BIOLOGICAL STREAM SURVEY

ROCKLAND COUNTY, NEW YORK
LOTIC SCENE INVESTIGATION (LSI)
2006 STREAM BIOMONITORING WATER QUALITY PROJECT

J. KELLY NOLAN

PREPARED FOR
HUDSON BASIN RIVER WATCH
EAST GREENWICH, NEW YORK

BY
WATERSHED ASSESSMENT ASSOCIATES, LLC
SCHENECTADY, NEW YORK

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3570 Route 29
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Principal Investigator: J. Kelly Nolan, Watershed Assessment Associates

Project Overview

The purpose of this study was to sample stream sites within Rockland County for benthic (bottom dwelling) invertebrates and to determine both water quality and impact source, if any, affecting a site based on the invertebrate community structure.

The project also provided an undergraduate student applied research training in rapid watershed assessment technique and analysis under the direct guidance of a professional aquatic biologist. The student completed side-by-side data collection with the aquatic biologist at 4 stations and compiled a separate student analytic report.

The data and analysis obtained from this project can be used by county planning and development agencies for planning purposes. In addition, the results of the surveyed stations located within Municipal Separate Storm Sewer Systems (MS4) communities can be used by the MS4 community in meeting several requirements set forth in the US EPA MS4 regulations.

Background

Rockland County encompasses approximately 210 miles of streams and rivers and more than 600 lakes and ponds, comprising a drainage area of about 114,000 acres. It is the smallest New York County outside of New York City. According to the Rockland County Planning Department, the most recent (2003/2004) percentages of land use within the county are: 32% residential, 5% commercial/office/industrial, 8% institutional/utilities, 0.2% agricultural, 38% parks/open space, 8% transportation, 9% vacant/not yet classified. A detailed definition for each category is available from the Rockland County Planning Department.

Threats to water quality of the streams and rivers in Rockland County include wastewater and runoff from public sewage treatment facilities, human impact from increasing land use and urbanization, runoff from urban and residential areas, industrial discharges, and water withdrawal (both surface and ground) for its public water supply.

The Rockland County Soil and Water Conservation District (RC SWCD) endeavors to develop responsible soil and water conservation programs in order to protect and conserve soil and water resources, as well as to educate the community on the importance of conservation measures. To that end, the RC SWCD has retained Hudson Basin River Watch (HBRW), through its Lotic Scene Investigation (LSI) program, to provide water quality data and educational services to municipalities and agencies that will guide relevant water supply planning, watershed protection, stormwater management, economic development, and aquatic habitat protection, and fulfill Municipal Separate Storm Sewer Systems (MS4) mandated requirements.

The HBRW program was developed with the intent of providing state agencies, counties, municipalities, and organizations with water quality reports that mirror a state

Department of Environmental Conservation's stream biomonitoring methodology, while providing educational research opportunities to students. The course instructor, a professional aquatic biologist, generates a survey report on data that he obtains as he and the students collect side-by-side samples for analysis. This provides confirmation of student data, ensuring that the LSI assessment report is valuable for water quality and watershed planning and protection. Dependent upon station selection, assessment results provide either baseline information against which future changes in water quality can be compared or trend monitoring.

Biological assessments are a cost effective method for assessing water quality and can identify stressors to a water body, detect impaired waters, determine restoration priorities, help set protection and restoration goals, track restoration progress, and support water discharge permit enforcement.

Methods and Rational

The methods, rational, and data analysis used for this study adhered to procedures outlined in the Hudson Basin River Watch Hudson River Estuary Watershed Assessment and Outreach Water Quality Biomonitoring Project Quality Assurance Project Plan (Gruber, 2006) and the Quality Assurance Work Plan for Biological Stream Monitoring in New York State (Bode et al., 2002). Both documents are available upon request from Hudson Basin River Watch (HBRW). A brief explanation of methods and rationale of data collected follow. A glossary of selected terms is provided in appendix I.

Biological

In this study, biological refers to benthic macroinvertebrate larvae that make up the community in stream habitats. Because benthic macroinvertebrates are constantly exposed to the effects of various stressors, these communities reflect not only current conditions, but also the cumulative impact of stressors over time. Ascertaining the benthic macroinvertebrate community structure at a station can determine the level of water quality and, perhaps more importantly, the most likely stressors affecting the station.

