METHODS

Data Collection

Between June and October 2008, SRBC staff completed three rounds of sampling at the ten instream and two side channel locations listed in Table 1. Sampling included water chemistry, electrofishing, macroinvertebrate sampling, stream discharge measurements, and habitat assessments. Water was collected using a hand-held, depth-integrated sampler at six locations across the stream channel. The water was put into a churn splitter, mixed thoroughly, and split into two 500-ml bottles, one 125-ml bottle fixed for nutrient analysis,

Backpack electroshocking in the Tioughnioga River.

and two amber pre-fixed vials for total organic carbon (TOC). Water quality parameters are listed in Table 2. The remainder of the water was used to complete standard field chemistry analyses. Temperature was measured instream in degrees Celsius with a field thermometer. A Cole-Parmer Model 5996 meter was used to measure pH. Conductivity was measured with a Cole-Parmer 1481 meter, and dissolved oxygen was measured instream with a YSI 55 meter. Turbidity also was measured in the field with a Hach 2100P portable turbidometer. Alkalinity and acidity were determined using field titrations. Alkalinity was measured in the field by titrating a known volume of sample water to pH 4.5 with 0.02N H_2SO_4. Acidity was measured in the field by titrating a known volume of sample water to pH 8.3 with 0.02N NaOH. When wading was possible, stream discharge was measured using a FlowTracker and according to the U.S. Geological Survey (USGS) methods (Buchanan and Somers, 1969).

Macroinvertebrate assessments were adapted from Rapid Bioassessment Protocol (RBP) III, described by Barbour and others (1999) and Plafkin and others (1989) and followed NYSDEC's "Quality Assurance Work Plan for Biological Stream Monitoring in New York State" (Bode and others, 2002). Macroinvertebrate sampling was conducted in the best available riffle/run habitats at each main channel and side channel reach, where available. Sampling was conducted by placing an aquatic net (size 9 in. X 18 in., mesh opening 0.8 mm X 0.9 mm) perpendicular to the current and disturbing the substrate so dislodged macroinvertebrates were carried into the net. Sampling was continued in an upstream direction for five minutes for a distance of five meters. All collected specimens were preserved in 95 percent ethanol and returned to SRBC for identification and enumeration.

Fish community assessments were adapted from the RBP manual (Barbour and others, 1999) and from NYSDEC's quality assurance plan (Bode and others, 2002). Fish sampling was conducted in a representative stream reach that was selected so that riffle, run, and pool habitat were included within the reach, when possible. In June, a backpack electroshocker was used with poor results due to the size of the rivers being sampled, so the remaining sampling rounds were electrofished

Table 1. *Instream Monitoring Locations in the Whitney Point Study Area*

Site	Stream Name	Location	Latitude	Longitude
OTSL 8.7	Otselic River	Upstream of lake at Landers Corners	42.4225	-75.94861
OTSL 0.1	Otselic River	At mouth at Whitney Point	42.33073	-75.96607
TIOU 18.8	Tioughnioga River	At Marathon	42.4407	-76.0356
TIOU 13.2	Tioughnioga River	Along Rt. 11, approximately 1.5 miles north of Lisle	42.3705	-75.99981
TIOUB 13.2	Tioughnioga River	Side channel/backwater area at TIOU 13.2	42.3705	-75.99981
TIOU 11.8	Tioughnioga River	Upstream of Otselic River @ Lisle	42.35075	-75.99982
TIOU 9.5	Tioughnioga River	Downstream of Otselic River at Rt. 11 bridge at Whitney Point	42.33083	-75.96694
TIOU 5.7	Tioughnioga River	Downstream of Otselic River at Itaska	42.2987	-75.909
TIOUB 5.4	Tioughnioga River	Side channel/backwater area about 0.3 miles downstream of TIOU 5.7	42.29528	-75.90587
TIOU 0.1	Tioughnioga River	Upstream of Rt. 12 bridge at Chenango Forks	42.23833	-75.8475
CHEN 11.9	Chenango River	Downstream of Tioughnioga River at gaging station near Chenango Forks	42.2188	-75.8486
CHEN 7.0	Chenango River	Downstream of Rt. 12A	42.165783	-75.87293

Table 2. *Water Quality Parameters Sampled*

Field Parameters
Flow, instantaneous cfs
Temperature, °C
Dissolved Oxygen, (mg/l)
Conductivity, µmhos/cm
pH
Alkalinity, mg/l
Acidity, mg/l
Turbidity, NTU

Laboratory Analysis Parameters
Biological Oxygen Demand, 5-day, mg/l
Total Suspended Solids, mg/l
Total Organic Carbon, mg/l
Total Nitrogen, mg/l
Total Phosphorus, mg/l
Total Orthophosphate, mg/l

with a tote barge. (Note that in the results, the fish data from June are not included due to the difference in sampling methods.) Electrofishing with the tote barge proceeded in an upstream direction covering the maximum amount of habitat possible. All wadeable habitats within the reach, which changed with varying flow regimes, were sampled during a single pass. The exact length of sampling time, with a goal of approximately 40 minutes, was recorded at each site.

