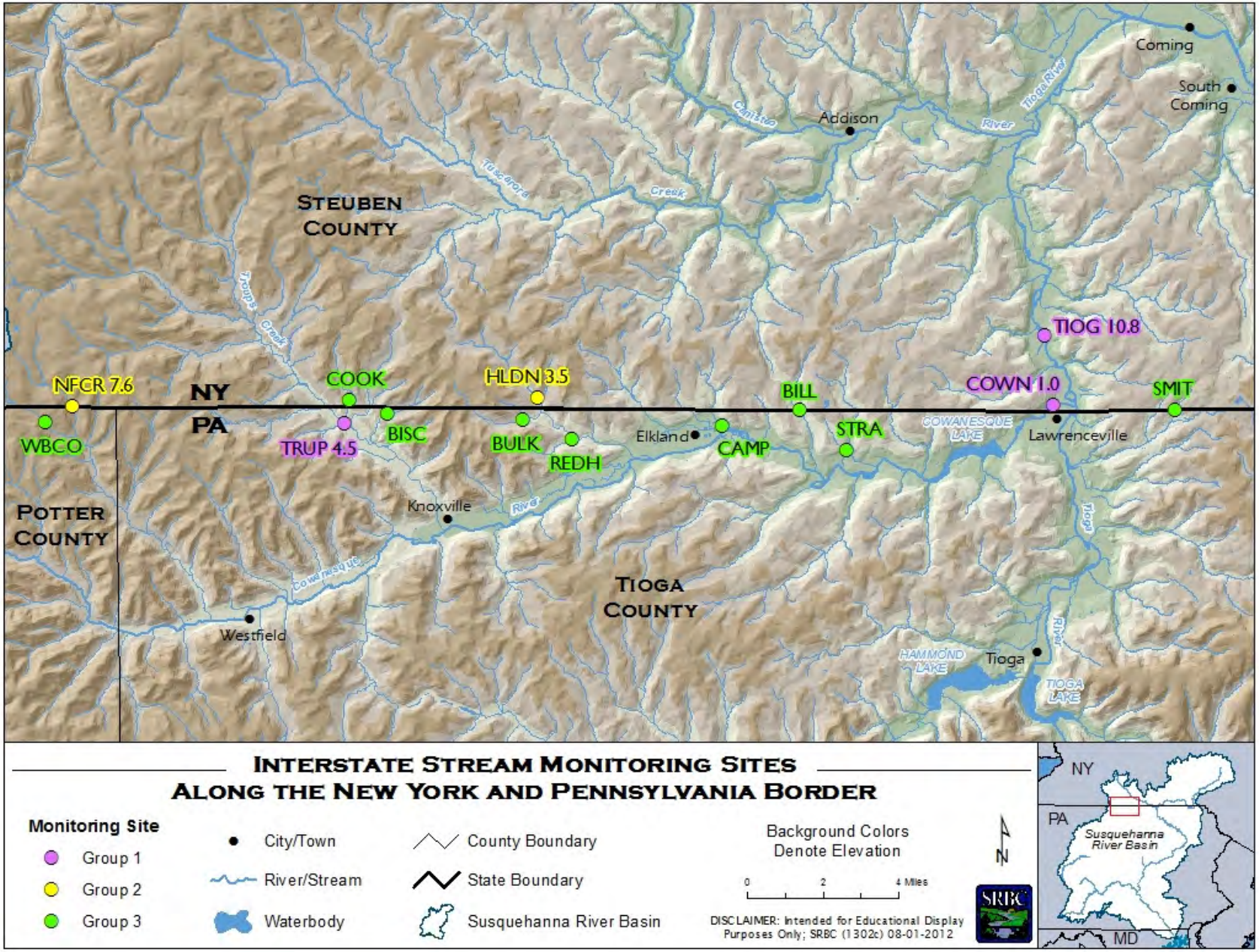
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SMIT
WBCO
TRUP 4.5
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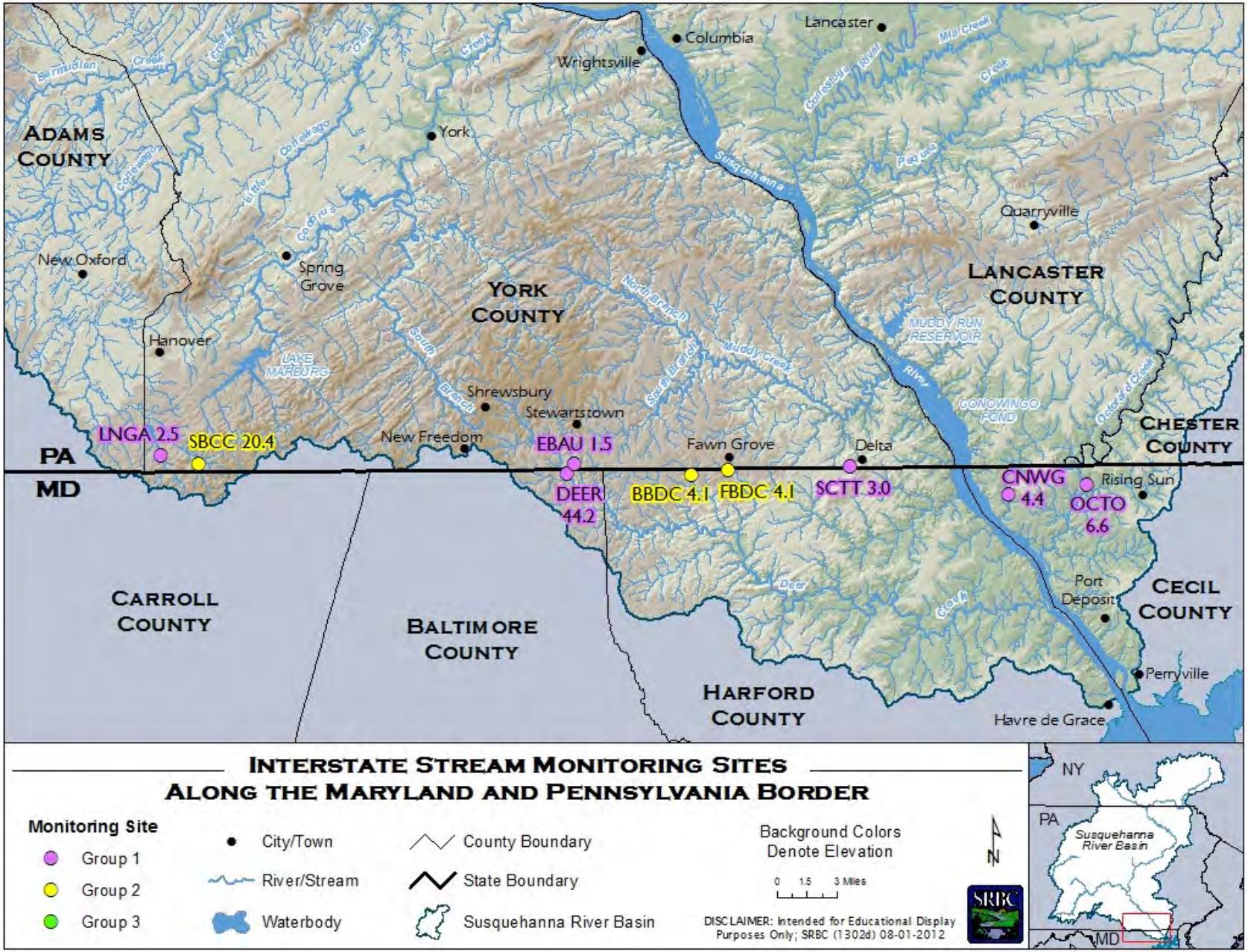
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York
Quarryville
New Oxford
Spring Grove
Hanover
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Stewartstown
New Freedom
Fawn Grove
Delta
Rising Sun
Port Deposit
Perryville
Havre de Grace
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SBCC 20.4
EBAU 1.5
DEER 44.2
BBDC 4.1
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OCTO 6.6
Susquehanna
Conestoga River
Pequea
Mill Creek
Codorus Creek
Muddy Run Reservoir
Conowingo Pond
Lake Marburg
North Branch
South Branch
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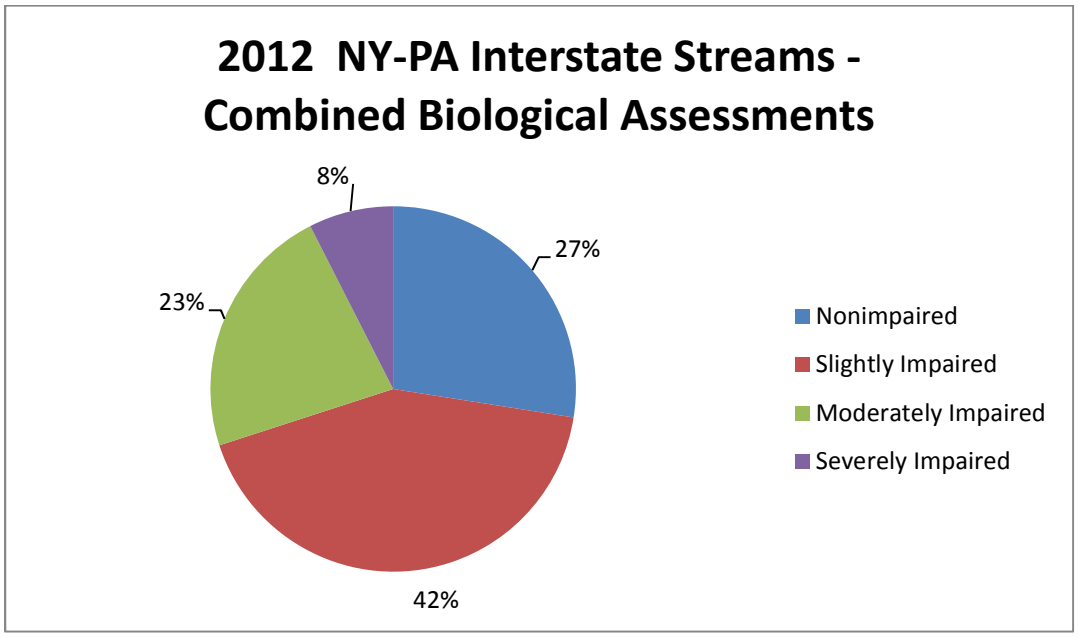
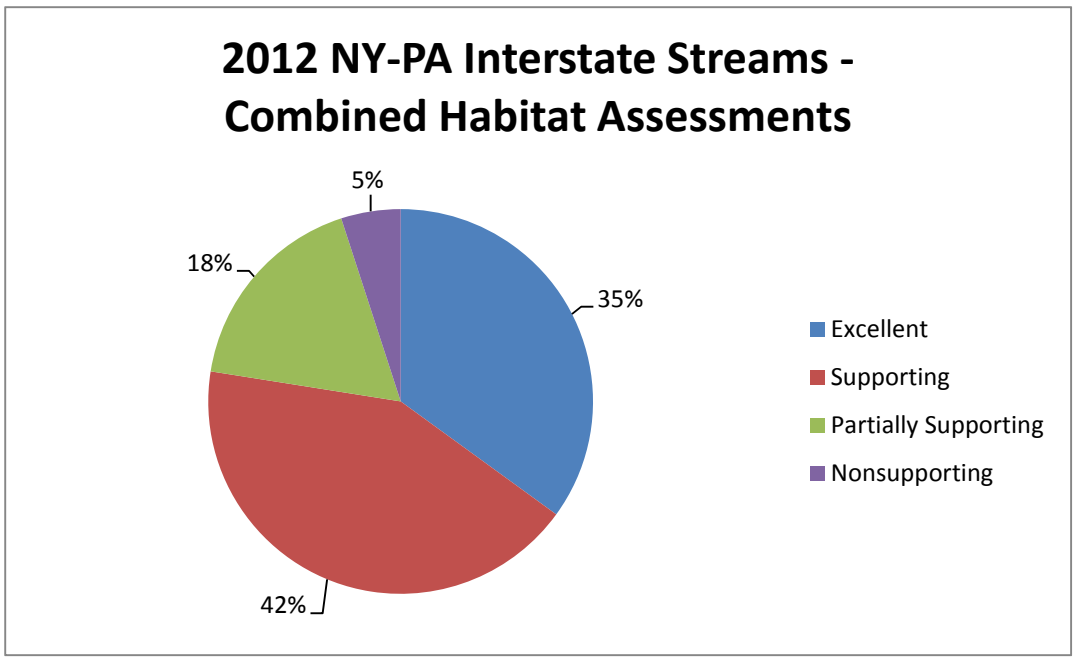
Overall Results

Macroinvertebrates and Habitat

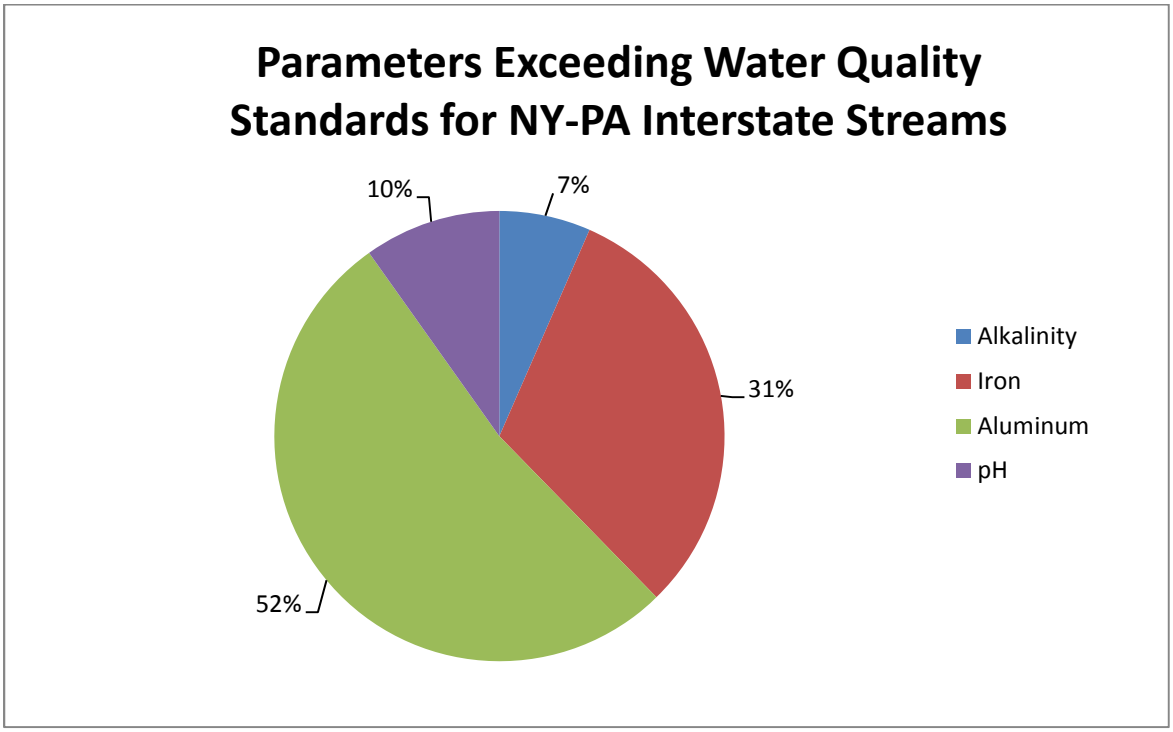
In 2012, 69 percent of the New York-Pennsylvania interstate streams assessed had a biological community deemed nonimpaired or slightly impaired. Nonimpaired biological communities were present at 11 of 40 streams assessed (27 percent), while three were considered severely impaired. Physical habitat was rated as being excellent or supporting at 77 percent of the streams evaluated. Of the 40 total sites where physical habitat was assessed, 11 were rated as excellent, while three were nonsupporting.





Water Quality

Parameter	Standard	Standard Value	Number of Observations	Number Exceeding Standards
Alkalinity	PA aquatic life	20 mg/L	73	4
Total Aluminum	NY aquatic (chronic)	100 µg/L	73	32
Total Iron	NY aquatic (chronic) PA aquatic life	300 µg/L 1500 µg/L	73	19
Nitrate plus Nitrite	PA public water supply	10 mg/L	73	0
pH	NY general MD aquatic life PA aquatic life	6.5-8.5 6.5-8.5 6.0-9.0	73	6
Total Manganese	NY aquatic (chronic)	300 µg/L	73	0
Turbidity	MD aquatic life	150 NTU	73	0
Dissolved Oxygen	PA aquatic life	5.0 mg/L	73	0



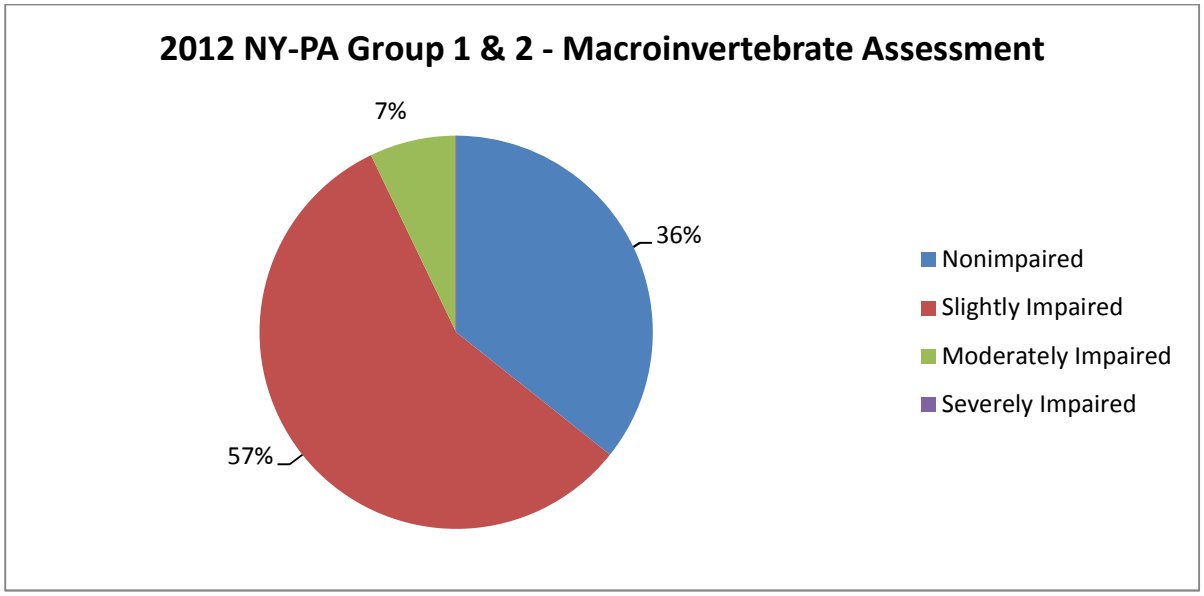
All NY-PA interstate stream monitoring sites are located within watersheds underlain, partially if not entirely, by natural gas containing shale formations. Water quality and biological monitoring at many of these sites began in 1989 with the initiation of the Interstate Streams Water Quality Network project. Beginning in 2008, many of the watersheds within the project's geographic bounds began experiencing natural gas extraction and development activities. In 2012, SRBC added monitoring for specific oil and gas related elements to the suite of routine parameters included in the laboratory water quality portion of the Interstate Streams Water Quality Network. These parameters included measuring concentrations of barium, bromide, lithium, and strontium. Laboratory water quality testing was added to the annual monitoring occurring at all 21 Group 3 streams assessed in the project. Previous years' analyses had only included laboratory water chemistry testing at Group 1 and 2 streams. None of the parameters associated with natural gas extraction and development were detected in elevated concentrations during the 2012 monitoring year.