Biological samples were collected at each station using an 800-900 micron mesh kick net (9 by 18 inch). Samples were collected by disturbing the substrate by foot upstream of the net and continuing over a five-meter transect for five minutes as described in the Quality Assurance Work Plan for Biological Stream Monitoring in New York State (Bode et al., 2002). Samples were separately preserved in 95% ethyl alcohol and were then sub-sampled in the lab by randomly selecting 15 cc of detritus from the sample and examining it under a dissecting microscope. Invertebrates larger than 1.5 mm were removed until 100 organisms were obtained for each sample. Macroinvertebrates were identified to genus level to determine the water quality category for each station. Identification to the required taxonomic level was conducted for each sub sample to determine the Impact Source Determination (ISD) described by Riva-Murry et al. (2002). The metrics used to determine water quality were those recommended by the NYS DEC Stream Biomonitoring Unit with the exception that an all genera level identification was used instead of a combination of genera and species level identification. Identification to genera has been shown to have 100 percent accuracy in properly categorizing water quality in the NYS DEC four tiered method of assessment (Nolan, unpublished data).

The expected variability of single sample macroinvertebrate sampling results is stated in Smith and Bode (2004).

The four community metrics utilized for both genera level were: Richness (Plafkin et al. 1989), EPT richness (Lenat, 1987), Hilsenhoff's Biotic Index (Hilsenhoff, 1987), and Percent Model Affinity (PMA) (Novak and Bode, 1992).

The score for each particular metric from each station was used to calculate each station's Biological Assessment Profile (BAP) by converting each metric score to a common scale of 0 – 10. The BAP score categorizes the overall water quality assessment into one of four categories: non-, slightly, moderately, or severely impacted (Bode et al. 2002). The NYS DEC surmises the ability of each of the above water qualities to support fish and their propagation, but a particular family or species of fish is not identified. This is significant because trout are sensitive to small amounts of pollutants and slight ecological changes, whereas bass or carp, having a higher tolerance to pollutants and ecological changes, are not. See appendix II for complete definitions of each category.

Impact Source Determination (ISD) was calculated for each station. ISD compares test station communities to model communities empirically derived from macroinvertebrate data; the greater the similarity of a test station community to a model community, the more likely a particular impact source is affecting the test community. Data is most conclusive if a test community exhibits at least 50% similarity to a model community (Bode et al., 2002). Riva-Murray et al. (2002) found that ISD correlated well with impairment sources inferred from chemical, physical, and watershed characteristics, and biomonitoring results.

Appendix III contains the macroinvertebrate taxa list and ISD results for each station.

Physical

Benthic macroinvertebrate community structure normally varies dependent on physical habitat. Multi-metrics used to determine water quality and impact source are based on divergence from the expected community and have been calibrated for a specific habitat. In general, stations are to be a "wadeable riffle" habitat with physical attributes that are consistent with the habitat comparability criteria outlined in Bode et al. (1990). Each station is therefore evaluated for percent canopy cover, current speed, and percent of rock, rubble, gravel, sand, and silt, and the embeddedness of the substrate. The depth and width of the stream were also measured and site photos were taken of the upstream and downstream areas to be included with the physical and chemical data.

An optimal macroinvertebrate collection site has a velocity between 0.45 and 0.75 meter/second. Velocity was taken using a Global Water Flow probe (range: 0.3-15 FPS, accuracy: 0.1 FPS) following the manufacturer calibration guidelines.

Water temperature directly affects both the nature of aquatic fauna and species diversity; temperature tolerance is organism specific, and the reproductive cycle (including timing of insect emergence and annual productivity) will vary within different temperature ranges. Temperature can also affect organisms indirectly as a consequence of oxygen saturation levels. As water temperature rises, the metabolism of aquatic organisms increases, with an attendant increase in their oxygen requirements. At higher water temperatures, however, the oxygen carrying capacity of water decreases because of a diminished affinity of the water for oxygen.

Optimal water temperature ranges and lethal limits of water temperature vary among different organisms. The ratio of Plecoptera to Ephemeroptera (individuals and numbers of species) has been found to drop as the annual range of temperature increases (Hynes, 1970). The optimal temperature range for brook trout is 11-16 ° Celsius with an upper lethal limit of 240 ° Celsius (Hynes, 1970). The NYS DEC does not have a water quality standard for water temperature.