Physical habitat conditions at each reach 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 reach and were used to calculate a site-specific habitat assessment score. Physical habitat assessments were performed for riffle/run or glide/pool areas, depending on stream type. Additional habitat information, including length of side channel, type of connection to main channel, and habitat unit types, were noted at both side channel/backwater reaches.

Data Analysis

Water quality was assessed by examining field and laboratory parameters, and comparing the data collected to water chemistry levels of concern based on current state and federal regulations, background levels of stream chemistry, or references for approximate tolerances for aquatic life (Table 3). The water quality throughout the study area was quite good with only a few sites exceeding any of these thresholds. Chemical concentrations for the three sampling rounds were averaged, and the following rankings were based on those means. The eight sites that had zero or one parameter exceeding the level of concern were ranked as having "higher" water quality and the four sites that had two parameters exceeding levels of concern were ranked as having "middle" water quality.

For macroinvertebrates, subsampling and sorting procedures were based on the 1999 RBP document (Barbour and others, 1999). In the laboratory, composite samples were sorted into 200-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), when possible, and enumerated. See Table 4 for an explanation of the metrics used for macroinvertebrate analysis.

Fish were identified, weighed, and measured in the field when possible, and, when necessary, fish were preserved in formalin and returned to the lab for verification. The data for each reach were analyzed with the following metrics: (1) species richness, weighted by stream size; (2) percent non-tolerant individuals; (3) percent non-tolerant species; and (4) percent model affinity, by trophic class. See Table 5 for a more detailed explanation of these metrics. Table 6 shows a list of fish species caught in order of abundance.

"The water quality throughout the study area was quite good with only a few sites exceeding any of these thresholds."

Habitat assessment scores of the reaches were calculated to classify each reach into a habitat condition category. Any reach that scored 220 to 171 was designated excellent. A habitat score of 170 to 116 was designated supporting; partially supporting conditions were characterized as 115 to 61; and a score of less than 60 was rated as nonsupporting.

Overall rankings, based on the averages of all three sampling rounds, for water quality, macroinvertebrates, fish, and physical habitat are displayed graphically in Figure 3.

Table 3. *Water Quality Standards and Aquatic Life Tolerances*

Parameters	Limit	Reference Code
Temperature	> 25 degrees C	a,f
Dissolved Oxygen	< 4 mg/l	a,g
Conductivity	> 800 mmhos/cm	d
pH	6.5 – 8.5	c
Acidity	> 20 mg/l	k
Alkalinity	< 20 mg/l	a,g
Turbidity	> 50 NTU	l
Total Suspended Solids	> 15 mg/l	h
Total Nitrogen	> 1.0 mg/l	i,j
Total Phosphorus	> 0.1 mg/l	e
Biological Oxygen Demand	> 5 mg/l	m
Total Organic Carbon	> 10 mg/l	b
Total Orthophosphate	> 0.05 mg/l	i,j

Reference Code & References

a. http://www.pacode.com/secure/data/025/chapter93/s93.7.html
b. Hem (1970)
c. http://www.dec.ny.gov/regs/4590.html#16132
d. http://www.uky.edu/WaterResources/Watershed/KRB_AR/wq_standards.htm
e. http://www.uky.edu/WaterResources/Watershed/KRB_AR/krww_parameters.htm
f. http://www.hach.com/h2ou/h2wtrqual.htm
g. http://sites.state.pa.us/PA_Exec/Fish_Boat/education/catalog/pondstream.pdf
h. http://adm.idaho.gov/adminrules/rules/idapa58/0102.pdf
i. http://water.usgs.gov/pubs/circ/circ1225/images/table.html
j. http://www.water.ncsu.edu/watersheds
k. based on archived data at SRBC
l. http://www.epa.gov/waterscience/criteria/sediment/appendix3.pdf
m. http://www.ciese.org/curriculum/dipproj2/en/fieldbook/index.html

Table 4. *Explanation of Macroinvertebrate Metrics*

Taxonomic Richness:	Total number of taxa in the sample. Number decreases with increasing stress.
Hilsenhoff Biotic Index:	A measure of organic pollution tolerance. Index value increases with increasing stress.
EPT Index:	Total number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa present in a sample. Number decreases with increasing stress.
Percent Model Affinity:	Measure of similarity between collected sample and model (non-affected) sample based on percent abundance of seven major groups. Percentage decreases with increasing stress.
Percent Contribution of Dominant Taxa:	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.
Percent Ephemeroptera:	Percentage of number of Ephemeroptera (mayflies) in the sample divided by the total number of individuals in the sample. Percentage decreases with increasing stress.
Percent Chironomidae:	Percentage of number of Chironomidae individuals out of the total number of macroinvertebrates in the sample. Percentage decreases with increasing stress.
Shannon-Wiener Diversity Index:	A measure of the taxonomic diversity of the community. Index value decreases with increasing stress.