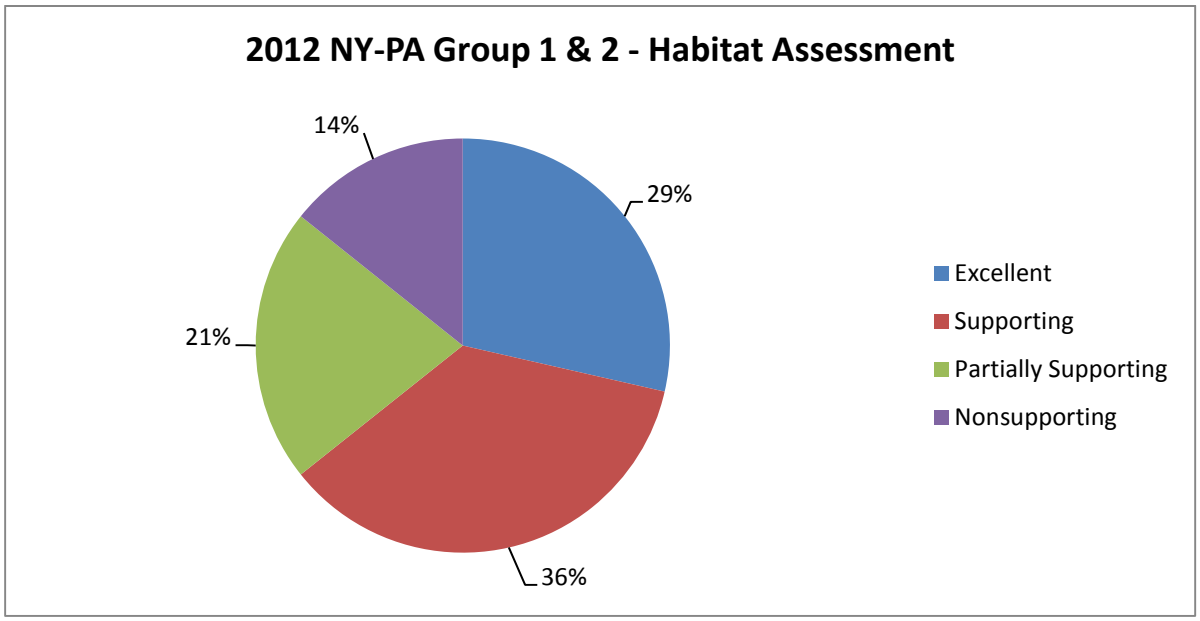
As part of the SRBC's Remote Water Quality Monitoring Network (RWQMN), real-time water quality monitoring stations were installed on a number of streams, which are part of the Interstate Streams project. Streams jointly monitored by the RWQMN and the Interstate Streams project include Apalachin Creek, Choconut Creek, Snake Creek, Tioga River, and Wappasening Creek. Additionally, the RWQMN continuously monitors Hammond Creek, a major tributary to the Group 1 interstate stream, Seeley Creek. Supplemental water quality monitoring conducted since 2010 as part of the RWQMN project on streams shared within the spatial bounds of the two projects supported the findings of the Interstate Streams monitoring (Dawn Hintz, personal communication, May 2013).

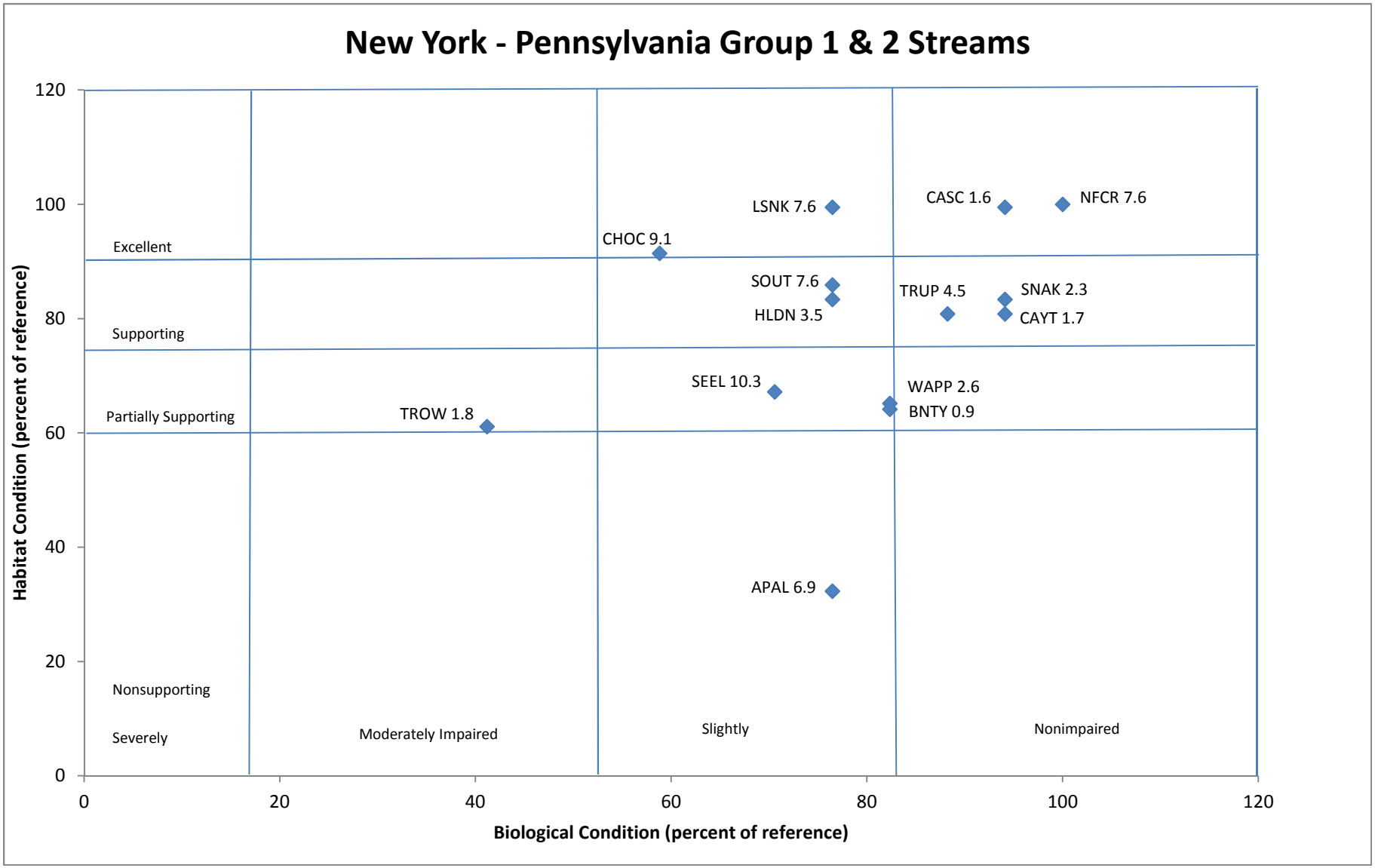
In 2012, biological assessments were performed on four of these shared streams (Apalachin Creek, Choconut Creek, Snake Creek and Wappasening Creek). All four streams received biological condition ratings of "slightly impaired" or "nonimpaired" suggesting minimally impaired biological communities. Analysis of macroinvertebrate samples collected independently through the RWQMN project revealed similar community structure and comparable scores in commonly used metrics. Available physical habitat conditions displayed greater variation with Choconut Creek possessing "excellent" habitat conditions while Apalachin Creek was deemed "nonsupporting." Snake Creek and Wappasening Creek were rated as "supporting" and "partially supporting," respectively. Variables contributing to streams scoring poorly in habitat condition were mainly related to flooding events in September 2011 and subsequent remediation efforts.

Results for 2012 New York-Pennsylvania Group 1 & 2 Stream Assessments

Sites that represent the best available combination of conditions in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. In 2012, the North Fork Cowanesque River near North Fork, Pa. (NFCR 7.6), served as the reference stream to which all other New York-Pennsylvania Group 1 and 2 streams were compared. The North Fork Cowanesque River station possessed the highest rated macroinvertebrate community and best available habitat of all New York-Pennsylvania border streams sampled in 2012. Of the 14 Group 1 and 2 streams where biological communities were evaluated, five were rated as nonimpaired and eight were rated as slightly impaired. Available physical habitat was rated as excellent or supporting at nine of 14 Group 1 and 2 streams assessed.

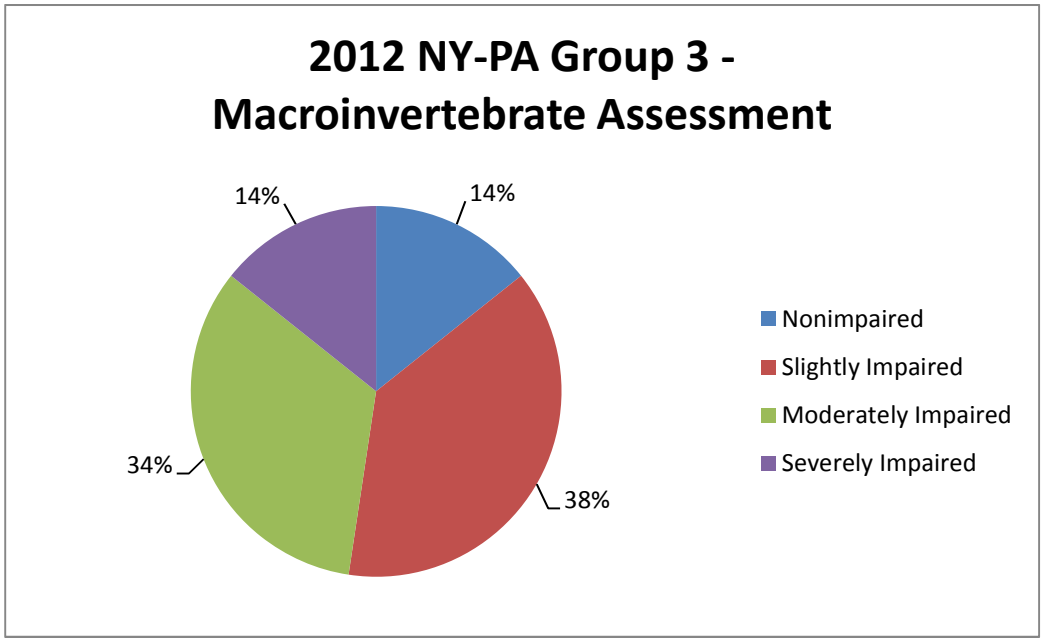


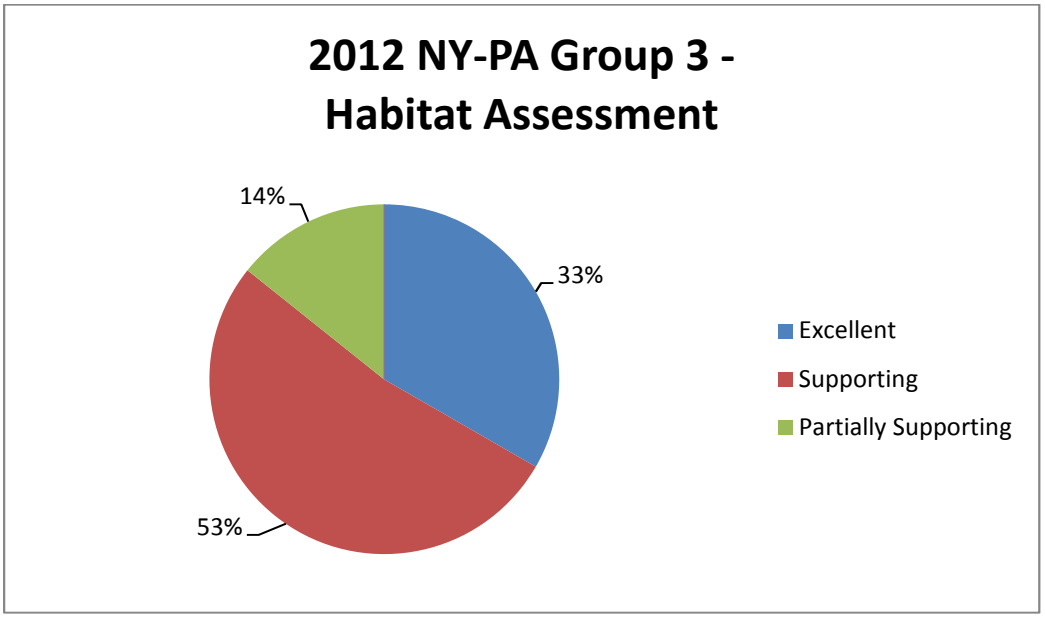


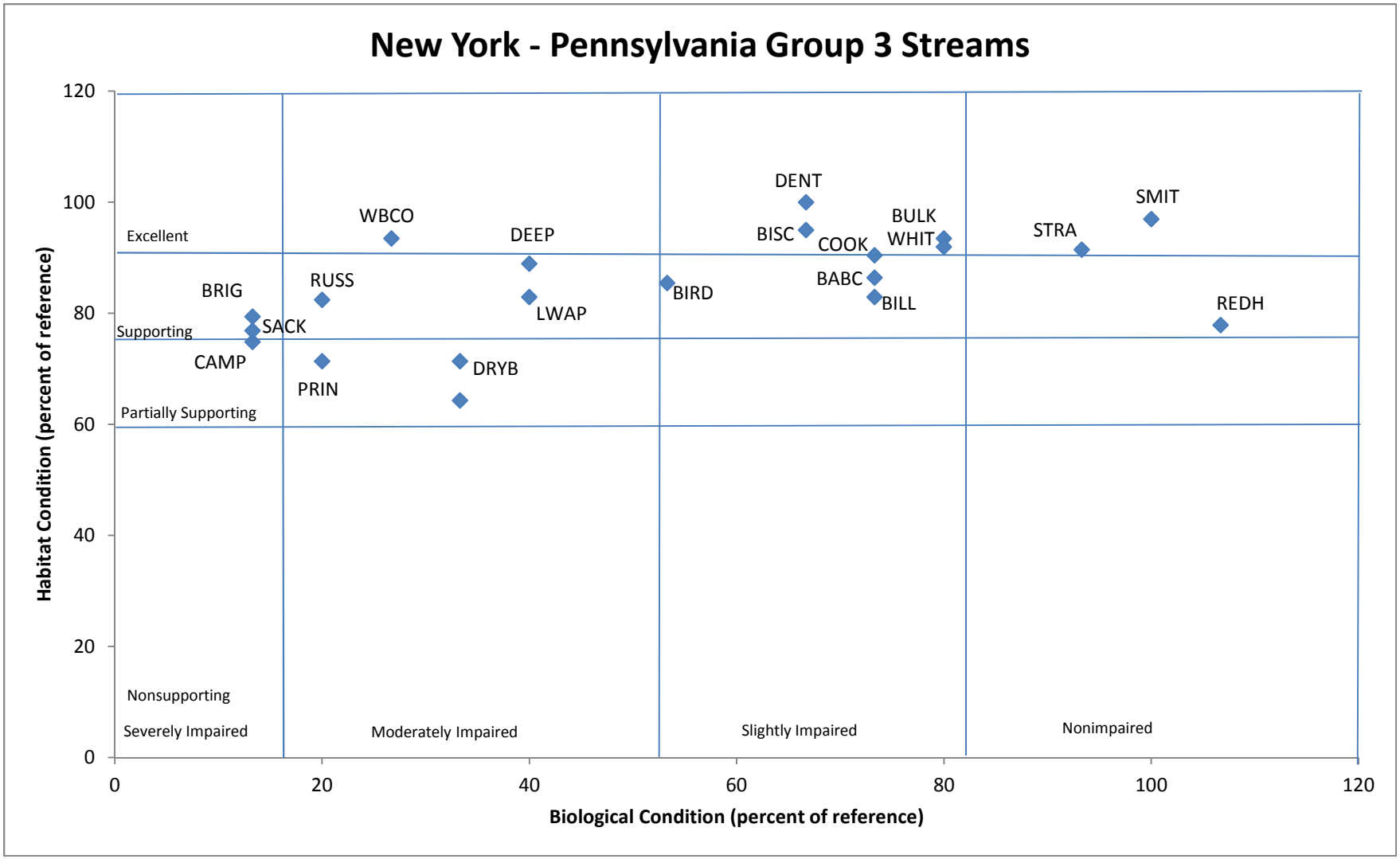

New York - Pennsylvania Group 1 & 2 Streams
Habitat Condition (percent of reference)
Biological Condition (percent of reference)
120
100
80
60
40
20
0
0
20
40
60
80
100
120
Excellent
Supporting
Partially Supporting
Nonsupporting
Severely
Moderately Impaired
Slightly
Nonimpaired
LSNK 7.6
CASC 1.6
NFCR 7.6
CHOC 9.1
SOUT 7.6
HLDN 3.5
TRUP 4.5
SNAK 2.3
CAYT 1.7
SEEL 10.3
WAPP 2.6
BNTY 0.9
TROW 1.8
APAL 6.9

Results for 2012 New York – Pennsylvania Group 3 Stream Assessments

In 2012, Smith Creek near East Lawrence, Pa. (SMIT), was designated as the reference stream to which all other Group 3 streams were compared. Smith Creek possessed excellent available physical habitat and a nonimpaired macroinvertebrate community assessment. Smith Creek has served as the Group 3 reference site in three of the five previous sampling years.