Temperature was recorded using a Hydrolab Quanta probe (accuracy ± 0.2° C) following the manufacturer calibration guidelines.

Chemical

Dissolved oxygen (DO) level is a function of water turbulence, diffusion, and plant respiration. A significant drop in DO concentration can occur over a 24-hour period, particularly if a water body contains a large amount of plant growth. Oxygen is released into the water as a result of plant photosynthesis during daylight; dense plant growth within a stream can therefore elevate the DO level significantly. At night photosynthesis ceases and DO may drop to levels maintained by diffusion and turbulence. A pre-dawn DO level will, in this case, reflect the lowest DO concentration in a 24 hour period, and thus provide important data on the overall health of the system.

DO was measured using a Hydrolab Quanta Probe (range: 0 to 50 mg/L, accuracy: ±0.2 mg/L) following the manufacturer calibration guidelines.

It is also important to consider percent oxygen saturation, since dissolved oxygen levels vary inversely with water temperature. Percent saturation is the ratio of dissolved oxygen present in the water at a specific temperature to the maximum dissolved oxygen for a given temperature. (The calculation is also standardized to altitude or barometric pressure.) Percent oxygen saturation falls when something other than temperature, such as dissolved solids or bacterial decomposition, affects oxygen levels. It can rise to super-saturated level secondary to photosynthetic activity of abundant algae growth.

A healthy stream contains near 100 percent oxygen saturation at any given temperature (Hynes, 1970). Trout are particularly sensitive to even a slight drop in oxygen saturation and will migrate away from streams when oxygen saturation falls. Similarly, certain macroinvertebrates are sensitive to varying saturation levels and because the inability of these organisms to migrate away from the changing conditions, a drop in saturation can be lethal.

Specific conductance or conductivity is a measure of the ability of an electrical current to pass through a stream; it is dependent on both the concentration of dissolved electrolytes within the water and water temperature. Conductivity increases when inorganic ions are dissolved in water. Organic ions, such as phenols, oil, alcohol and sugar, can decrease conductivity (EPA, 1987). Warmer water is also more conductive and, therefore, conductivity is reported for a standardized water temperature of 25 degrees Celsius. Measurements are reported in micro Siemens per centimeter (µS/cm) following the manufacturer calibration guidelines.

In the United States, freshwater stream conductivity readings vary greatly from 50-1,500µS/cm. The given conductivity of a particular stream remains relatively constant, however, unless an extraneous source of contamination is present. A failing septic system would raise conductivity because of its chloride, phosphate, and nitrate content, while an oil spill would lower conductivity.

A Hydrolab Quanta probe was used to measure conductivity (range of 0 – 100 mS with a resolution of 4 digits) following the manufacturer calibration guidelines.

The pH is a measure of a stream's acidity. A desirable pH for salmonid is 6.5-8.5. A Hydrolab Quanta probe was used to obtain pH (range: 2 to 12 units, accuracy: ± 0.2 units) following the manufacturer calibration guidelines.

For physical and chemical data see appendix III.

Results and Discussion

An examination of all possible relationships between land use and water quality is beyond the scope of this project, but some general correlations are evident from the data collected.

Based on the analysis of the invertebrate communities at each station the water quality of the test sites ranged from non-impacted to moderately impacted (see figure I). A breakdown by each category of the 20 stream stations assessed showed that 4 stations were non-impacted, 14 were slightly impacted and 2 were moderately impacted. For definitions of impact categories see appendix II.

Similar to the 2002 NY DEC statewide assessment, which found that 52% of the impacted stations were affected by non-point source nutrient enrichment (Bode et al., 2004), the most likely impairment in this present survey, by Impact Source Determination, is non-point source nutrient enrichment, affecting 60% of the impacted stations (see figure V). The remaining impacted stations are influenced by toxic or complex municipal/industrial discharge or sewage effluent/organic inputs.