Metrics in **bold constitute the NYSDEC assessment methodology.*

Table 5. *Explanation of Fish Metrics*

Species Richness, weighted:	Total number of species present in the sample, weighted by stream size. Streams over 20 meters wide are total number minus four and anything over 14 species is given the maximum value of 10.
Percent Non-Tolerant Individuals:	Percentage of total individuals belonging to the species considered intolerant or intermediate to environmental perturbations.
Percent Tolerant Species:	Similar to percentage non-tolerant individuals but calculated for species.
Percent Model Affinity:	The highest percentage of similarity of any of five models of non-impacted fish communities, by trophic class.

Table 6. *Species List of Fish Collected (listed in order of relative abundance)*

Central Stoneroller	Greenside Darter
Banded Darter	Yellow Perch
White Sucker	Swallowtail Shiner
Longnose Dace	Fallfish
Tessellated Darter	Blacknose Dace
Spotfin Shiner	Common Carp
Rock Bass	Shield Darter
White Crappie	Golden Shiner
Northern Hog Sucker	Walleye
Bluegill	Common Shiner
Margined Madtom	River Chub
Comely Shiner	Northern Pike
Cutlips Minnow	Redbreast Sunfish
Pumpkinseed	Yellow Bullhead
Spottail Shiner	Banded Killifish
Mottled Sculpin	Brown Bullhead
Creek Chub	Chain Pickerel
Mimic Shiner	Muskellunge

Walleye from the Chenango River.

Whitney Point Lake.

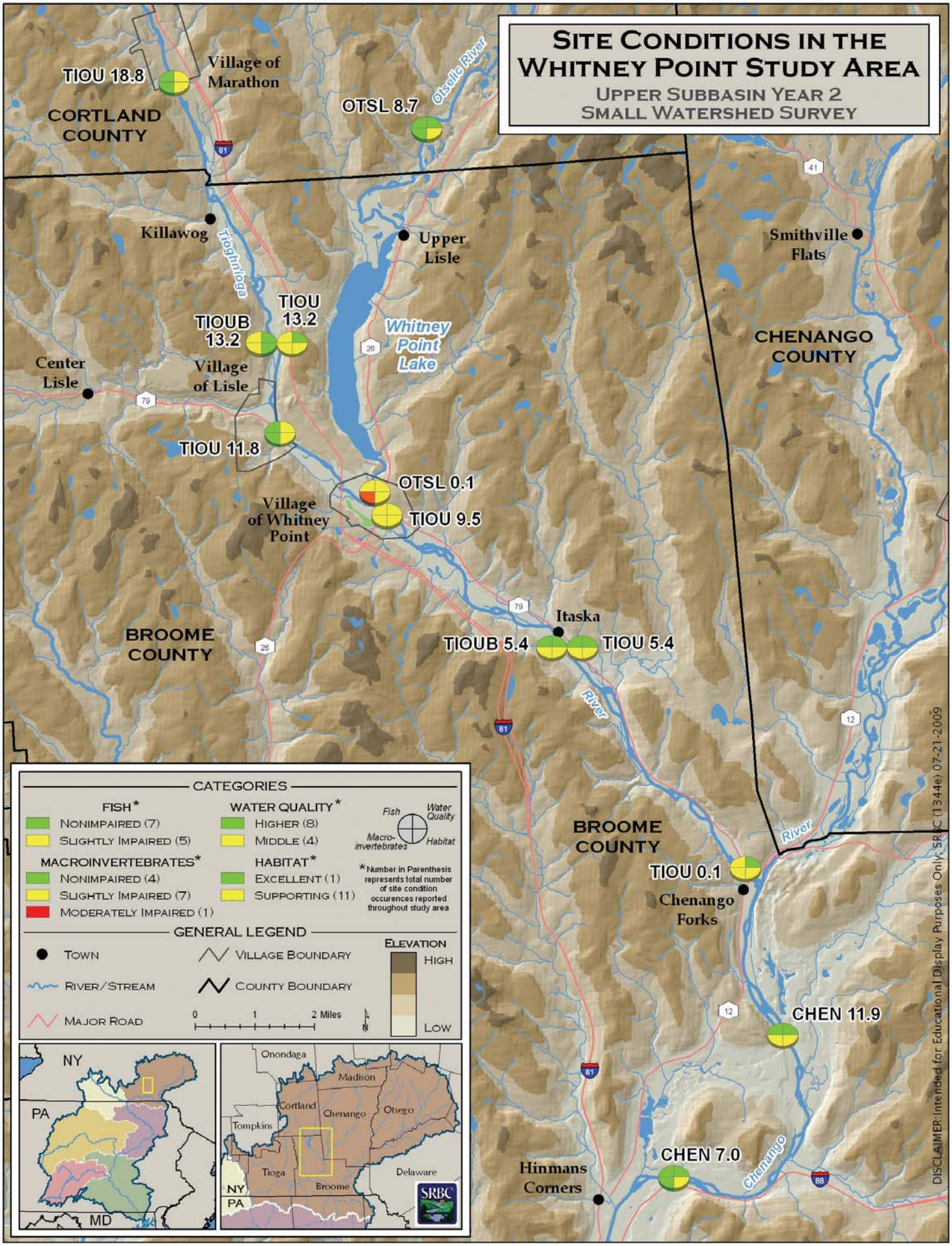

Figure 3. *Site Conditions in the Whitney Point Study Area*