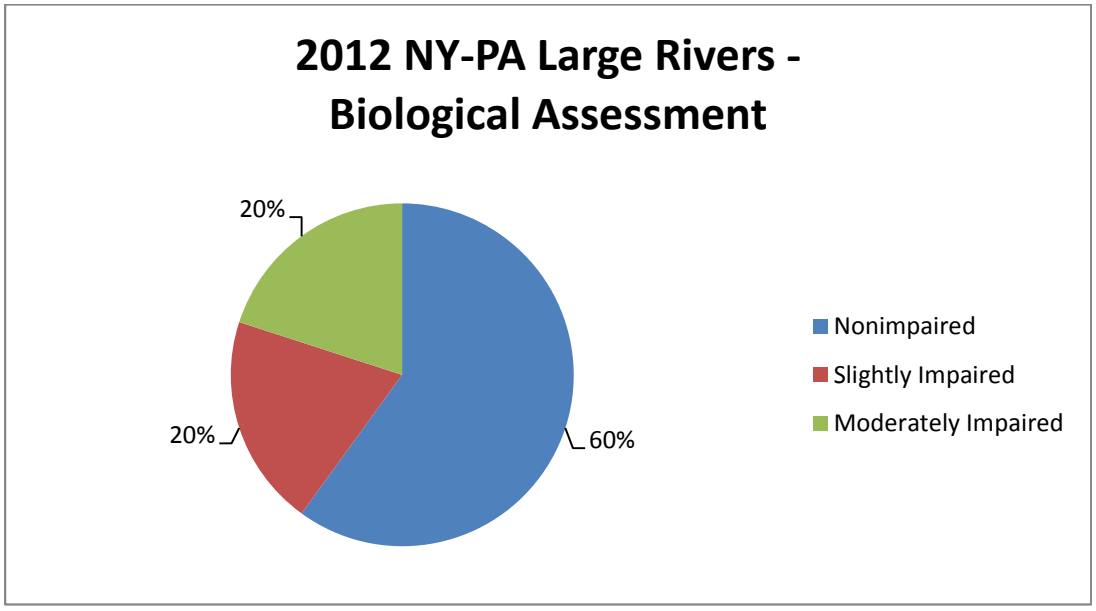


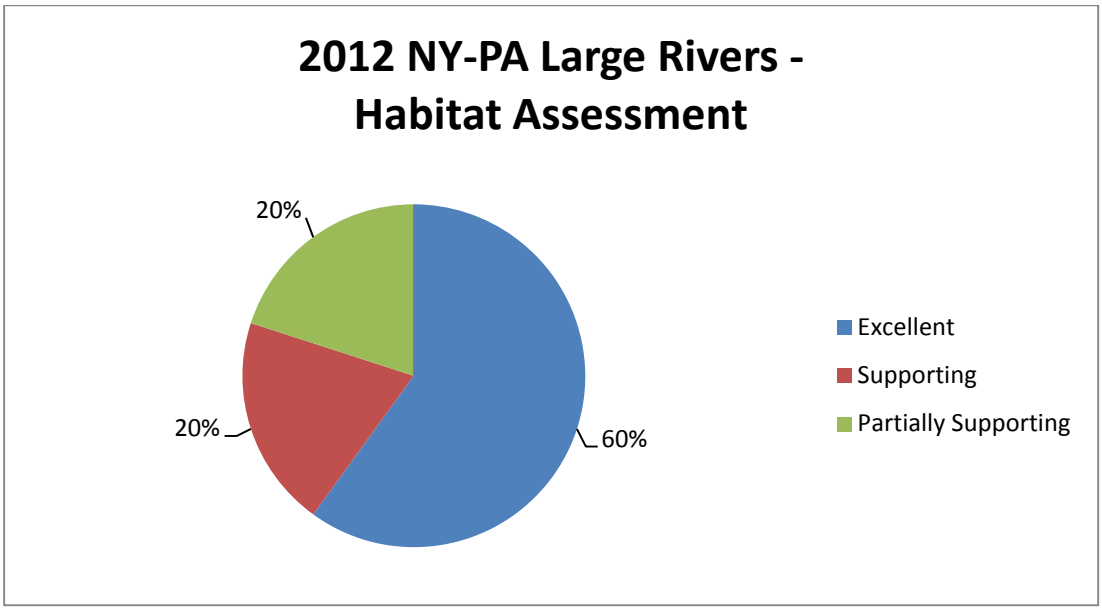


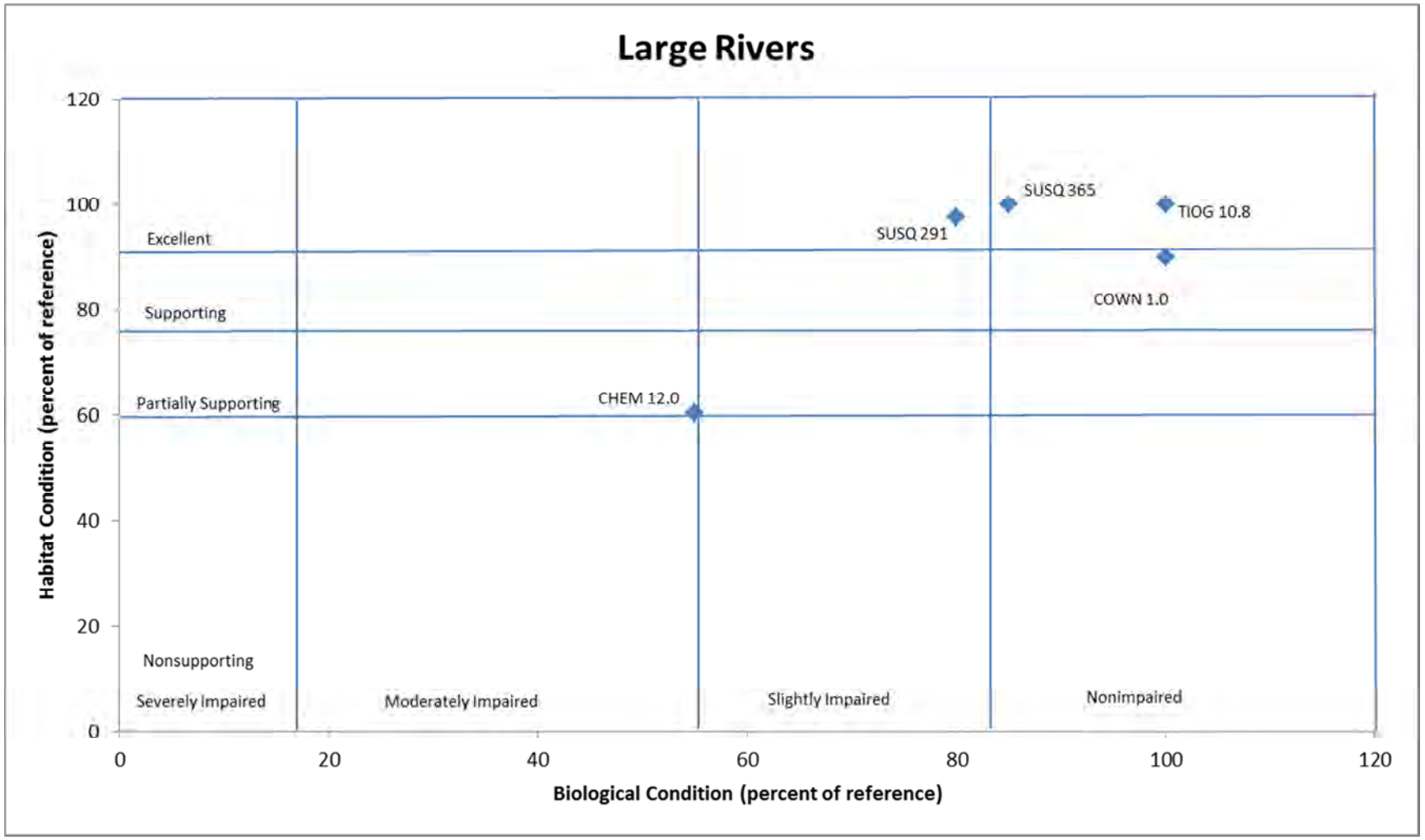

New York - Pennsylvania Group 3 Streams
Habitat Condition (percent of reference)
Biological Condition (percent of reference)
120
100
80
60
40
20
0
0
20
40
60
80
100
120
Excellent
Supporting
Partially Supporting
Nonsupporting
Severely Impaired
Moderately Impaired
Slightly Impaired
Nonimpaired
WBCO
DEEP
DENT
BISC
BULK
WHIT
COOK
SMIT
STRA
BRIG
RUSS
BIRD
BABC
BILL
LWAP
REDH
SACK
CAMP
PRIN
DRYB

Results for 2012 Large River Assessment

Sites that represent the best available combination of conditions, in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. In 2012, the Susquehanna River at Windsor, N.Y. (SUSQ 365), was designated as the reference site to which all other large river sites were compared. SUSQ 365 possessed excellent available physical habitat, a nonimpaired macroinvertebrate community, and the lowest overall water quality index score within the large river grouping.






Large Rivers
Habitat Condition (percent of reference)
Biological Condition (percent of reference)
120
100
80
60
40
20
0
0
20
40
60
80
100
120
Excellent
Supporting
Partially Supporting
Nonsupporting
Severely Impaired
Moderately Impaired
Slightly Impaired
Nonimpaired
SUSQ 365
TIOG 10.8
SUSQ 291
COWN 1.0
CHEM 12.0

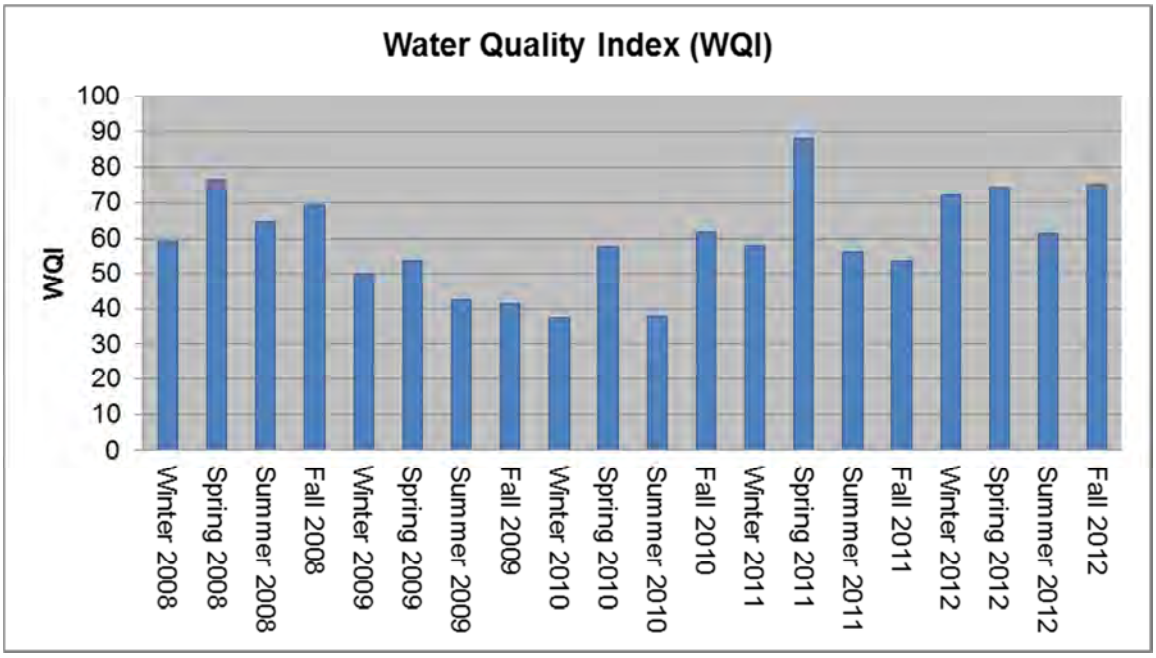
Site Results for NY-PA Large River Interstate Sites

Chemung River at Chemung, N.Y. (CHEM 12.0)

Group 1

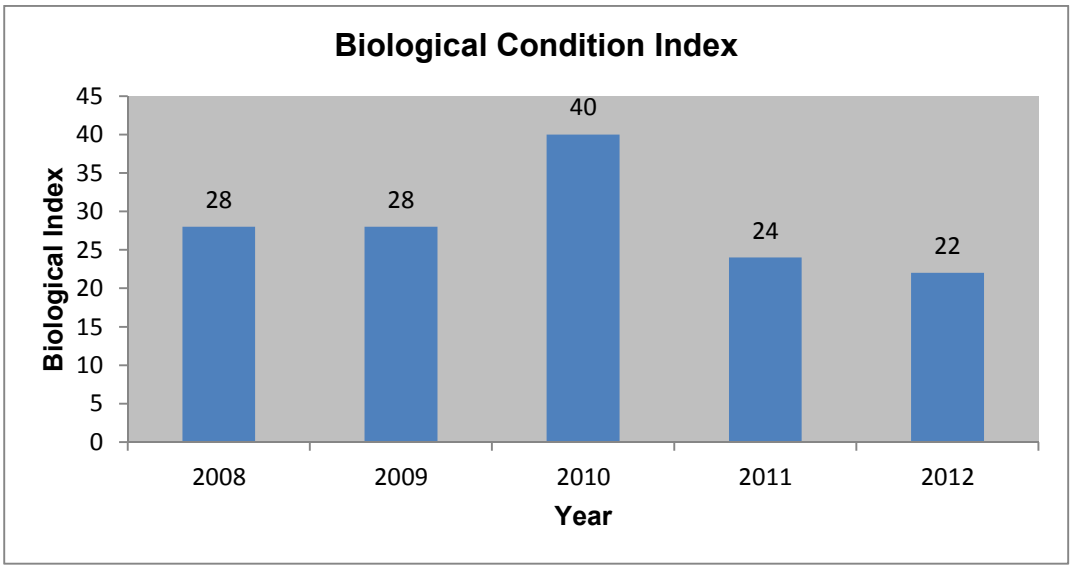
Habitat Condition: Physical habitat was rated as partially supporting at CHEM 12.0 in 2012. Scoring 102 out of a possible 220, CHEM 12.0 received the lowest habitat assessment score of all large river sites in 2012.

Water Quality: Total aluminum concentrations were found to be above the New York state water quality standard of 100 µg/L, on three of four site visits during the sampling year. A total iron reading of 310 µg/L exceeded the state threshold of 300 µg/L, when the river was sampled in November 2012.



Biological Condition: CHEM 12.0 received a biological condition rating of moderately impaired when sampled in 2012.

Biological Condition		
Year	Score	Rating
2008	28	Nonimpaired
2009	28	Slightly Impaired
2010	40	Nonimpaired
2011	24	Slightly Impaired
2012	22	Moderately Impaired

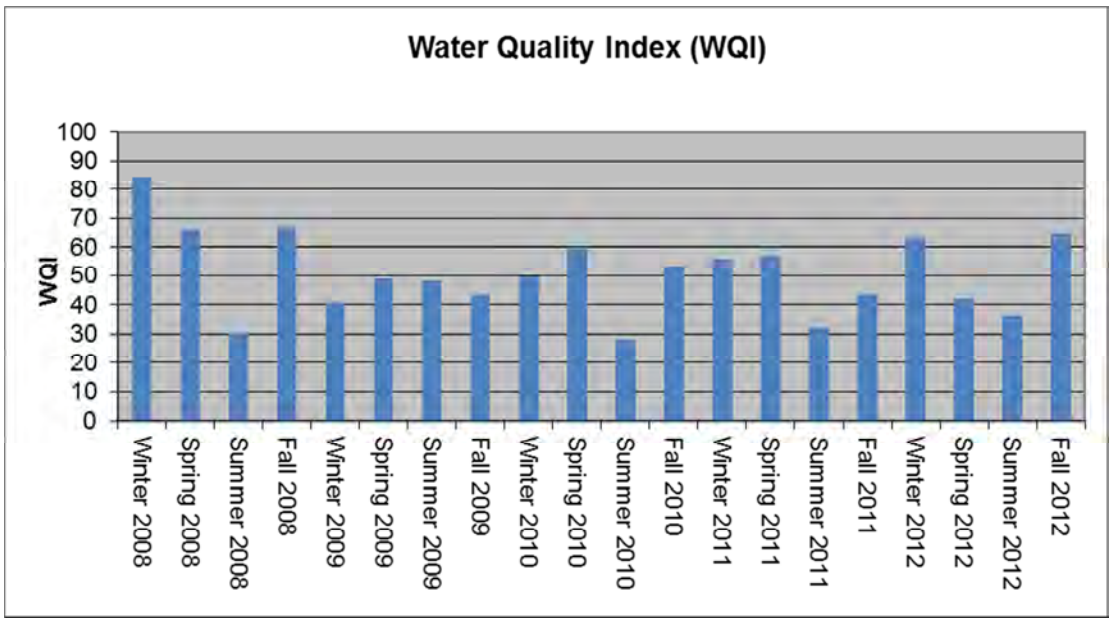


Cowanesque River at Lawrenceville, Pa. (COWN 1.0)

Group 1

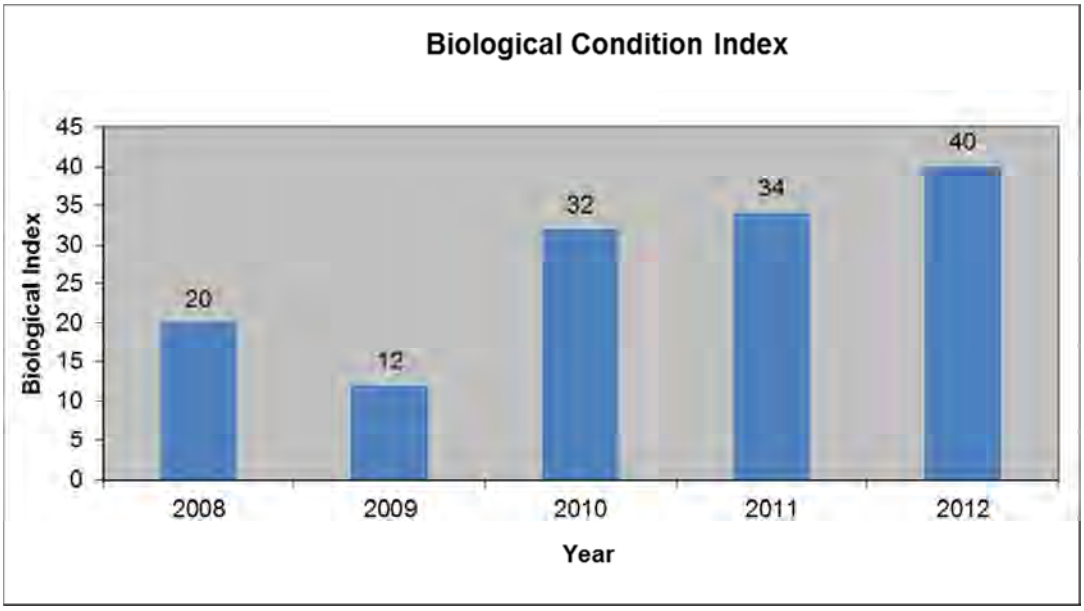
Habitat Condition: Scoring 152 out of a possible 220, physical habitat was classified as supporting at COWN 1.0. Increased commercial development along the right bank decreased the habitat score for this site.

Water Quality: Total iron concentrations of 340 µg/L and 460 µg/L were recorded in winter and fall, respectively. Total aluminum concentrations were found to be 220 µg/L and 260 µg/L during the same monitoring periods. These readings were in excess of New York state water quality standards, which limit total iron to 300 µg/L and total aluminum to 100 µg/L.



Biological Condition: COWN 1.0 received a biological condition rating of nonimpaired when sampled in 2012.

Biological Condition		
Year	Score	Rating
2008	20	Slightly Impaired
2009	12	Moderately Impaired
2010	32	Nonimpaired
2011	34	Nonimpaired
2012	40	Nonimpaired

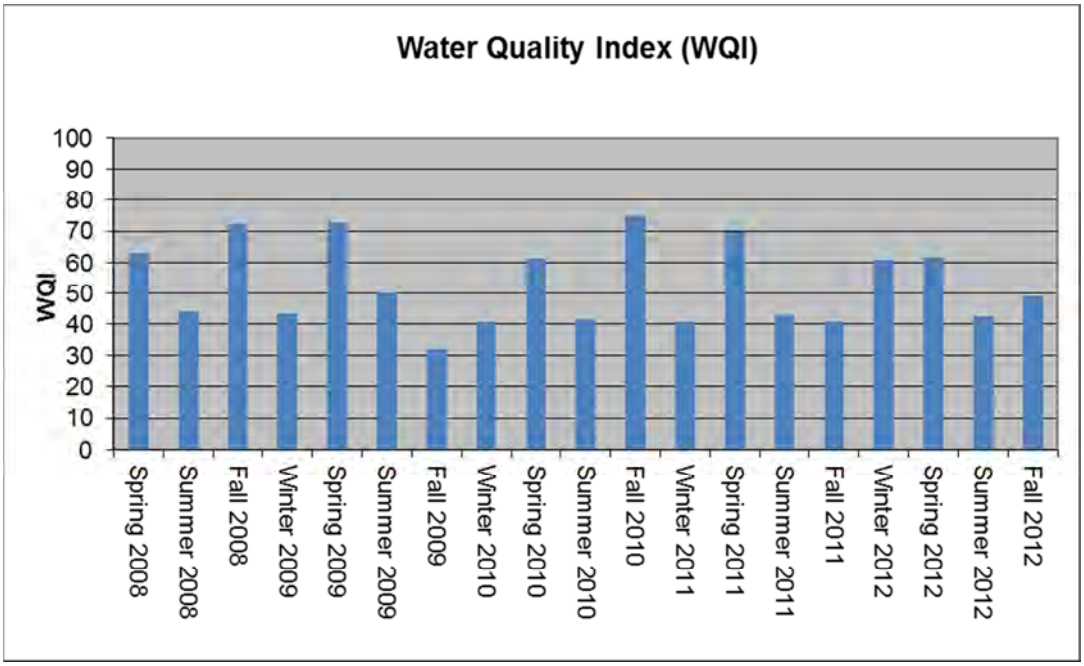


Susquehanna River at Sayre, Pa. (SUSQ 289.1)

Group 1

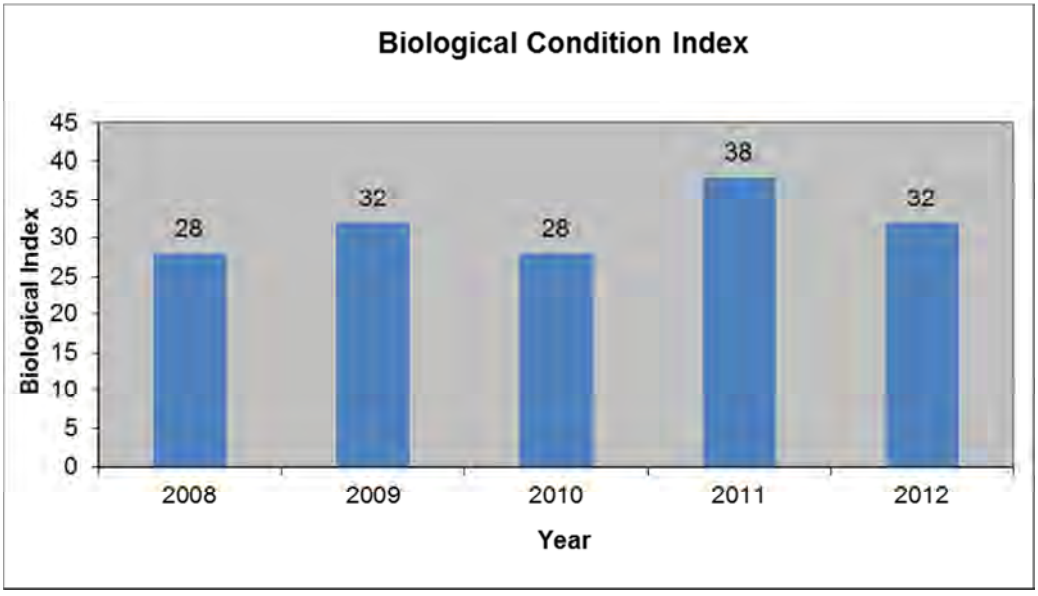
Habitat Condition: Available physical habitat was classified as excellent in 2012. SUSQ 289.1 scored 165 out of a possible 220.

Water Quality: Total aluminum concentrations exceeding the New York state threshold of 100 µg/L were found during the spring, summer, and fall sampling periods. Reported concentrations during these periods were: 230 µg/L in June, 190 µg/L in August and 110 µg/L in November 2012.



Biological Condition: The biological community at SUSQ 289.1 was classified as slightly impaired in 2012.