This survey demonstrated a correlation between increasing specific conductance and declining water quality, based on resident benthic macroinvertebrates (figure II). Land use and the percent of impervious surface area have clearly been shown to affect water quality, and specific conductance can be used as an indicator of land use contaminants. Changes in conductivity begin to occur when impervious surface area in a catchment area reaches greater than ten percent. This type of calculation is beyond the scope of our current study, but figure III demonstrates land use in relationship to the study test sites (GIS data obtained from the USGS, NY Land Cover Data Set).

A correlation also occurred between specific conductance and decline in EPT richness (figure IV). With declining EPT richness there is a corresponding loss of sensitive fishes (Miltner and Rankin, 1998; Kilgour and Barton, 1999), and this may occur in waters assessed as slightly impacted.

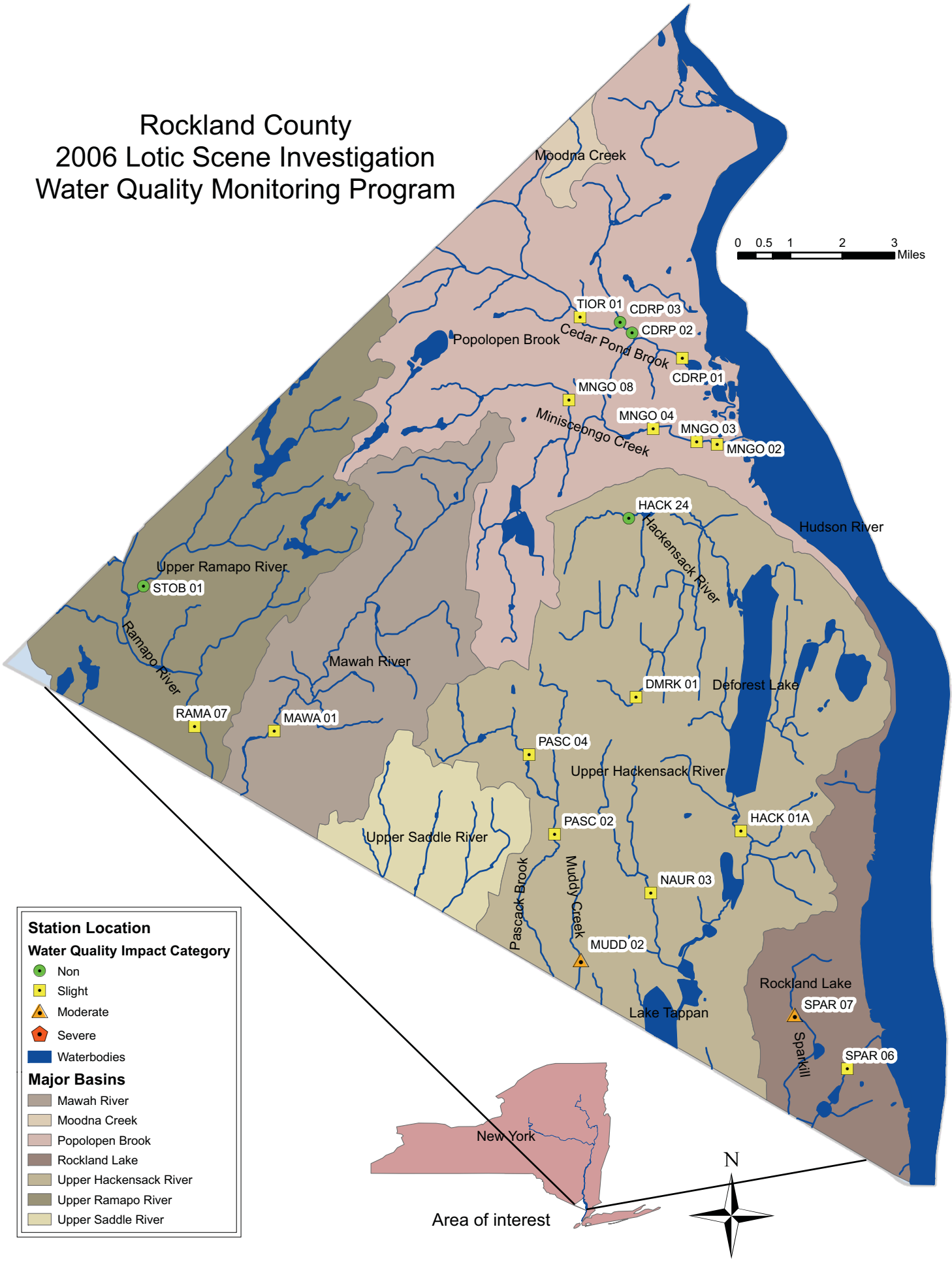
NYS DEC SBU has conducted numerous water quality assessments within Rockland County, providing valuable historical documentation of the county's water quality for longitudinal water quality trend monitoring. Several stations assessed during this survey were previously assessed by NYS DEC; when feasible, the data from NYS DEC assessments were incorporated into this survey to provide trend analysis. It may be a worthwhile project for Rockland County Soil and Water District to produce a county water quality trend report utilizing all available macroinvertebrate data.