Biological Condition		
Year	Score	Rating
2008	28	Nonimpaired
2009	32	Nonimpaired
2010	28	Slightly Impaired
2011	38	Nonimpaired
2012	32	Slightly Impaired

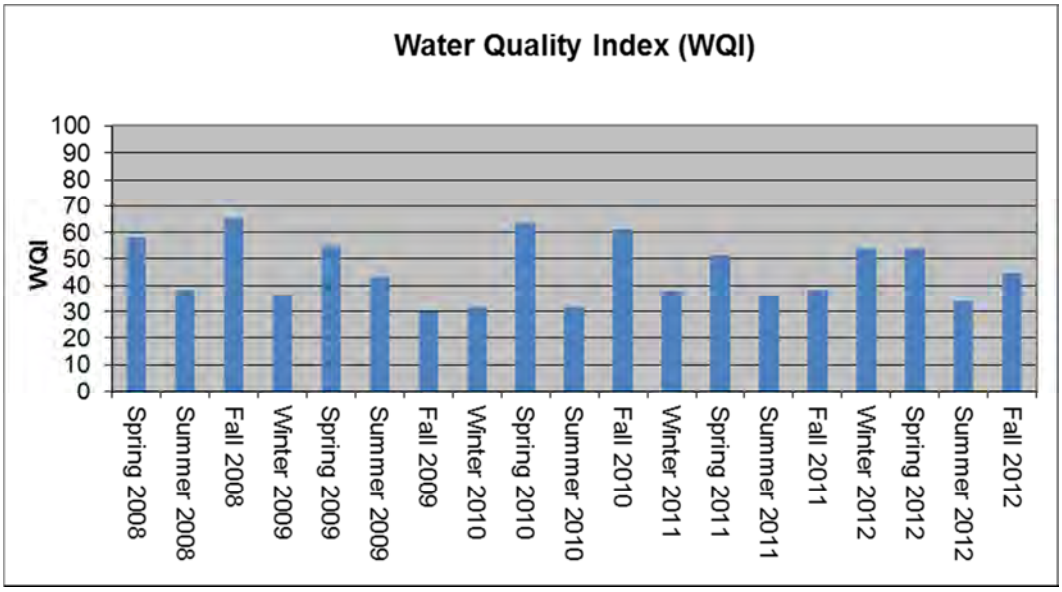


Susquehanna River at Windsor, N.Y. (SUSQ 365.0)

Group 1

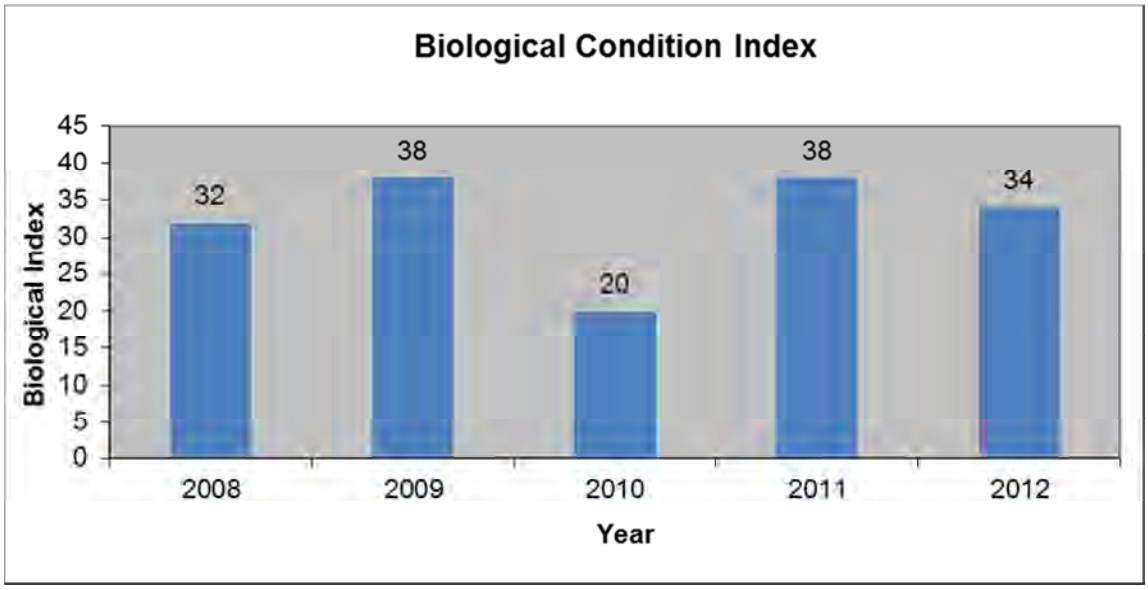
Habitat Condition: Scoring 169 out of a possible 220, physical habitat conditions were considered excellent in 2012. SUSQ 365.0 served as the reference station to which all other large river sites were compared to in 2012.

Water Quality: Measured in June and August, total aluminum concentrations were determined to be 280 µg/L and 190 µg/L, respectively. Collected in concert, total iron levels were also measured to be 520 µg/L and 440 µg/L



Biological Condition: The biological community at SUSQ 365.0 was classified as nonimpaired in 2012.

Biological Condition		
Year	Score	Rating
2008	32	Nonimpaired
2009	38	Nonimpaired
2010	20	Slightly Impaired
2011	38	Nonimpaired
2012	34	Nonimpaired

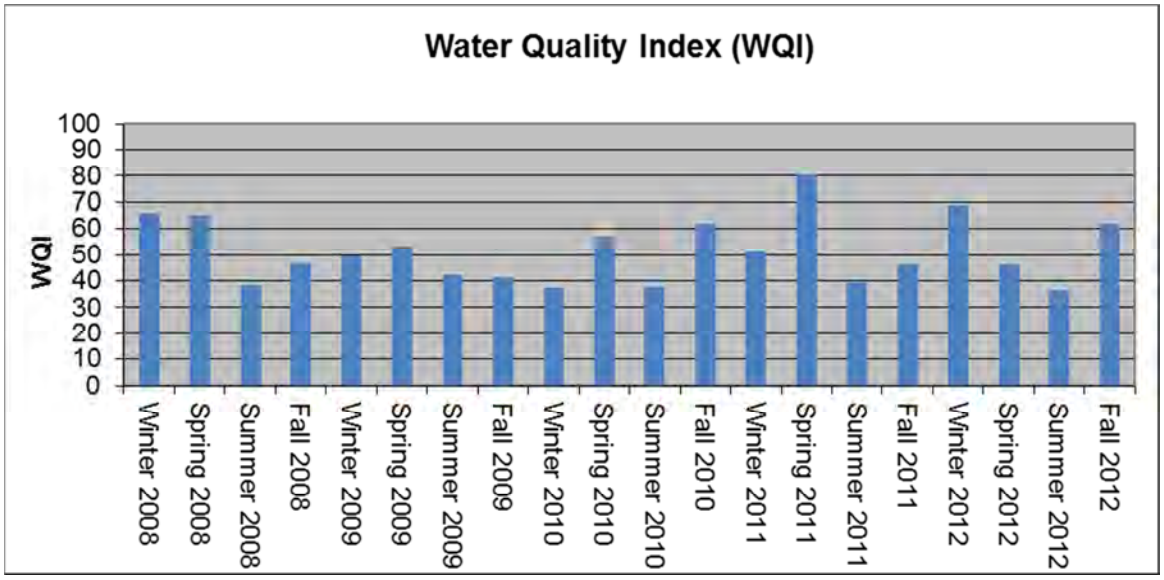


Tioga River at Lindley, Pa. (TIOG 10.8)

Group 1

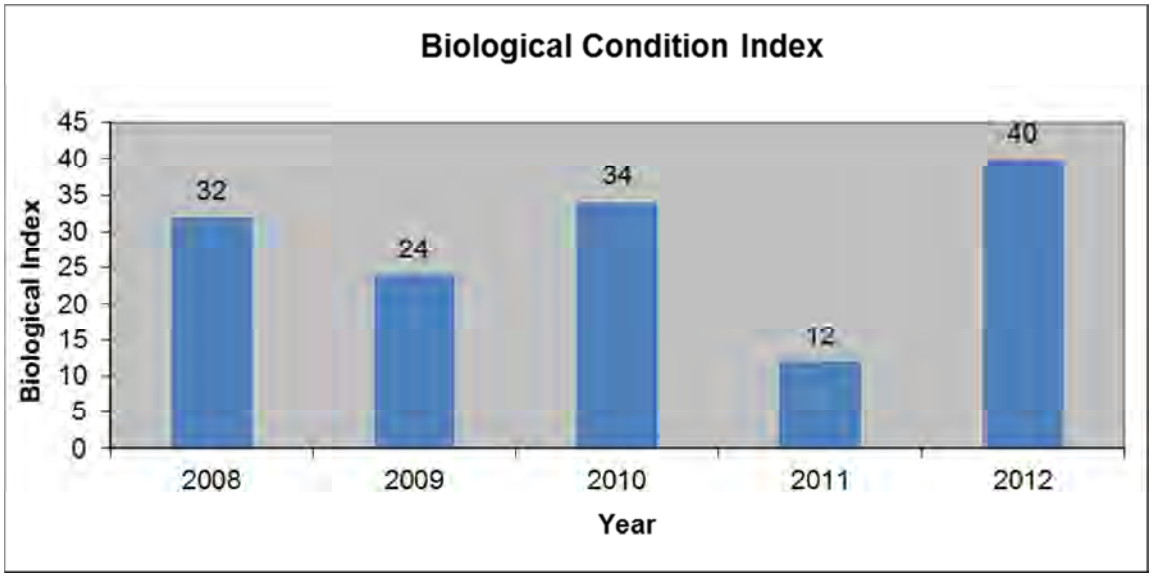
Habitat Condition: Scoring 169 out of a possible 220, TIOG 10.8 possessed a habitat condition rating of excellent when assessed in 2012.

Water Quality: Total aluminum and total iron concentrations exceeded water quality standards when measured 2012. Aluminum concentrations of 190 µg/L in February and 230 µg/L in November exceeded the New York water quality standard of 100 µg/L. Total iron concentrations of 320 µg/L and 450 µg/L exceed the New York standard of 300 µg/L.



Biological Condition: The biological condition of TIOG 10.8 was determined to be nonimpaired, marking a return to conditions observed in 2008 and 2010.

Biological Condition		
Year	Score	Rating
2008	32	Nonimpaired
2009	24	Slightly Impaired
2010	34	Nonimpaired
2011	12	Moderately Impaired
2012	40	Nonimpaired



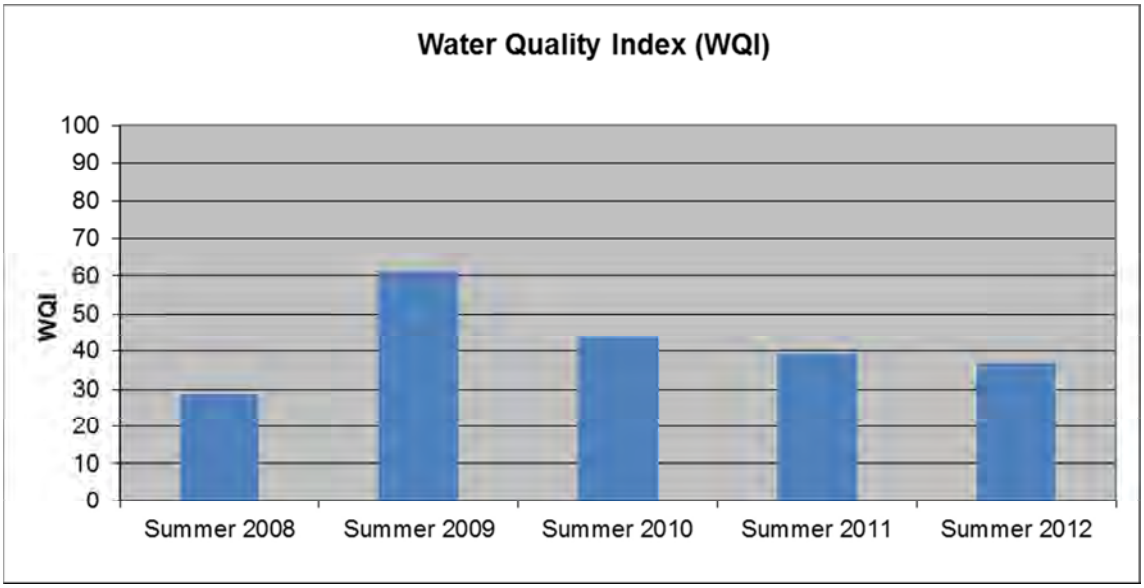
Site Results for NY-PA Group 1 and 2 Streams

Apalachin Creek at Little Meadows, Pa. (APAL 6.9)

Group 2

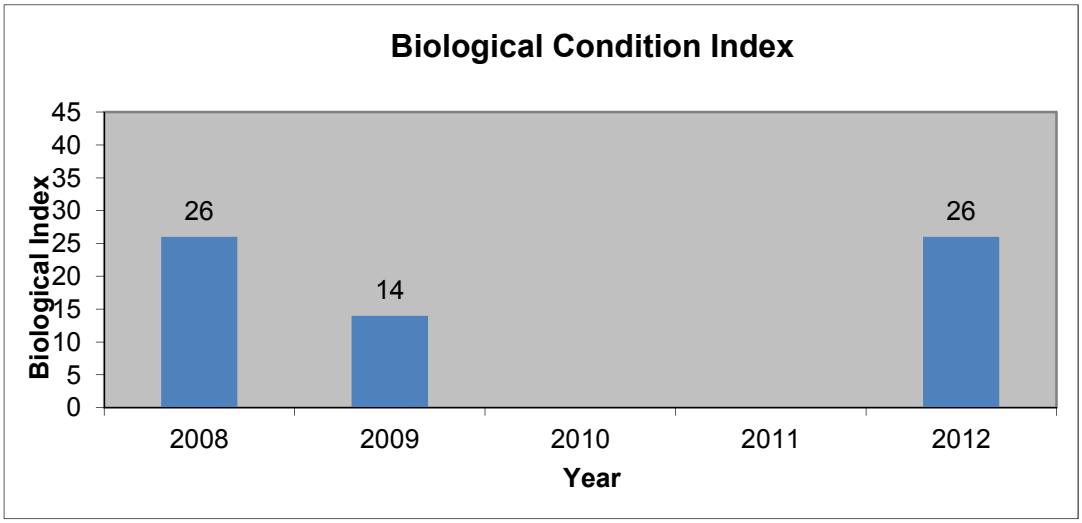
Habitat Condition: Physical habitat at APAL 6.9 received a nonsupporting classification, scoring only 64 out of a possible 220 points. Major channel alteration was noted, with the original stream channel being diverted to the west, away from nearby homes. Significant habitat disruption was evident at this site.

Water Quality: Total aluminum and total iron levels were determined to be outside of accepted limits when measured in 2012. A water sample collected in August revealed an aluminum concentration of 255 µg/L and a total iron reading of 625 µg/L. New York state maintains a water quality standard of 100 µg/L for total aluminum and 300 µg/L for total iron concentrations.



Biological Condition: APAL 6.9 received a biological condition rating of slightly impaired despite ongoing stream channel modifications.

Biological Condition		
Year	Score	Rating
2008	26	Slightly Impaired
2009	14	Moderately Impaired
2010	NA	NA
2011	NA	NA
2012	26	Slightly Impaired

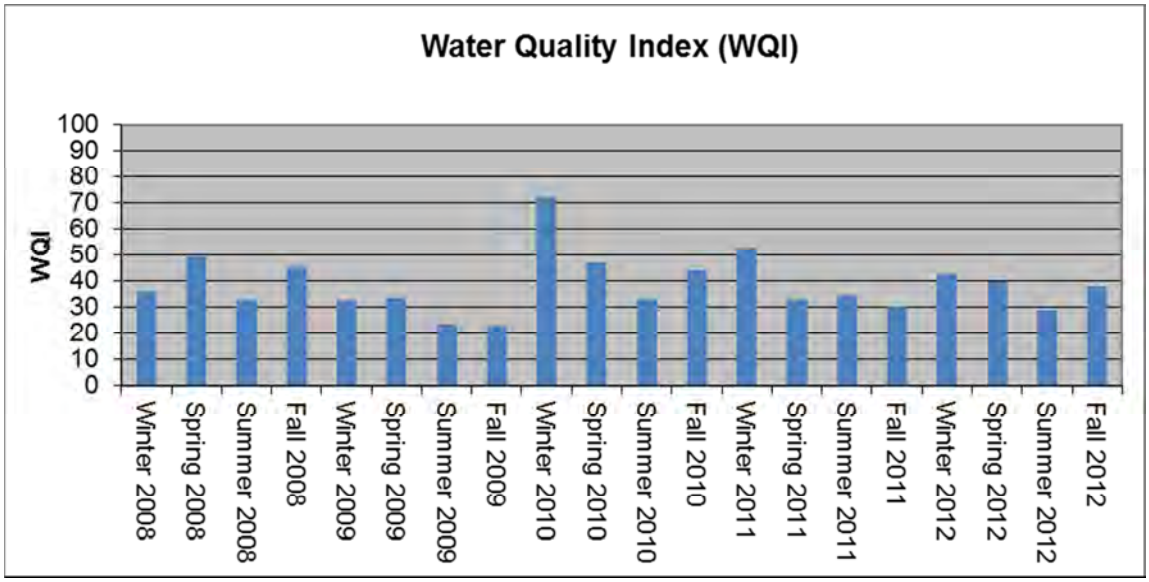


Bentley Creek at Wellsburg, N.Y. (BNTY 0.9)

Group 1

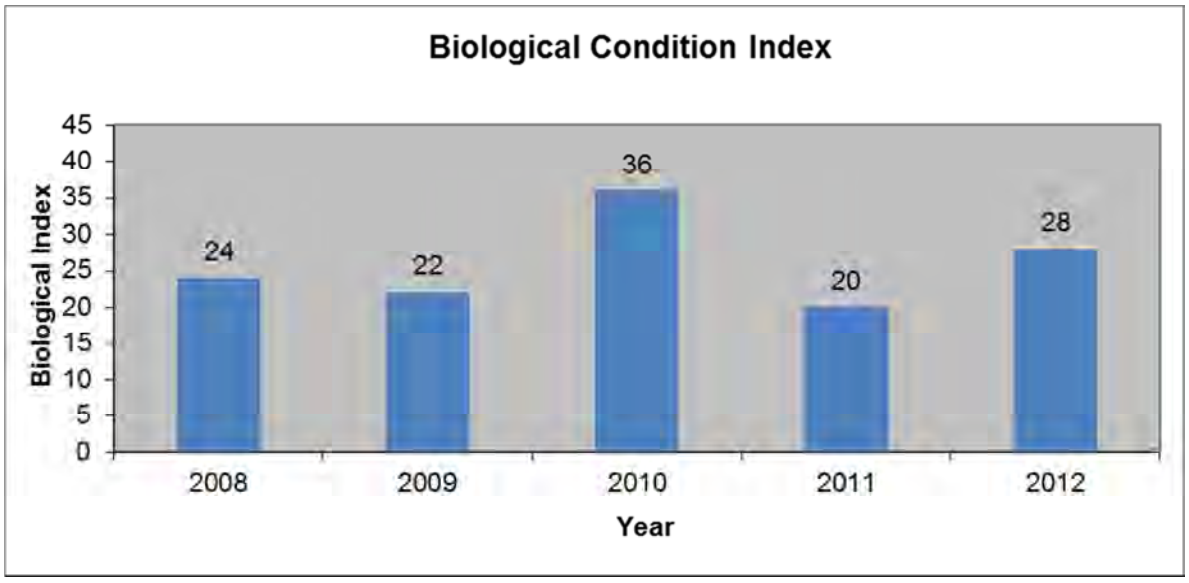
Habitat Condition: BNTY 0.9 received a habitat condition rating of partially supporting. Staff noted stream channel modifications occurring during the summer monitoring period. Channel grading and excavation was occurring immediately downstream on the sampling location.

Water Quality: All measured water quality parameters were within accepted limits when tested in 2012.