Description of Remaining Sections of this Report

An overview map of Rockland County containing all sites assessed in 2006, with corresponding steam name, station number, and water quality category, precedes narrative descriptions and BAP graphs for each major watershed basin in Rockland

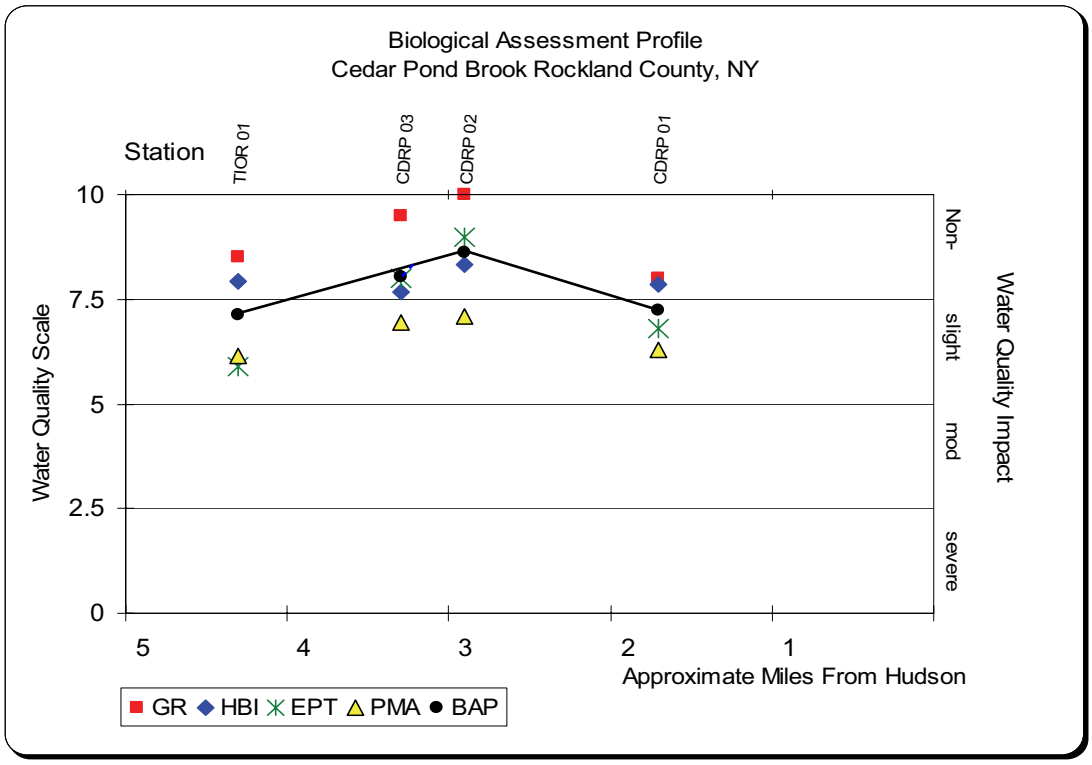
County.

Following this, the physical and chemical data page and macroinvertebrate community data page for each individual station sampled within the particular watershed is provided, which includes: site location, number, sampling date, physical and chemical data obtained, taxa identified, multi metric scores, biological assessment profile score, and ISD scores.



Mapping by Watershed Assessment Associates

Cedar Pond Brook



The biological assessment profile is comprised of four contributory indices that are determined from sub-samples of macroinvertebrates collected from each station. The solid line connects the BAP score between each station. The dashed lines indicate the approximate location where tributaries that were surveyed enter the stream/river.

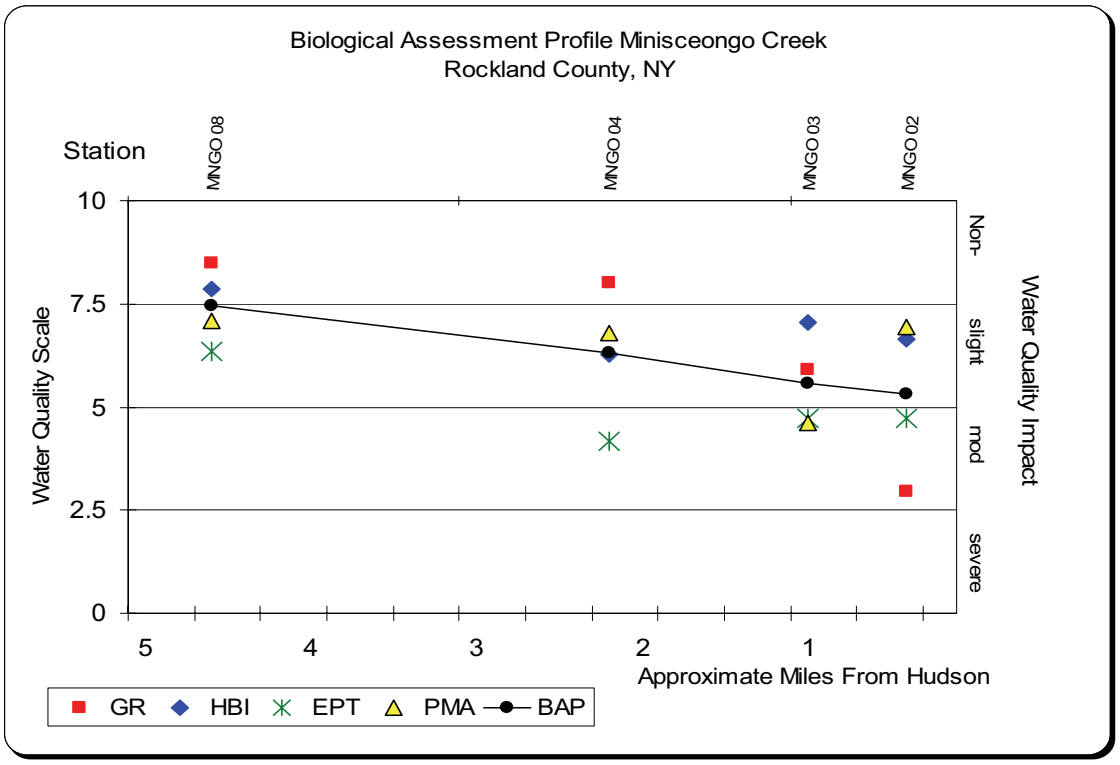
Station TIOR 01 is located just above the CR 106/210 Bridge. Based on the benthic macroinvertebrate sub-sample, water quality is slightly impacted and impact source determination is most similar to a natural, non-impacted community structure. This station was previously assessed by NYS DEC in 2002 as non-impacted.

Station CDRP 03 is located just above the West Main Street Bridge. This tributary of Cedar Pond Book enters approximately 0.9 miles downstream from station TIOR 01. Water quality, based on the benthic macroinvertebrate community, is non-impacted. ISD however, indicates a community structure most similar to one affected by non point source nutrients and complex inputs.

Station CDRP 02 is located just above Reservoir Road Bridge and approximately 2.4 miles below the upper most station, TIOR 01. Based on the benthic macroinvertebrate sub-sample, water quality is non-impacted and impact source determination is most similar to a natural, non-impacted community structure. Of note, this station had the highest BAP score (8.6) of all the stations assessed in Rockland County for this project.

Station CDRP 01 is located approximately 1.1 miles below Station CDRP 02 and just above Lowland Hill Road Bridge. Based on the benthic macroinvertebrate sub-sample, water quality dropped into the slightly impacted category compared to station CDRP 02. ISD is most similar to a natural, non-impacted community structure.