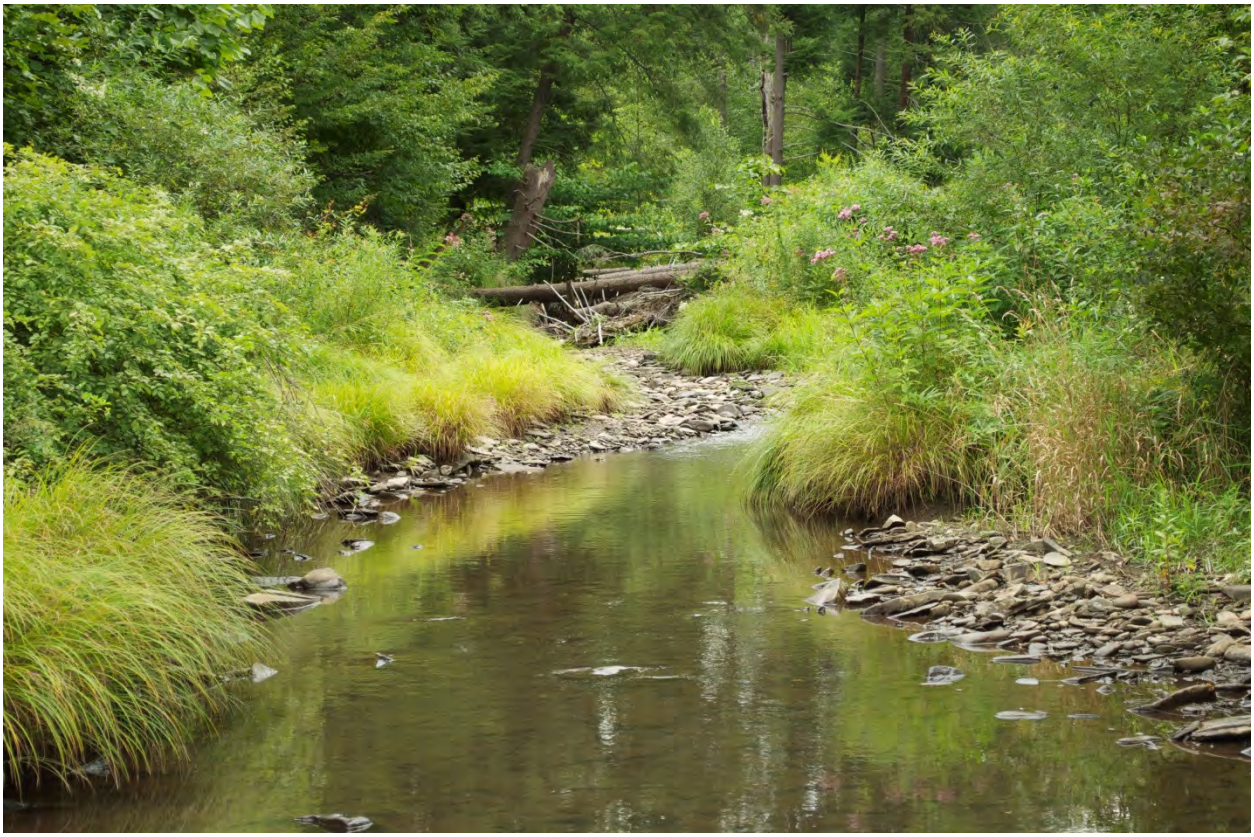
Biological Condition: BNTY 0.9 received a biological condition rating of slightly impaired despite ongoing stream channel modifications and disturbances.

Biological Condition		
Year	Score	Rating
2008	24	Slightly Impaired
2009	22	Slightly Impaired
2010	36	Nonimpaired
2011	20	Slightly Impaired
2012	28	Slightly Impaired



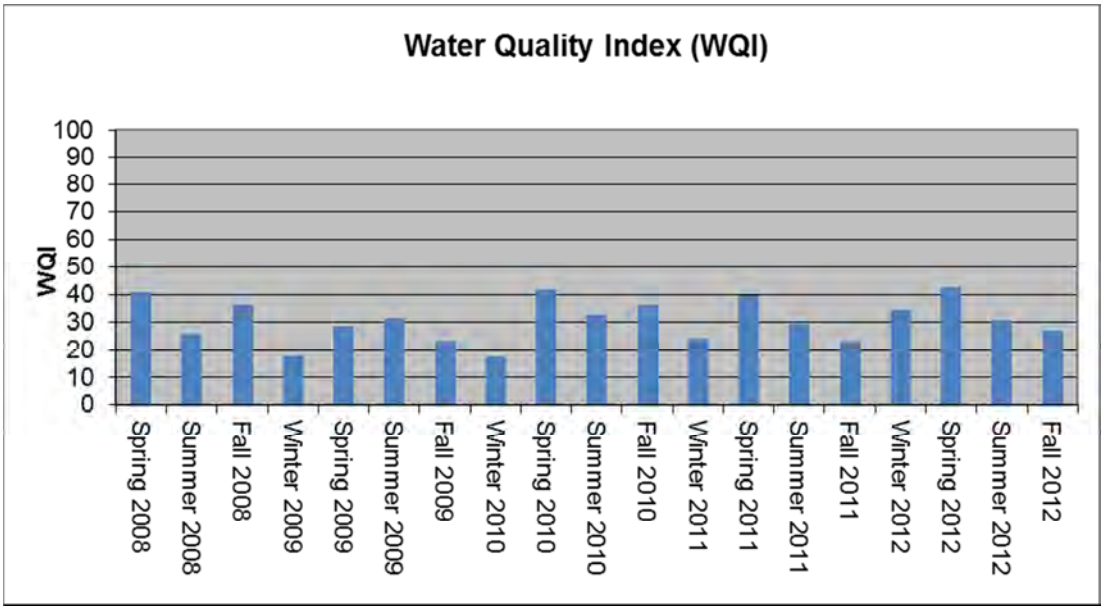
Cascade Creek at Lanesboro, Pa. (CASC 1.6)

Group 1



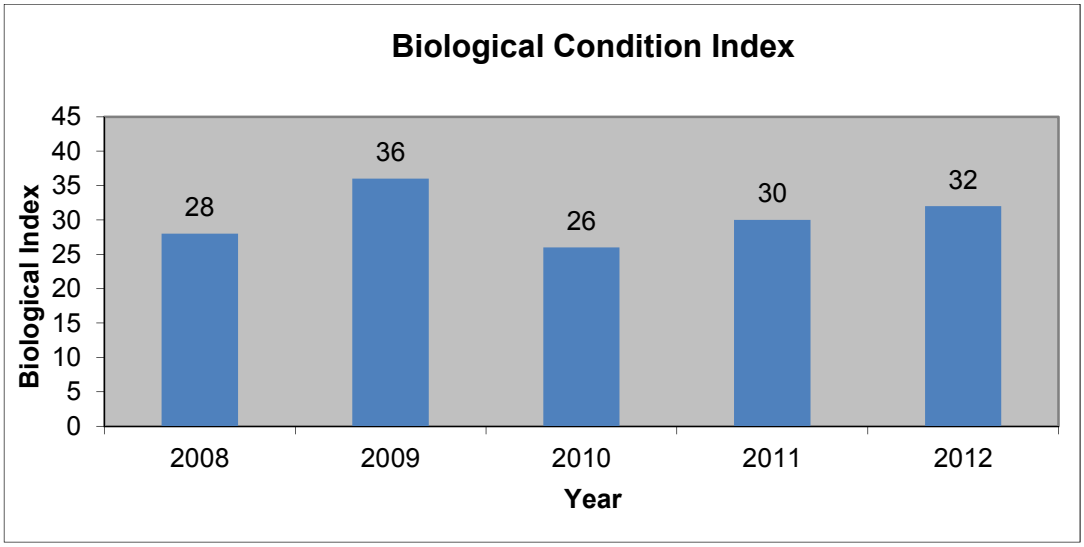
Habitat Condition: Available physical habitat was classified as excellent in 2012. CASC 1.6 possessed optimal amounts of instream cover and frequent riffles, and all velocity/depth regimes were present. The station continually rates among the best streams within the project in terms of biology, water quality, and habitat conditions.

Water Quality: Total iron, total aluminum, and alkalinity levels were outside of state thresholds when measured in 2012. Alkalinity levels of 7 mg/L and 10 mg/L were reported in February and November, respectively. Total iron concentrations of 510 µg/L and 630 µg/L were recorded in May and August, respectively. A total aluminum concentration of 120 µg/L, exceeding the 100 µg/L New York state standard, was observed in November.



Biological Condition: CASC 1.6 received a nonimpaired macroinvertebrate community designation in 2012. The biological community possessed good overall diversity and a large contribution of sensitive EPT taxa.

Biological Condition		
Year	Score	Rating
2008	28	Slightly Impaired
2009	36	Nonimpaired
2010	26	Slightly Impaired
2011	30	Nonimpaired
2012	32	Nonimpaired

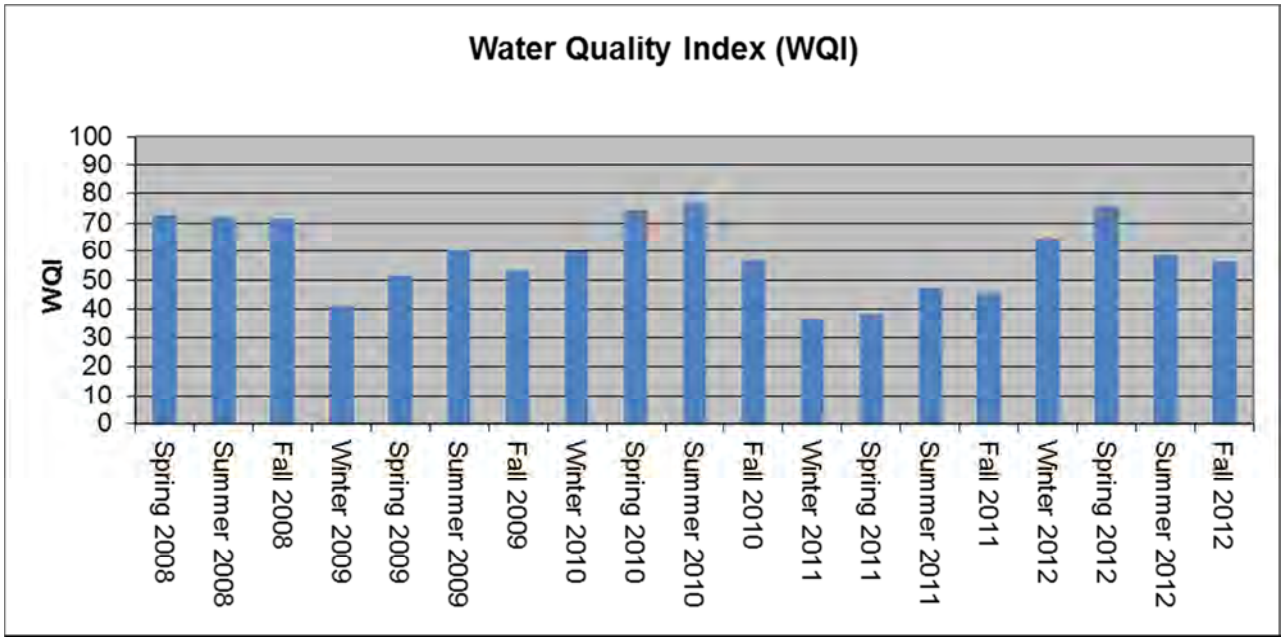


Cayuta Creek at Waverly, N.Y. (CAYT 1.7)

Group 1

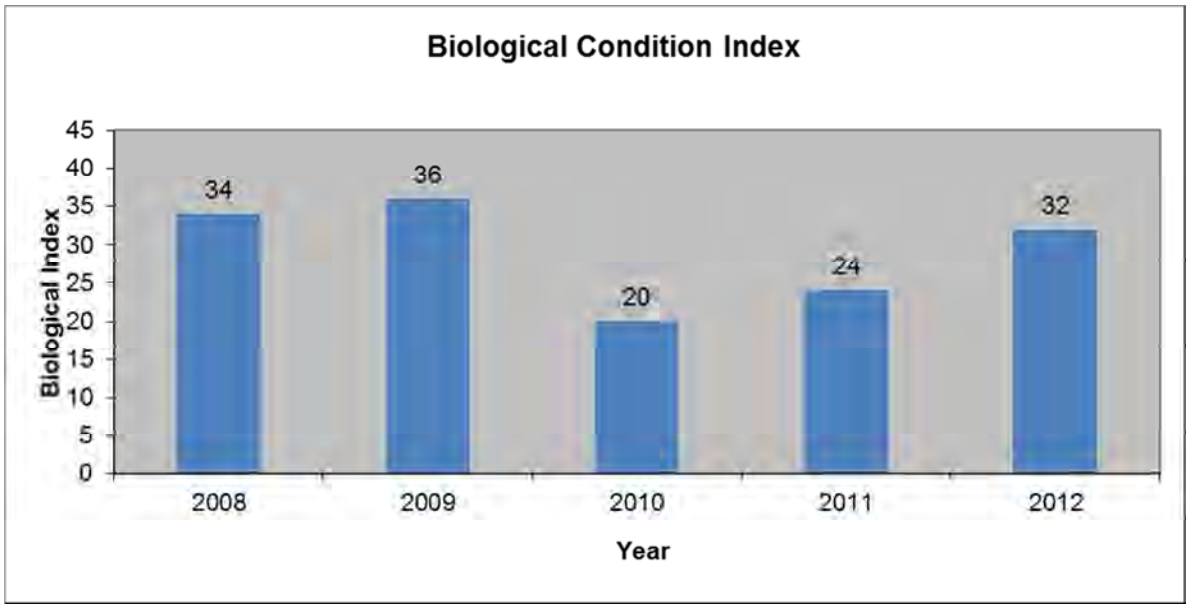
Habitat Condition: Scoring 160 out of a possible 220, the habitat at CAYT 1.7 was rated as supporting in 2012. Staff noted marginal protective cover and bank conditions at the sampling site.

Water Quality: All measured parameters were within water quality standards; however, CAYT 1.7 possessed the highest average water quality index value of all Group 1 and 2 streams assessed in 2012.



Biological Condition: The macroinvertebrate community was classified as nonimpaired when sampled in August 2012.

Biological Condition		
Year	Score	Rating
2008	34	Nonimpaired
2009	36	Nonimpaired
2010	20	Slightly Impaired
2011	24	Slightly Impaired
2012	32	Nonimpaired

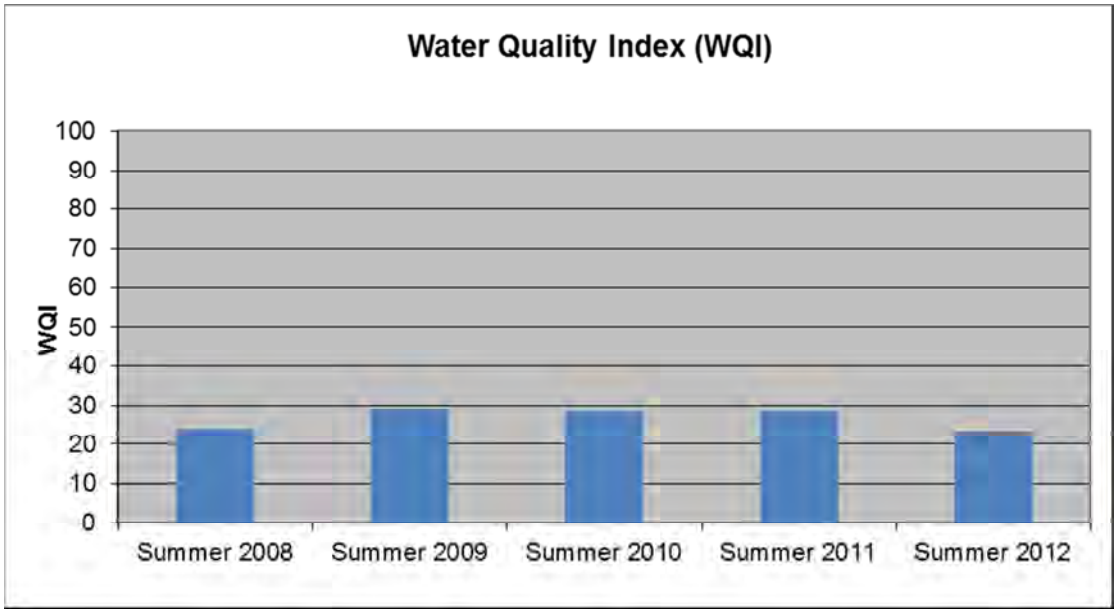


Choconut Creek at Vestal Center, N.Y. (CHOC 9.1)

Group 2

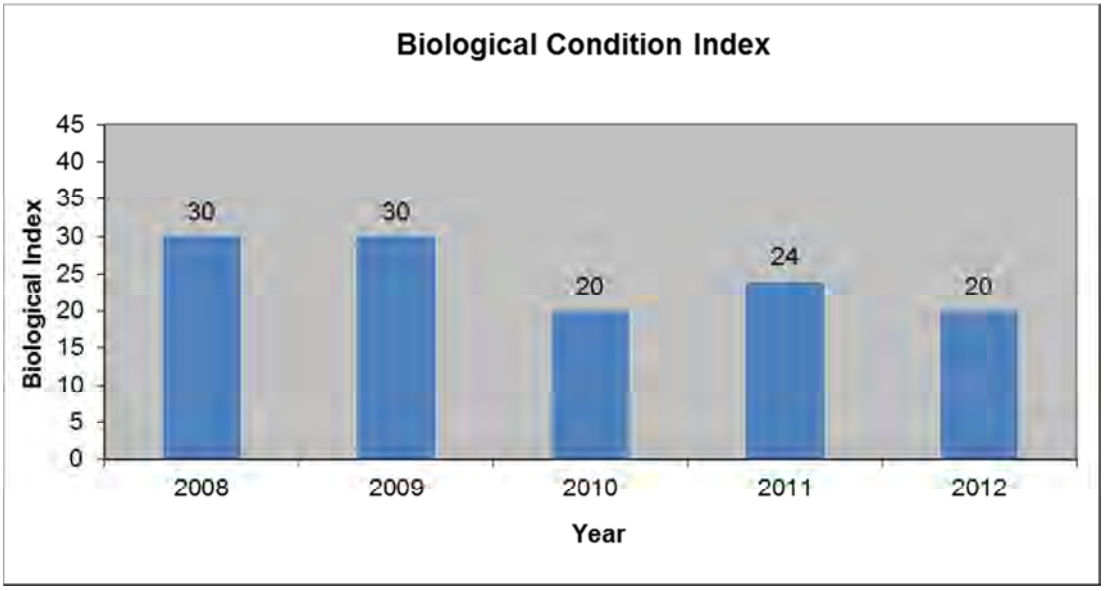
Habitat Condition: Physical habitat was rated as excellent when assessed in 2012. The site scored 181 out of 220 possible points.

Water Quality: All measured water quality parameters were within accepted limits when tested in 2012. CHOC 9.1 possessed the best water quality index score of all Group 2 streams monitored in 2012.



Biological Condition: CHOC 9.1 received a biological condition classification of slightly impaired for the sixth consecutive year.

Biological Condition		
Year	Score	Rating
2008	30	Slightly Impaired
2009	30	Slightly Impaired
2010	20	Slightly Impaired
2011	24	Slightly Impaired
2012	20	Slightly Impaired

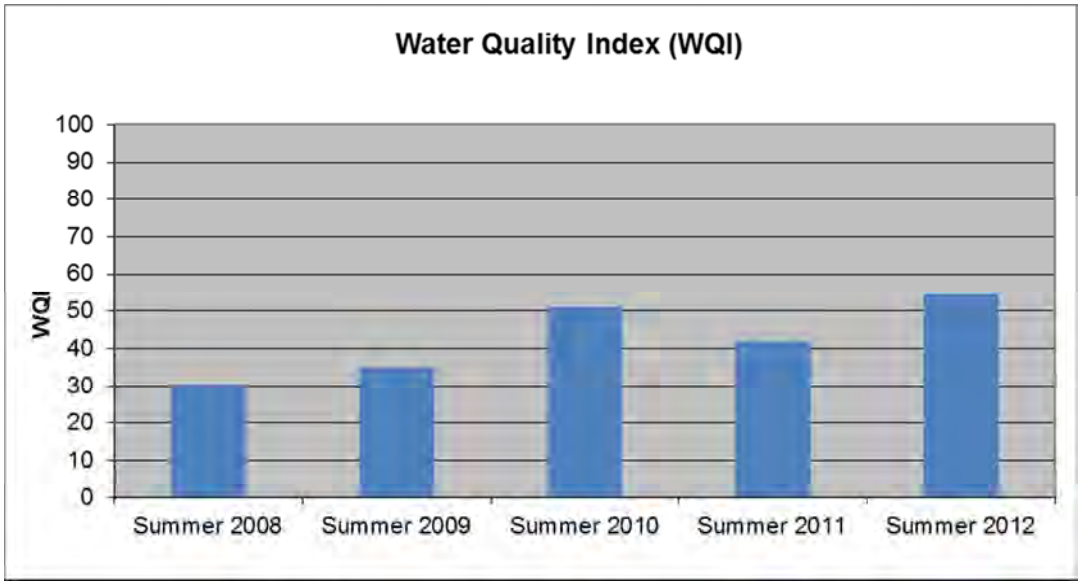


Holden Creek at Woodhull, N.Y. (HLDN 3.5)

Group 2

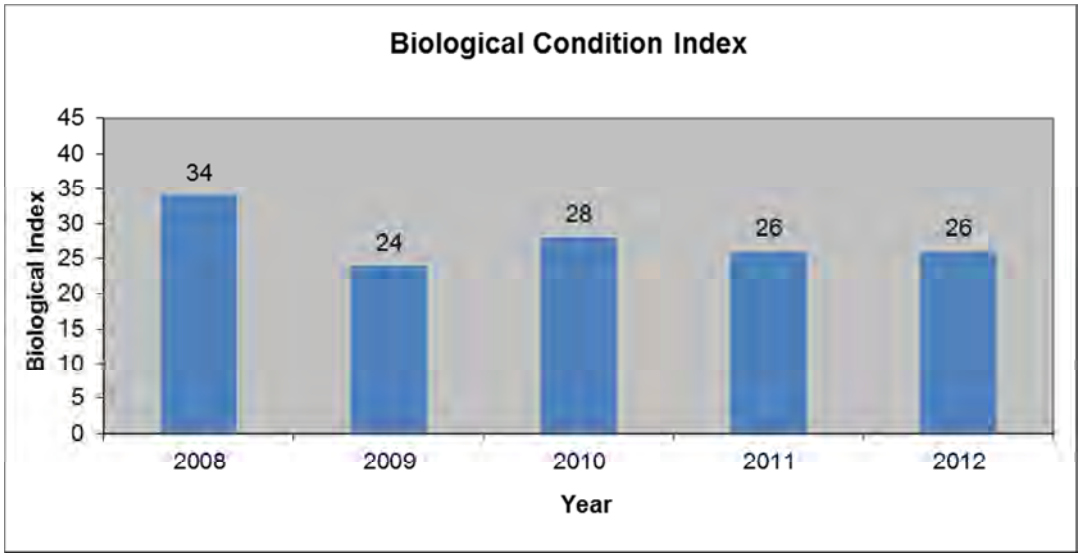
Habitat Condition: Scoring 165 out of 220 possible points, HLDN 3.5 received a supporting habitat designation. SRBC staff noted suboptimal levels of sediment deposition and a lack of instream cover.