Minisceongo Creek



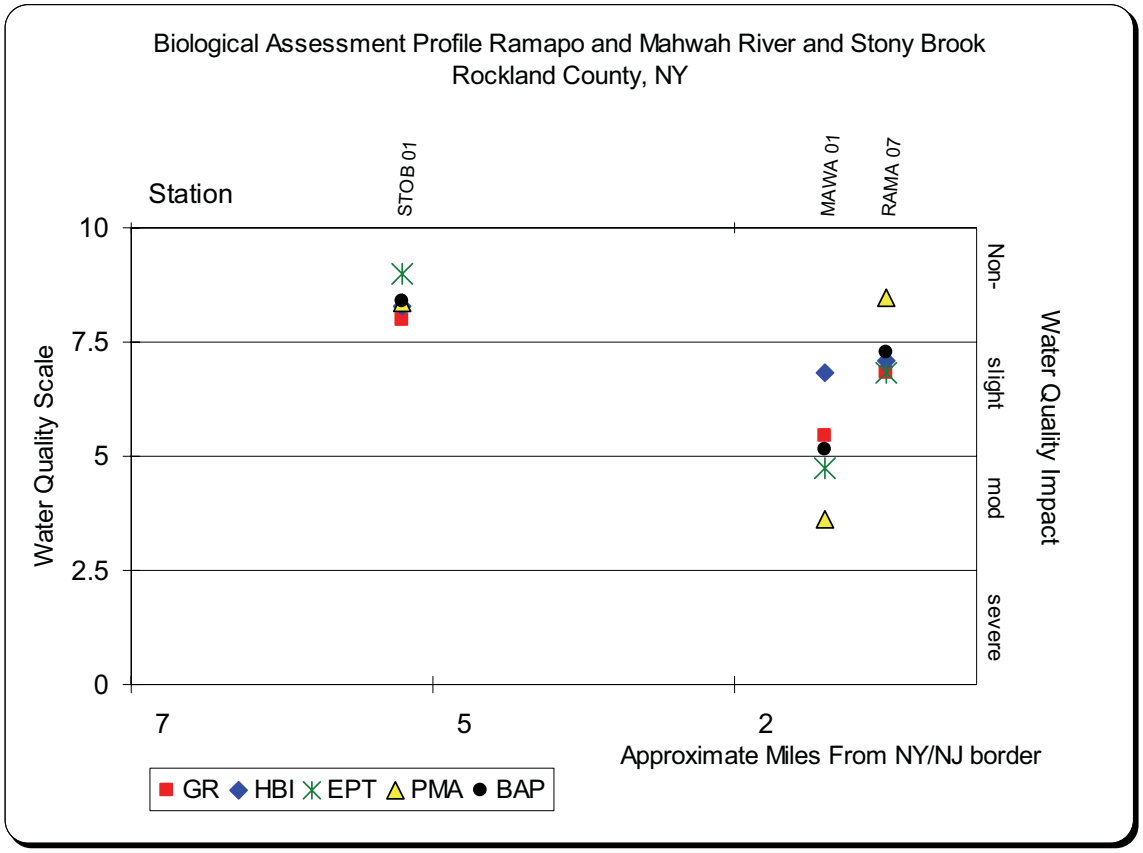
Station MNGO 08 is located approximately 5.6 miles above the confluence with the Hudson River just above Storrs Rd. Bridge. By benthic macroinvertebrate community structure, water quality is slightly impacted. ISD indicated a community structure most similar to one affected by non point source nutrient inputs.

Located approximately 2.2 miles below station MNGO 08, just off Church Street, station MNGO 04 is slightly impacted, based on the benthic macroinvertebrate community structure. The most likely cause of water quality impairment, by ISD, is complex municipal and industrial inputs.

Station MNGO 03 is located approximately 1.2 miles below station MNGO 04. Based on the benthic macroinvertebrate community structure, water quality is slightly impacted. ISD indicates a community structure affected by multiple stressors, including non point source, organic, and complex inputs. The ISD for impoundment is spurious, as no impound exists.

Station MNGO 02 is located approximately 0.9 miles below station MNGO 03, and water quality is slightly impacted by macroinvertebrate community structure. ISD indicates a community structure affected by multiple stressors, including non point source, organic, and complex inputs. The ISD for impoundment is spurious, as no impound exists.