Water Quality: All measured water quality parameters were within acceptable limits when tested in 2012.



Biological Condition: The macroinvertebrate community was assessed as being slightly impaired when sampled in 2012.

Biological Condition		
Year	Score	Rating
2008	34	Nonimpaired
2009	24	Slightly Impaired
2010	28	Slightly Impaired
2011	26	Nonimpaired
2012	26	Slightly Impaired

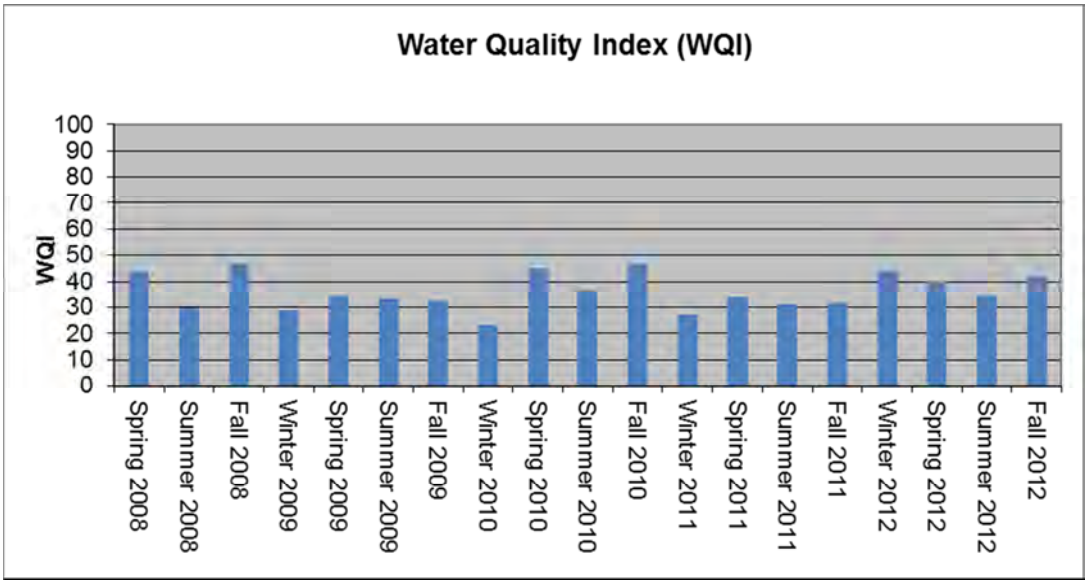


Little Snake Creek at Brackney, Pa. (LSNK 7.6)

Group 1

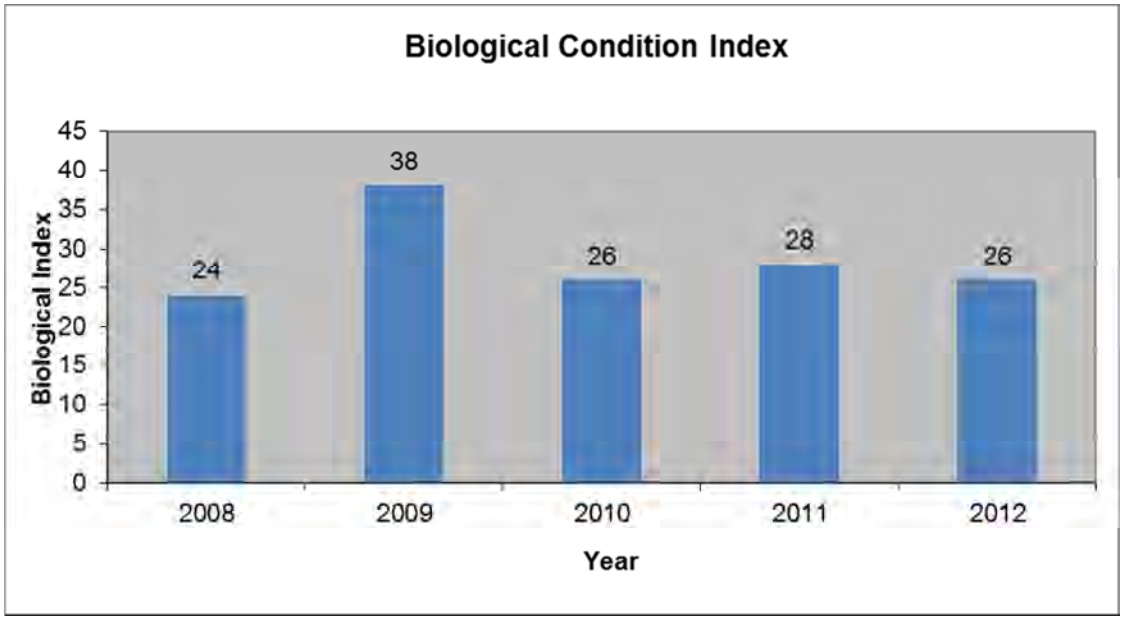
Habitat Condition: Available physical habitat was rated as excellent in 2012. The station received a score of 197 out of 220, tying CASC 1.6 for the second highest Group 1 and 2 habitat score analyzed in this monitoring year.

Water Quality: Total iron and total aluminum concentrations were outside of accepted limits when tested in 2012. Water quality standard violations were reported as follows: total aluminum 180 µg/L in August, 250 µg/L in November; total iron: 340 µg/L in May, 730 µg/L in August and 560 µg/L in November.



Biological Condition: Little Snake Creek received a biological condition rating of slightly impaired in 2012.

Biological Condition		
Year	Score	Rating
2008	24	Slightly Impaired
2009	38	Nonimpaired
2010	26	Slightly Impaired
2011	28	Nonimpaired
2012	26	Slightly Impaired

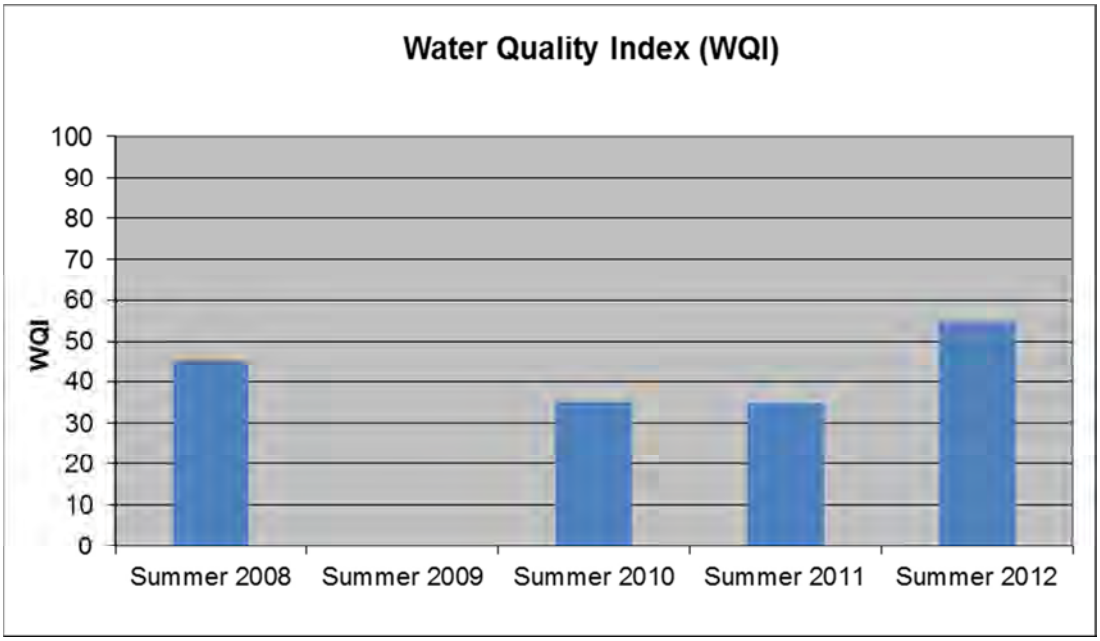


North Fork Cowanesque River at North Fork, Pa. (NFCR 7.6)

Group 2

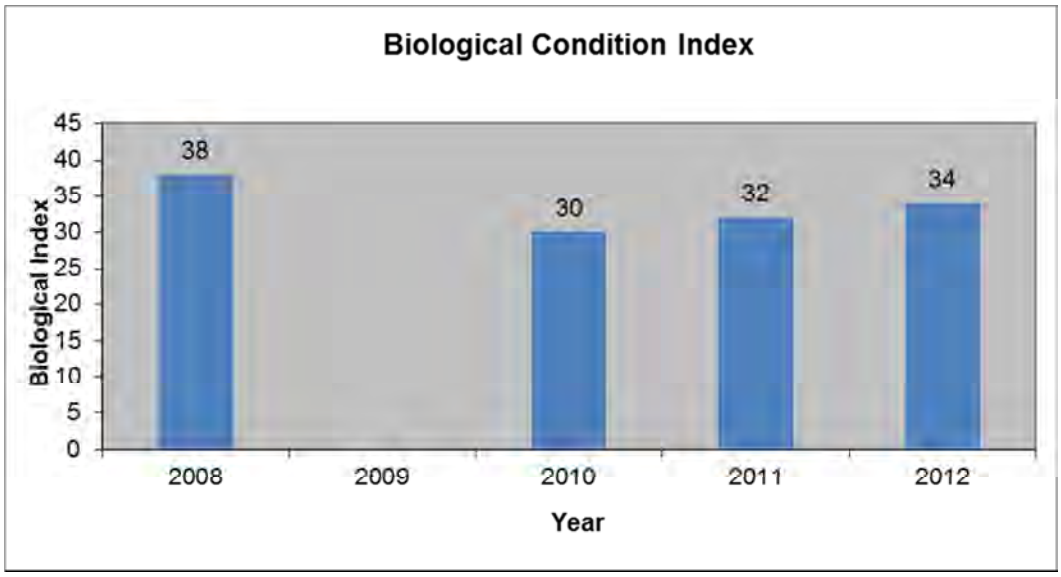
Habitat Condition: NFCR 7.6 received the highest habitat score of all Group 1 and 2 streams assessed in 2012. Overall conditions were deemed excellent.

Water Quality: Total aluminum was measured to be 150 µg/L, exceeding the New York state threshold of 100 µg/L.



Biological Condition: Receiving a designation of excellent, NFCR 7.6 served as the reference stream to which all other Group 1 and 2 streams were compared.

Biological Condition		
Year	Score	Rating
2008	38	Nonimpaired
2009		NA
2010	30	Nonimpaired
2011	32	Nonimpaired
2012	34	Nonimpaired

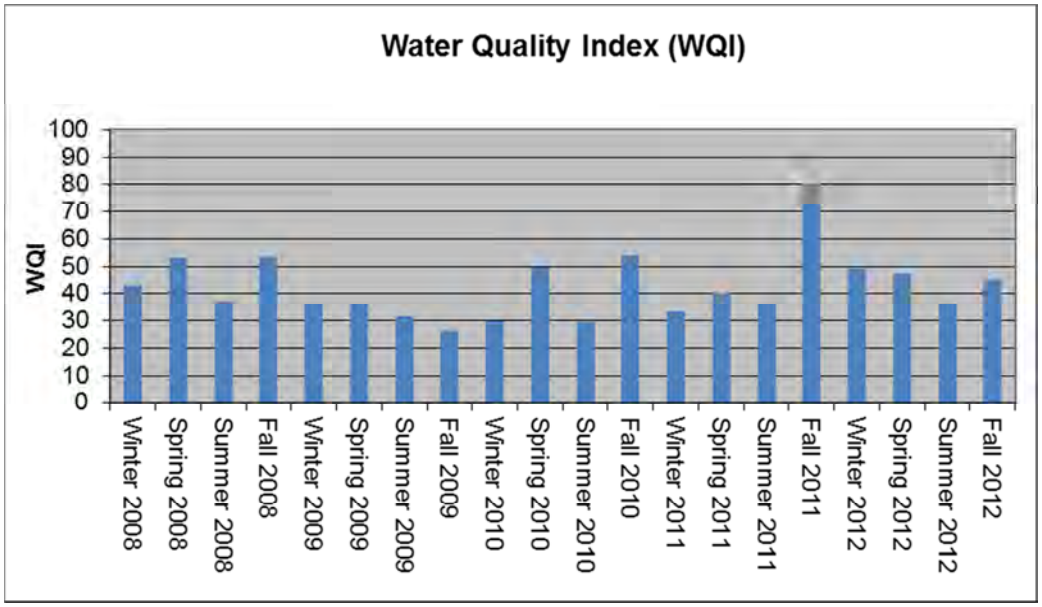


Seeley Creek at Seeley Creek, N.Y. (SEEL 10.3)

Group 1

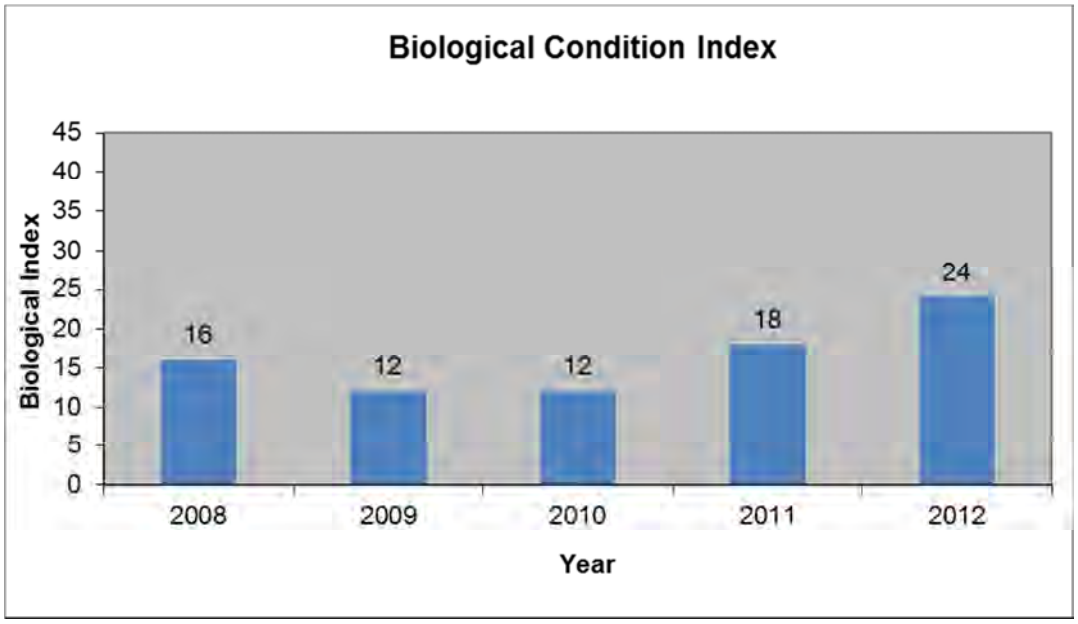
Habitat Condition: Available physical habitat was classified as partially supporting in 2012. Low flow conditions were present during the summer assessment period. Measured discharge in August 2012 was 1.161 cubic feet per second.

Water Quality: All measured water quality parameters were within acceptable limits when tested in 2012.



Biological Condition: SEEL 10.3 received a biological condition rating of slightly impaired in 2012.

Biological Condition		
Year	Score	Rating
2008	16	Moderately Impaired
2009	12	Moderately Impaired
2010	12	Moderately Impaired
2011	18	Slightly Impaired
2012	24	Slightly Impaired

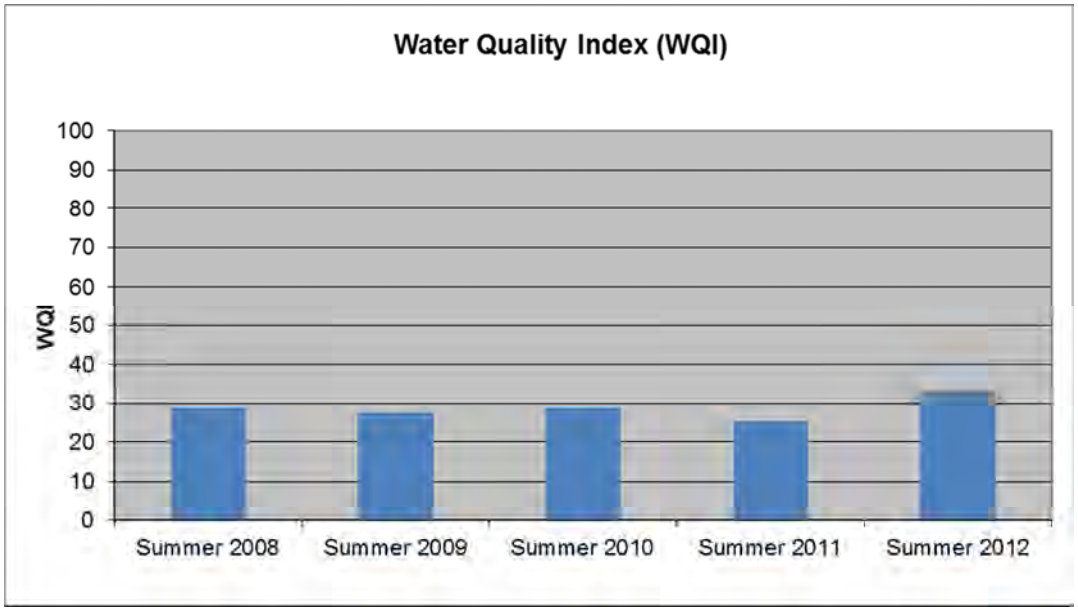


Snake Creek at Brookdale, Pa. (SNAK 2.3)

Group 2

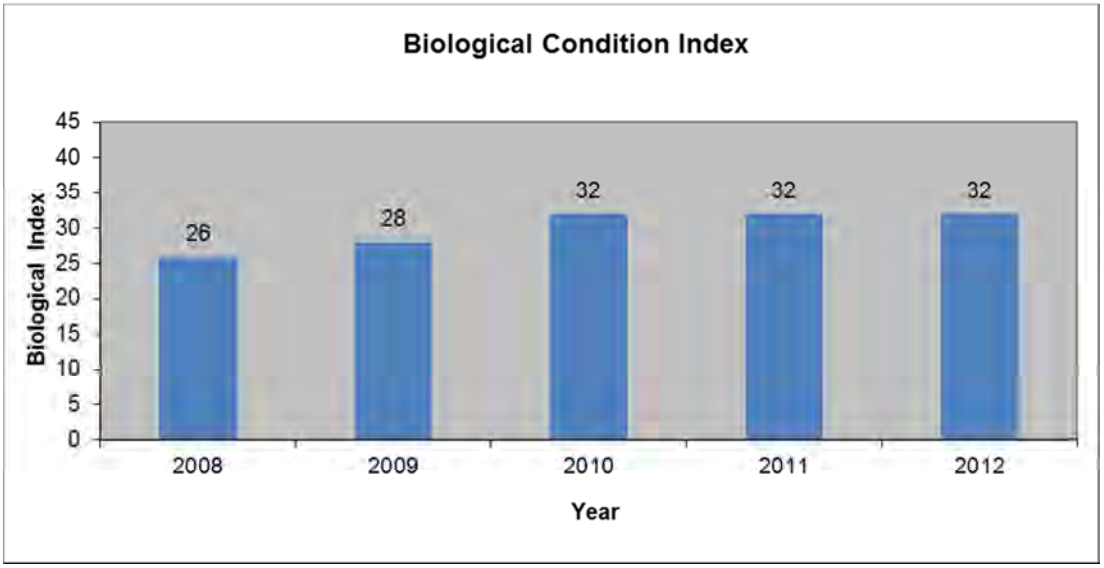
Habitat Condition: Physical habitat at Snake Creek was rated as excellent in 2012. Staff noted a highly eroded left bank but overall favorable conditions.

Water Quality: Total aluminum was measured to be 340 µg/L, exceeding the New York state threshold of 100 µg/L.



Biological Condition: The macroinvertebrate community of Snake Creek received a classification of nonimpaired when sampled in 2012.

Biological Condition		
Year	Score	Rating
2008	26	Nonimpaired
2009	28	Slightly Impaired
2010	32	Slightly Impaired
2011	32	Nonimpaired
2012	32	Nonimpaired

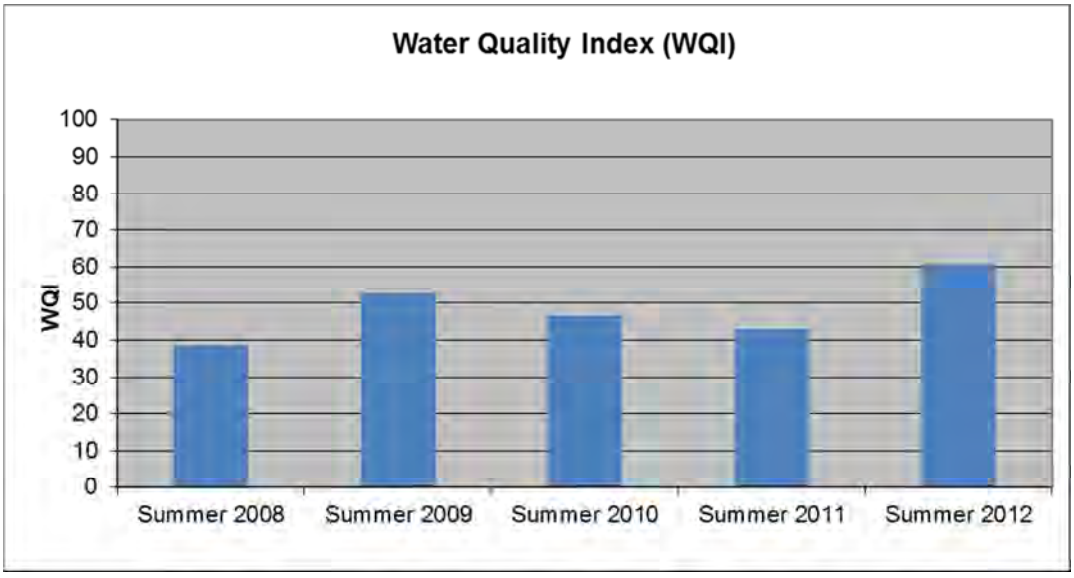


South Creek at Fassett, Pa. (SOUT 7.6)

Group 2

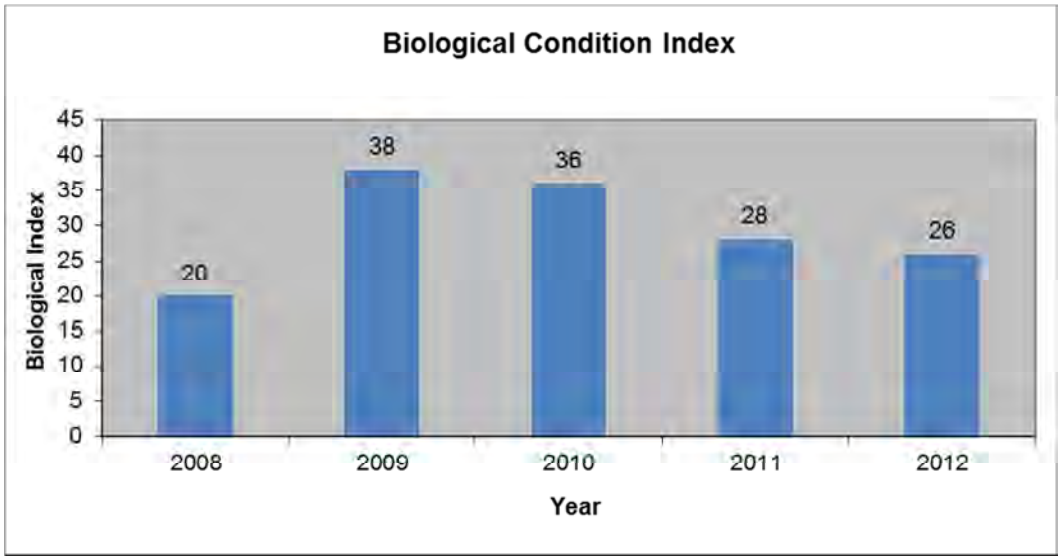
Habitat Condition: Possessing a score of 170 out of a possible 220, available physical habitat was rated as supporting in 2012.

Water Quality: Total iron was measured to be 510 µg/L, exceeding the New York state threshold of 300 µg/L.



Biological Condition: South Creek received a biological community condition rating of slightly impaired when sampled in 2012. With 19 species detected, SOUT 7.6 possessed the most diverse fish community of all of the monitored interstate streams.

Biological Condition		
Year	Score	Rating
2008	20	Slightly Impaired
2009	38	Nonimpaired
2010	36	Nonimpaired
2011	28	Nonimpaired
2012	26	Slightly Impaired

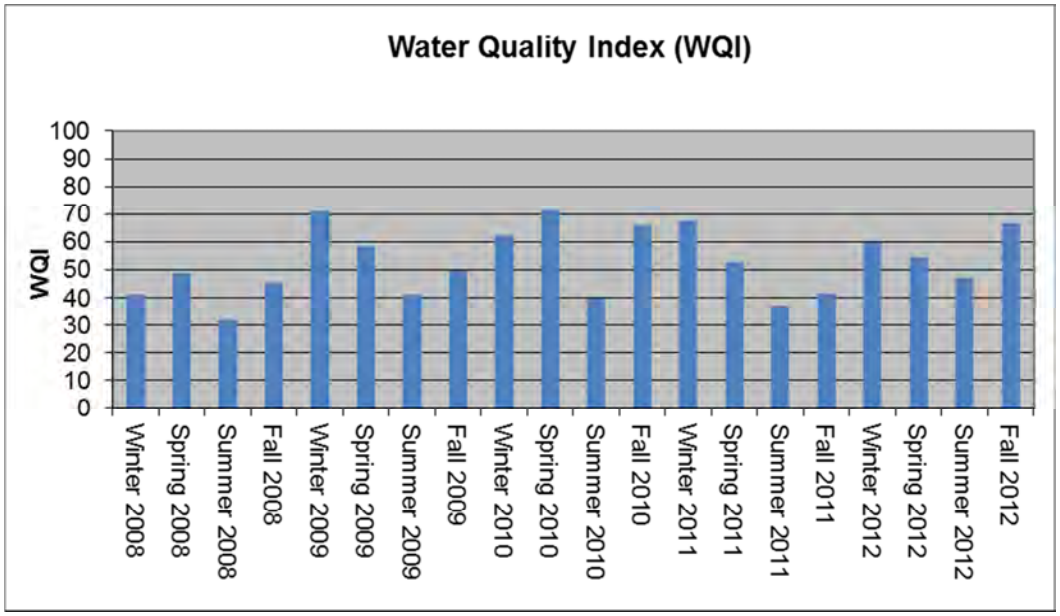


Troups Creek at Austinburg, Pa. (TRUP 4.5)

Group 1

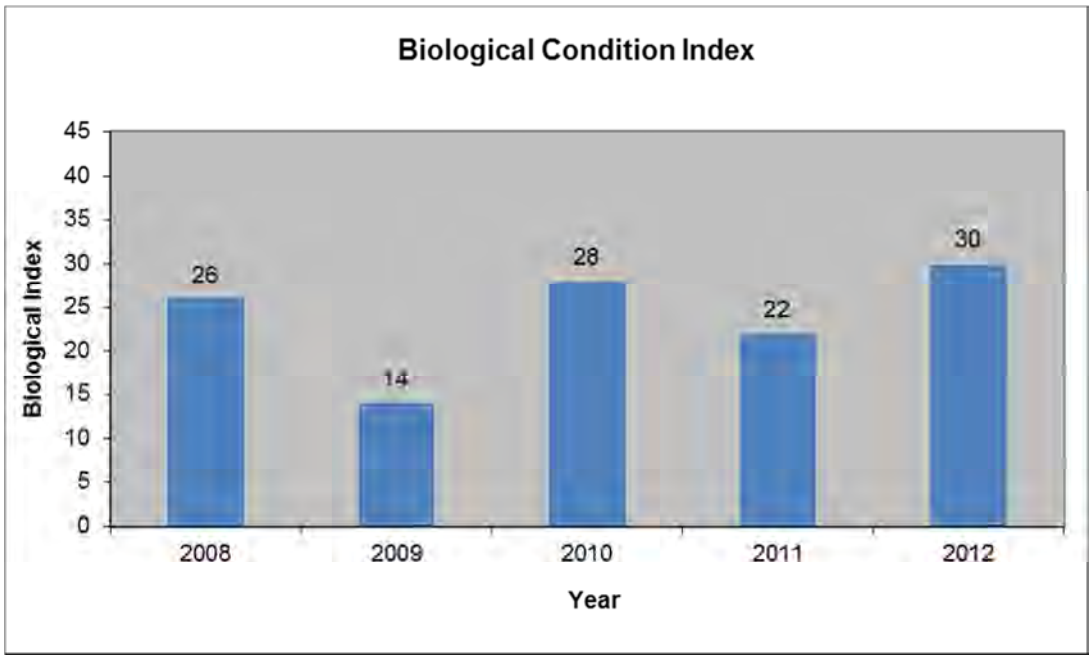
Habitat Condition: Scoring 160 out of a possible 220, available physical habitat was rated as supporting in 2012. Construction activity identified in 2011 was absent in 2012 with no additional evidence of disturbances noted.

Water Quality: Elevated total aluminum, total iron, and pH values were found to be above New York state water quality criteria. A pH reading of 9.02 in May exceeded the New York state standard of 8.5. Total iron was determined to be 480 µg/L in May, exceeding the 300 µg/L standard. Total Aluminum concentrations were reported to be 150 µg/L in February, 220 µg/L in May and 260 µg/L in November. The New York water quality threshold for total aluminum is 100 µg/L.



Biological Condition: The macroinvertebrate community was rated as nonimpaired when sampled in 2012.

Biological Condition		
Year	Score	Rating
2008	26	Slightly Impaired
2009	14	Moderately Impaired
2010	28	Slightly Impaired
2011	22	Slightly Impaired
2012	30	Nonimpaired

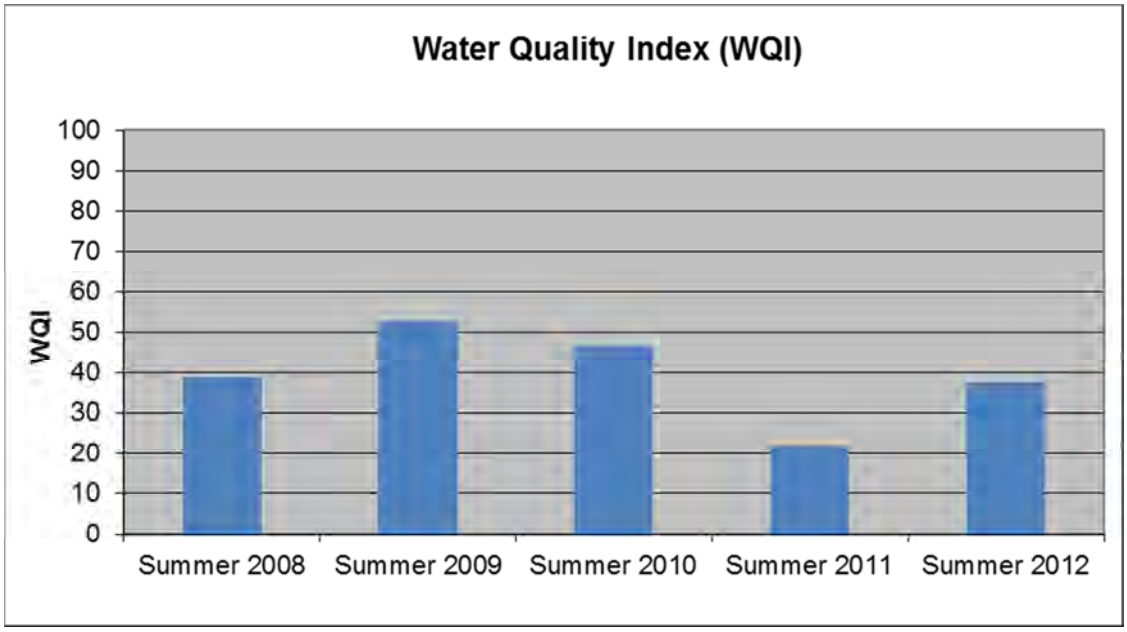


Trowbridge Creek at Great Bend, Pa. (TROW 1.8)

Group 2

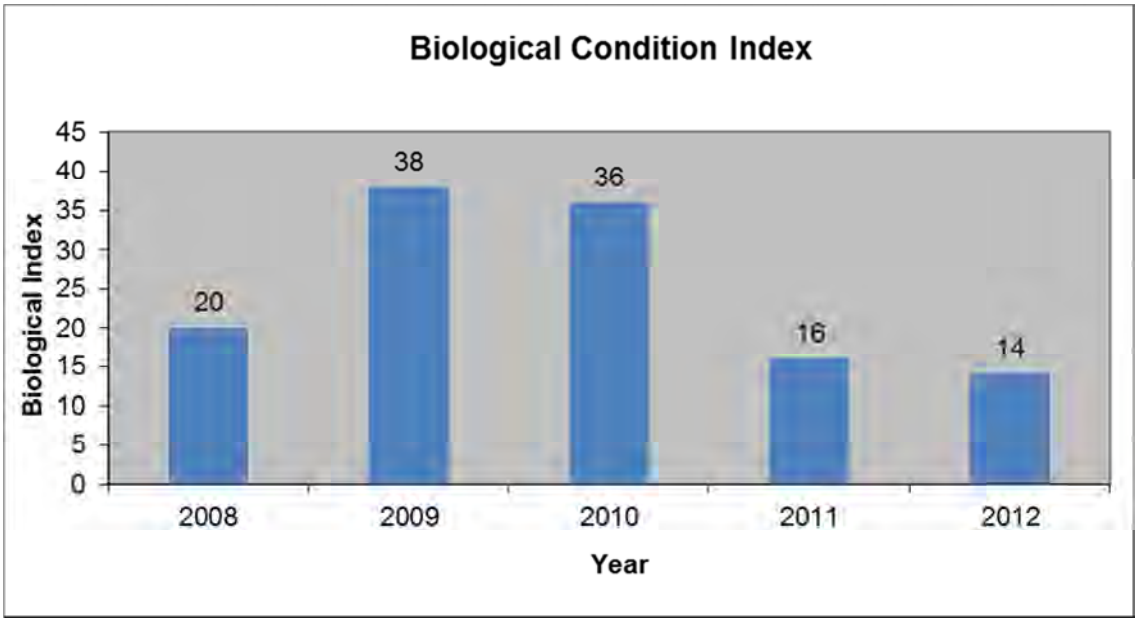
Habitat Condition: Physical habitat was rated as nonsupporting when assessed in 2012. Staff noted a highly modified stream channel and banks devoid of vegetative cover.

Water Quality: Total iron and total aluminum concentrations were outside of accepted limits when tested in 2012. August water quality sampling determined a total iron concentration of 1000 µg/L and a total aluminum concentration of 560 µg/L.



Biological Condition: The macroinvertebrate community at TROW 1.8 received a rating of moderately impaired when assessed in 2012.

Biological Condition		
Year	Score	Rating
2008	20	Slightly Impaired
2009	38	Nonimpaired
2010	36	Nonimpaired
2011	16	Slightly Impaired
2012	14	Moderately Impaired

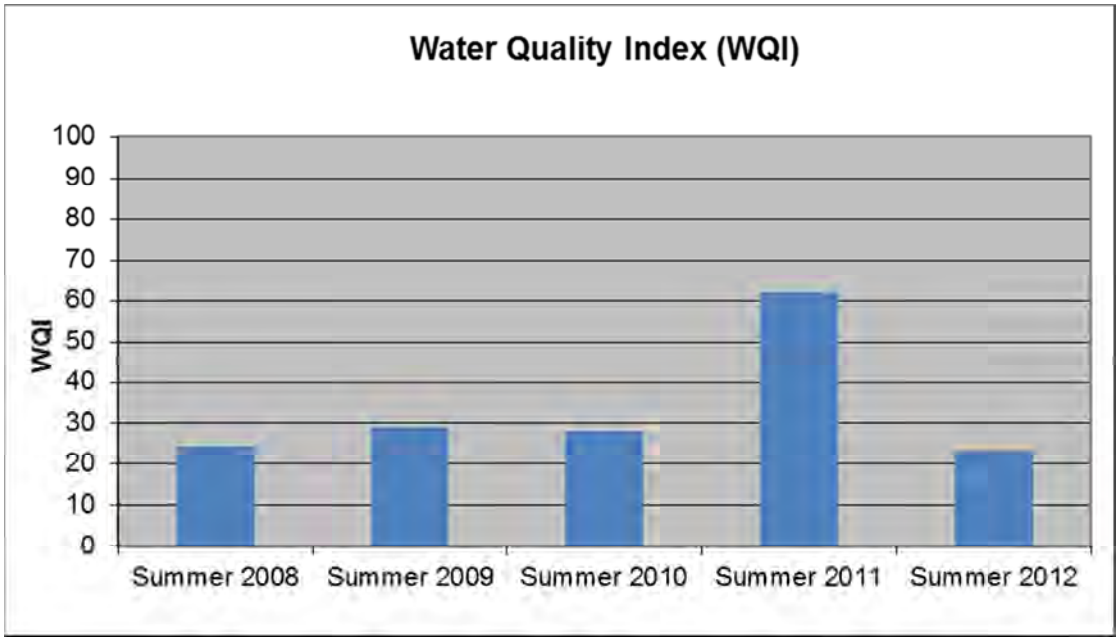


Wappasening Creek at Nichols, N.Y. (WAPP 2.6)

Group 2

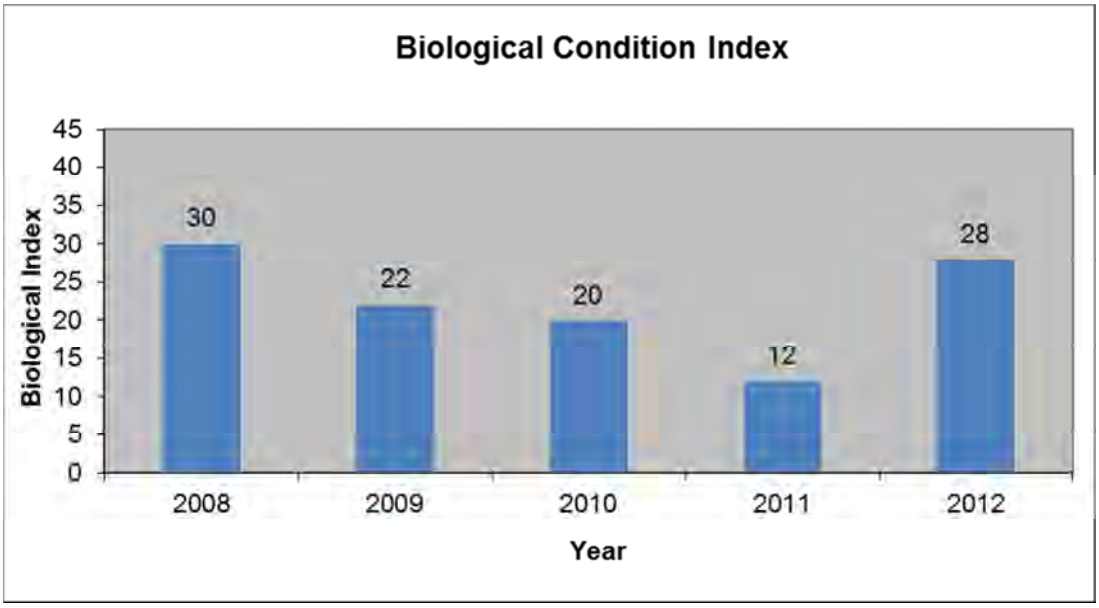
Habitat Condition: Scoring 129 out of a possible 220, available physical habitat was rated as partially supporting. Preparation for the replacement of the Route 282/187 bridge at the station was occurring when SRBC staff sampled the location in 2012.

Water Quality: All measured water quality parameters were within acceptable limits when tested in 2012.



Biological Condition: WAPP 2.6 received a biological condition rating of slightly impaired when sampled in 2012.

Biological Condition		
Year	Score	Rating
2008	30	Slightly Impaired
2009	22	Slightly Impaired
2010	20	Slightly Impaired
2011	12	Moderately Impaired
2012	28	Slightly Impaired



Site Results for NY-PA Group 3 Streams

Babcock Run near Cadis, Pa. (BABC)

Group 3

Biological Condition		
Year	Score	Rating
2008	22	Slightly Impaired
2009	24	Slightly Impaired
2010	28	Slightly Impaired
2011	14	Moderately Impaired
2012	22	Slightly Impaired

In May 2012, staff assessed Babcock Run. Overall physical habitat was rated as supporting with optimal riffle frequency and minimal embeddedness noted. BABC possessed good water quality, yielding no measured parameters outside of acceptable limits.

Bill Hess Creek in Nelson, Pa. (BILL)

Group 3

Biological Condition		
Year	Score	Rating
2008	16	Moderately Impaired
2009	22	Slightly Impaired
2010	28	Slightly Impaired
2011	18	Slightly Impaired
2012	22	Slightly Impaired

Bill Hess Creek, located near Route 49 in Nelson, Pa., received a biological condition rating of slightly impaired when sampled in May 2012. The macroinvertebrate sample scored optimally in the Shannon Diversity Index but lacked significant numbers of EPT taxa. Overall physical habitat was rated as supporting. All water quality parameters tested within acceptable limits.

Bird Creek near Webb Mills, N.Y.(BIRD)

Group 3

Biological Condition		
Year	Score	Rating
2008	28	Slightly Impaired
2009	30	Nonimpaired
2010	30	Nonimpaired
2011	18	Slightly Impaired
2012	16	Slightly Impaired

SRBC staff reported a slightly impaired biological community at Bird Creek near Webb Mills, N.Y., when the stream was assessed in May 2012. Overall physical habitat was classified as supporting. Total reported aluminum concentrations were 170 µg/L, above the New York water quality standard of 100 µg/L. Overall water quality was very good, yielding the best water quality index score of all Group 3 sites monitored in 2012.

Biscuit Hollow near Austinburg, Pa. (BISC)

Group 3

Biological Condition		
Year	Score	Rating
2008	NA	NA
2009	10	Moderately Impaired
2010	24	Slightly Impaired
2011	22	Slightly Impaired
2012	20	Slightly Impaired

Biscuit Hollow received a biological condition rating of slightly impaired when SRBC staff evaluated the stream in May 2012. Overall physical habitat was rated as excellent with staff noting minimal amounts of sediment deposition and channel alteration at the site. Measured aluminum concentrations were 120 µg/L, above the New York water quality standard of 100 µg/L.

Briggs Hollow Run near Nichols, N.Y. (BRIG)

Group 3

Biological Condition		
Year	Score	Rating
2008	26	Slightly Impaired
2009	26	Slightly Impaired
2010	30	Nonimpaired
2011	24	Slightly Impaired
2012	4	Severely Impaired

Briggs Hollow Run received a biological condition classification of severely impaired when sampled in 2012. The macroinvertebrate community was dominated by Chrominidae, yielding poor diversity-related metric scores. Available physical habitat was rated as supporting, though suboptimal bank conditions were reported. All measured water quality parameters tested within acceptable limits.

Bulkley Brook near Knoxville, Pa. (BULK)

Group 3

Biological Condition		
Year	Score	Rating
2008	NA	NA
2009	26	Slightly Impaired
2010	32	Nonimpaired
2011	26	Slightly Impaired
2012	24	Slightly Impaired

SRBC staff evaluated Bulkley Brook in May 2012. Total reported aluminum concentrations were 170 µg/L, exceeding the New York water quality standard of 100 µg/L. The biological community was rated as slightly impaired for the second consecutive year. Available physical habitat was classified as excellent with investigators reporting frequent, well-developed riffle habitat.

Camp Brook near Osceola, Pa. (CAMP)

Group 3

Biological Condition		
Year	Score	Rating
2008	24	Slightly Impaired
2009	8	Moderately Impaired
2010	12	Moderately Impaired
2011	28	Nonimpaired
2012	4	Severely Impaired

Camp Brook received a severely impaired biological condition rating in 2012. This marked a significant decline from the previous year's nonimpaired rating. The macroinvertebrate sample contained a low number of overall taxa (14) and a large overall contribution of Chrominidae taxa (73 percent). Habitat conditions remained comparable with the station receiving a classification of supporting. Laboratory water quality analysis revealed CAMP did possess a total iron concentration of 440 µg/L, above the New York aquatic life standard of 300 µg/L.

Cook Hollow near Austinburg, Pa. (COOK)

Group 3

Biological Condition		
Year	Score	Rating
2008	26	Slightly Impaired
2009	24	Slightly Impaired
2010	28	Slightly Impaired
2011	22	Slightly Impaired
2012	22	Slightly Impaired

Cook Hollow Brook attained a biological condition rating of slightly impaired for a seventh consecutive monitoring year. Physical habitat was rated as supporting with investigators noting optimal riparian buffer widths on both banks. Total reported aluminum concentrations were 120 µg/L, slightly exceeding the New York water quality standard of 100 µg/L.

Deep Hollow Brook near Danville, N.Y. (DEEP)

Group 3

Biological Condition		
Year	Score	Rating
2008	26	Slightly Impaired
2009	30	Nonimpaired
2010	30	Nonimpaired
2011	24	Slightly Impaired
2012	12	Moderately Impaired

Deep Hollow Brook received a biological condition rating of moderately impaired in 2012. DEEP possessed supporting physical habitat conditions at the time of assessment. Three water quality standard violations were noted: measured alkalinity of 13 mg/L below the Pennsylvania standard of 20 mg/L; an aluminum concentration of 560 µg/L exceeding the New York 100 µg/L standard; and total iron concentrations of 1100 µg/L, above the New York standard of 300 µg/L.

Denton Creek near Hickory Grove, Pa. (DENT)

Group 3

Biological Condition		
Year	Score	Rating
2008	22	Slightly Impaired
2009	18	Slightly Impaired
2010	14	Moderately Impaired
2011	10	Moderately Impaired
2012	20	Slightly Impaired

SRBC staff assessed Denton Creek near the Hawkins Pond Nature Area outside of Hickory Grove, Pa., in May 2012. Three water quality standard violations were noted: measured alkalinity of 10 mg/L below the Pennsylvania standard of 20 mg/L; an aluminum concentration of 190 µg/L exceeding the New York 100 µg/L standard; and total iron concentrations of 1000 µg/L, above the New York standard of 300 µg/L. Available physical habitat was rated excellent, yielding the highest score of all Group 3 streams assessed in 2012.

Dry Brook in Waverly, N.Y. (DRYB)

Group 3

Biological Condition		
Year	Score	Rating
2008	8	Slightly Impaired
2009	10	Moderately Impaired
2010	26	Slightly Impaired
2011	16	Moderately Impaired
2012	10	Moderately Impaired

Located in Waverly, N.Y., Dry Brook possessed a moderately impaired biological community when sampled in 2012. Available physical habitat was rated as partially supporting with staff noting suboptimal bank conditions. A narrow corridor of invasive Japanese knotweed dominated the riparian vegetation. All measured water quality parameters tested within acceptable limits.

Little Wappasening Creek near Nichols, N.Y. (LWAP)

Group 3

Biological Condition		
Year	Score	Rating
2008	30	Slightly Impaired
2009	28	Nonimpaired
2010	36	Nonimpaired
2011	24	Slightly Impaired
2012	12	Moderately Impaired

Little Wappasening Creek near Nichols, N.Y., received a biological condition rating of moderately impaired when assessed by SRBC staff in 2012. Overall water quality was good with no measured parameters falling outside of accepted limits. Compared to all other Group 3 streams, LWAP ranked third overall based on water quality index values. Physical habitat was rated as supporting.

Parks Creek near Litchfield, N.Y. (PARK)

Group 3

Biological Condition		
Year	Score	Rating
2008	26	Slightly Impaired
2009	26	Slightly Impaired
2010	24	Slightly Impaired
2011	28	Nonimpaired
2012	10	Moderately Impaired

Parks Creek near Litchfield, N.Y., was designated as having a moderately impaired biological community in 2012. Scoring 128 out of a possible 220, overall physical habitat was rated as partially supporting. Citing poorly vegetated, unstable banks and a highly mobile substrate, PARK received the lowest habitat score of all Group 3 streams assessed in the sampling year. All measured water quality parameters were within acceptable limits at the time of sampling.

Prince Hollow Run near Cadis, Pa. (PRIN)

Group 3

Biological Condition		
Year	Score	Rating
2008	14	Moderately Impaired
2009	16	Moderately Impaired
2010	20	Slightly Impaired
2011	24	Slightly Impaired
2012	6	Moderately Impaired

Prince Hollow Run received a biological condition rating of moderately impaired when sampled in 2012. The macroinvertebrate community scored poorly in overall taxa diversity, with tolerant Chorominid taxa comprising 70 percent of the sample. Overall physical habitat was classified as partially supporting with staff noting marginal bank conditions and sparse riffle development. All measured water quality parameters were within acceptable limits at the time of sampling.

Redhouse Run/Beagle Hollow near Osceola, Pa. (REDH)

Group 3

Biological Condition		
Year	Score	Rating
2008	NA	NA
2009	22	Slightly Impaired
2010	34	Nonimpaired
2011	24	Slightly Impaired
2012	32	Nonimpaired

Redhouse Run (Beagle Hollow) received a biological condition rating of nonimpaired in 2012. REDH possessed the highest biological condition score of all Group 3 streams monitored in 2012. Available physical habitat was classified as supporting with staff noting marginal riparian buffer widths at the site. Total reported aluminum concentrations were 125 µg/L, slightly exceeding the New York water quality standard of 100 µg/L.

Russell Run near Windham, Pa. (RUSS)

Group 3

Biological Condition		
Year	Score	Rating
2008	28	Slightly Impaired
2009	24	Slightly Impaired
2010	24	Slightly Impaired
2011	14	Moderately Impaired
2012	6	Moderately Impaired

Russell Run near Windham, Pa., had a moderately impaired biological community when sampled in 2012. SRBC has noted declining biological conditions scores since 2006 when RUSS received a nonimpaired designation. Available physical habitat was rated as supporting. Total reported aluminum concentrations were 160 µg/L, slightly exceeding the New York water quality standard of 100 µg/L.

Sacket Creek near Nichols, N.Y. (SACK)

Group 3

Biological Condition		
Year	Score	Rating
2008	28	Slightly Impaired
2009	32	Nonimpaired
2010	26	Slightly Impaired
2011	22	Slightly Impaired
2012	4	Severely Impaired

SRBC staff surveyed Sackett Creek in June 2012. SACK possessed a severely impaired biological community exhibiting poor macroinvertebrate diversity. The station reported the fewest overall taxa (eight) and least EPT taxa (three) of all Group 3 streams monitored in 2012. Physical habitat was rated as supporting with staff noting suboptimal levels of instream cover and marginal bank conditions. All measured water quality parameters were within acceptable limits at the time of sampling.

Smith Creek near East Lawrence, Pa. (SMIT)

Group 3

Biological Condition		
Year	Score	Rating
2008	38	Nonimpaired
2009	26	Slightly Impaired
2010	36	Nonimpaired
2011	8	Moderately Impaired
2012	30	Nonimpaired

Located near East Lawrence, Pa., Smith Creek was surveyed by SRBC staff in May 2012. SMIT was chosen as the reference site to which all other Group 3 streams were compared. The site possessed a diverse and nonimpaired biological community, and physical habitat was rated as excellent. Smith Creek did possess a total aluminum concentration of 380 µg/L and a total iron concentration of 590 µg/L in excess of New York state water quality thresholds of 100 µg/L and 300 µg/L, respectively.

Strait Creek near Nelson, Pa. (STRA)

Group 3

Biological Condition		
Year	Score	Rating
2008	30	Slightly Impaired
2009	18	Slightly Impaired
2010	30	Nonimpaired
2011	32	Nonimpaired
2012	28	Nonimpaired

Strait Creek received a biological condition rating of nonimpaired for the third consecutive year in 2012. STRA scored well on most metrics with the exception of the Hilsenhoff Biotic Index. Available physical habitat was deemed excellent with most assessed parameters scoring in the optimal condition range. All measured water quality parameters were within acceptable limits at the time of sampling.

White Branch Cowanesque River (WBCO)

Group 3

Biological Condition		
Year	Score	Rating
2008	6	Severely Impaired
2009	8	Moderately Impaired
2010	0	Severely Impaired
2011	4	Severely Impaired
2012	8	Moderately Impaired

Located immediately downstream of a recently completed reservoir, the White Branch of Cowanesque River received a biological condition rating of moderately impaired. Physical habitat was assessed as being excellent, despite the reservoir upstream. WBCO possessed a total aluminum concentration of 320 µg/L and a total iron concentration of 670 µg/L in excess of state water quality thresholds. WBCO also received the highest WQI score of all Group 3 sites, indicative of comparatively poor water quality.

White Hollow near Wellsburg, N.Y. (WHIT)

Group 3

Biological Condition		
Year	Score	Rating
2008	36	Slightly Impaired
2009	23	Slightly Impaired
2010	24	Slightly Impaired
2011	22	Slightly Impaired
2012	24	Slightly Impaired

White Hollow received a biological condition rating of slightly impaired when sampled in May 2012. 2012 marked the fifth consecutive year that WHIT received this same designation. Available physical habitat was rated as excellent. The total aluminum concentration was determined to be 170 µg/L, exceeding the New York water quality standard of 100 µg/L.

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Appendix

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.

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 bends 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)**

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 used for streams characterized by riffles and runs.

[2] G/P – Glide/Pool — Habitat assessment parameters used for streams 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 et al., 1999.

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 200-organism subsample. Number decreases with increasing stress.
2. Shannon 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. Modified 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 200-organism subsample. Number decreases with increasing stress.
5. Percent Ephemeroptera (a)	The percentage of Ephemeroptera in the 200-organism subsample. Percentage decreases with increasing stress.
6. Percent Dominant Taxa (a)	Percentage of the taxon with the largest number of individuals out of the total number of macroinvertebrates in the sample. Percentage increases with increasing stress.
7. Percent Chironomidae (a)	The percentage of Chironomidae in a 200-organism subsample. Percentage increases with increasing stress.

Sources: (a) Barbour et al., 1999 (b) Klemm et al., 1990

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. Percent Ephemeroptera (c)	>25 %	10 – 25 %	1 – 9 %	<1 %
6. Percent Chironomidae (c)	<5 %	5 – 20 %	21 – 35 %	>36 %
7. 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 (e)	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.

Summary of Criteria Used to Classify the Habitat Conditions of Sample Sites

DETERMINATION OF HABITAT ASSESSMENT SCORES				
	Habitat Parameter Scoring Criteria			
Parameter	**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)				

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

Summary of Fish Community Metrics from Group 1 and 2 Interstate Streams

		APAL 6.9	CASC 1.6	CAYT 1.7	CHOC 9.1	HLDN 3.5	LSNK 7.6	NFCR 7.6	SEEL 10.3	SNAK 2.3	SOUT 7.6	TROW 1.8	TRUP 4.5	WAPP 2.6
General Metrics	**Richness**	14	7	19	9	7	10	13	11	13	19	5	16	16
	Abundance	755	1462	765	418	1399	396	1176	3501	972	300	157	1638	359
Catch per unit of effort	**CPUE** (indiv/s)	0.25	0.48	0.14	0.12	1	0.09	0.38	1.41	0.23	0.1	0.05	0.42	0.11
	CPUE (indiv/min)	14.85	28.59	8.19	7.29	60	5.63	22.98	84.57	13.69	6	3.09	25.03	6.54
Relative Abundance, by Family	**% Catostomidae**	1.46	0	6.93	0	0	1.77	0.17	9.77	1.23	2.67	0	1.34	2.23
	% Centrarchidae	0.13	0.14	4.58	0	0	0	0	0.03	0	30	0	0	0.28
	% Cottidae	13.25	0	5.88	32.78	0	18.69	1.62	1.11	17.18	0.33	0.64	0.06	3.06
	% Cyprinidae	76.16	99.59	63.53	57.42	97.43	79.29	96	86.8	79.94	50.67	99.36	93.83	91.09
	% Gasterosteidae	0	0.07	0	0	0	0	0	0	0	0	0	0	0
	% Ictaluridae	9.01	0	2.48	8.85	1.07	0.25	2.13	0.06	1.13	2.33	0	3.3	2.79
	% Percidae	0	0	16.6	0.96	1.5	0	0.09	2.23	0.31	14	0	1.47	0.56
	% Salmonidae	0	0.21	0	0	0	0	0	0	0.21	0	0	0	0
Origin metrics	**Native Taxa Richness**	13	4	14	9	7	10	12	10	11	14	4	16	15
	% Native Individuals	99.87	99.59	79.74	100	100	100	99.74	99.97	99.79	76.33	97.45	100	99.72
	Introduced Taxa Richness	1	3	5	0	0	0	1	1	0	5	1	0	1
	% Introduced Taxa	0.13	0.41	20.26	0	0	0	0.26	0.03	0	23.67	2.55	0	0.28
Benthic metrics	**Benthic Taxa Richness**	4	0	8	3	2	3	5	5	4	6	1	4	7
	% Benthic Individuals	23.71	0	31.9	42.58	2.57	20.71	4	13.17	19.86	19.33	0.64	6.17	8.64
	Darter, sculpin, madtom Richness	2	0	5	3	2	2	3	4	3	4	1	3	4
	% Darters,sculpins,madtoms	22.25	0	24.84	42.58	2.57	18.94	2.81	3.4	18.62	16.67	0.64	4.82	6.13
Community Tolerance	**Tolerant Taxa Richness**	4	4	3	3	3	3	5	5	4	7	1	5	7
	% Tolerant Individuals	38.41	82.22	21.96	12.68	87.92	52.53	66.58	83.52	47.33	27.67	27.39	13.31	50.14
	Intolerant Taxa Richness	9	1	11	6	4	7	7	5	7	8	3	10	8
	% Intolerant Individuals	61.46	17.51	65.36	87.32	12.08	47.47	33.16	15.85	52.47	37.33	70.06	86.02	49.58
Lithophils	**Lithophilic Richness**	8	2	10	4	2	6	6	5	6	8	2	7	7
	% Lithophilic Individuals	38.41	17.72	39.48	60.05	8.86	43.18	25.17	21.14	42.08	57	15.29	76.01	38.72
Trophic Guilds	**Top Predator Richness**	0	1	1	0	0	0	0	1	0	1	0	0	0
	% Top Predators	0	0.21	4.18	0	0	0	0	0.03	0	5	0	0	0
	Generalist Feeder Richness	4	1	3	1	1	2	2	2	2	5	0	3	2
	% Generalist Feeders	3.31	17.1	9.02	1.2	9.72	14.65	23.04	10.85	2.67	39.67	0	2.26	9.19
	Invertivore Richness	4	1	4	3	3	3	4	3	3	5	0	6	6
	% Invertivores	13.11	0.14	10.07	21.29	3	7.07	2.38	4.86	7.92	17.33	0	10.87	6.96
	Insectivore Richness	1	0	4	1	0	1	1	2	1	3	1	1	2
	% Insectivores	13.25	0	22.48	32.78	0	18.69	1.62	1.74	17.18	14.33	0.64	0.06	3.34
	Omnivore Richness	4	3	5	3	2	3	5	2	0	4	3	5	5
	% Omnivores	59.47	82.49	46.41	41.63	78.84	50	51.36	76.09	0	16	84.71	53.42	59.61

Note: Fish data were not collected at Bentley Creek (BNTY 0.9) in 2012 due to instream construction activities occurring at the sampling location.