Ramapo and Mahwah River and Stony Brook

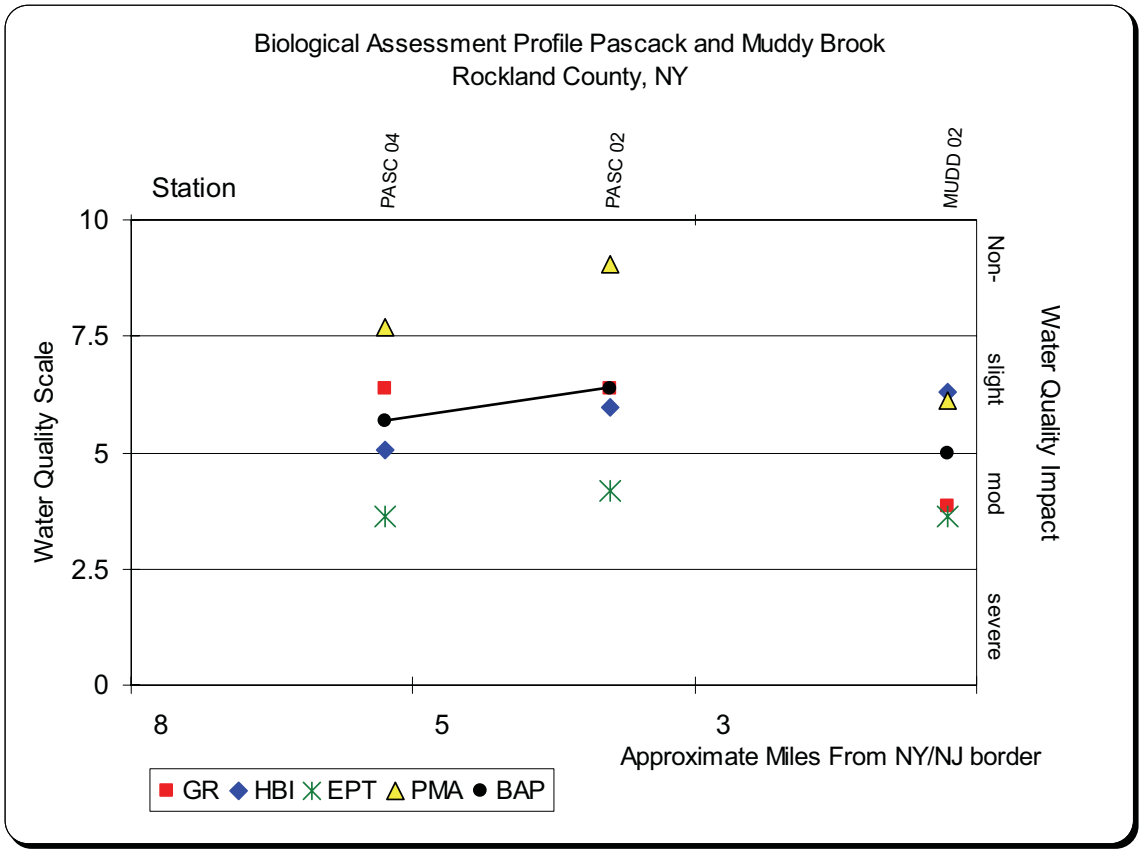


Located just above Seven Lakes Road Bridge, station STOB 01 water quality is non-impacted and most similar to a natural community by macroinvertebrate community structure and ISD. The NYS DEC also assessed water quality here as non-impacted in 2002.

Station MAWA 01, located approximately 100 meters above Montebello Road Bridge, was slightly impacted, but the benthic macroinvertebrate community structure was close to the moderately impacted category. ISD indicated a community structure most affected by non point source nutrient enrichment. NYS DEC assessed this station as slightly impacted in 2001.

Located just above the Fourth Street Bridge, station RAMA 07 was slightly impacted, though near the non-impacted category, based on the benthic macroinvertebrate community structure. ISD indicated a community structure most similar to a natural community and one affected by non point source nutrient additions. NYS DEC assessed this station in 1991, 1993, 1997, 1998, 2002, and 2003. Compared to those years, the water quality shows improvement, based on the benthic macroinvertebrate community structure.

Pascack and Muddy Brook

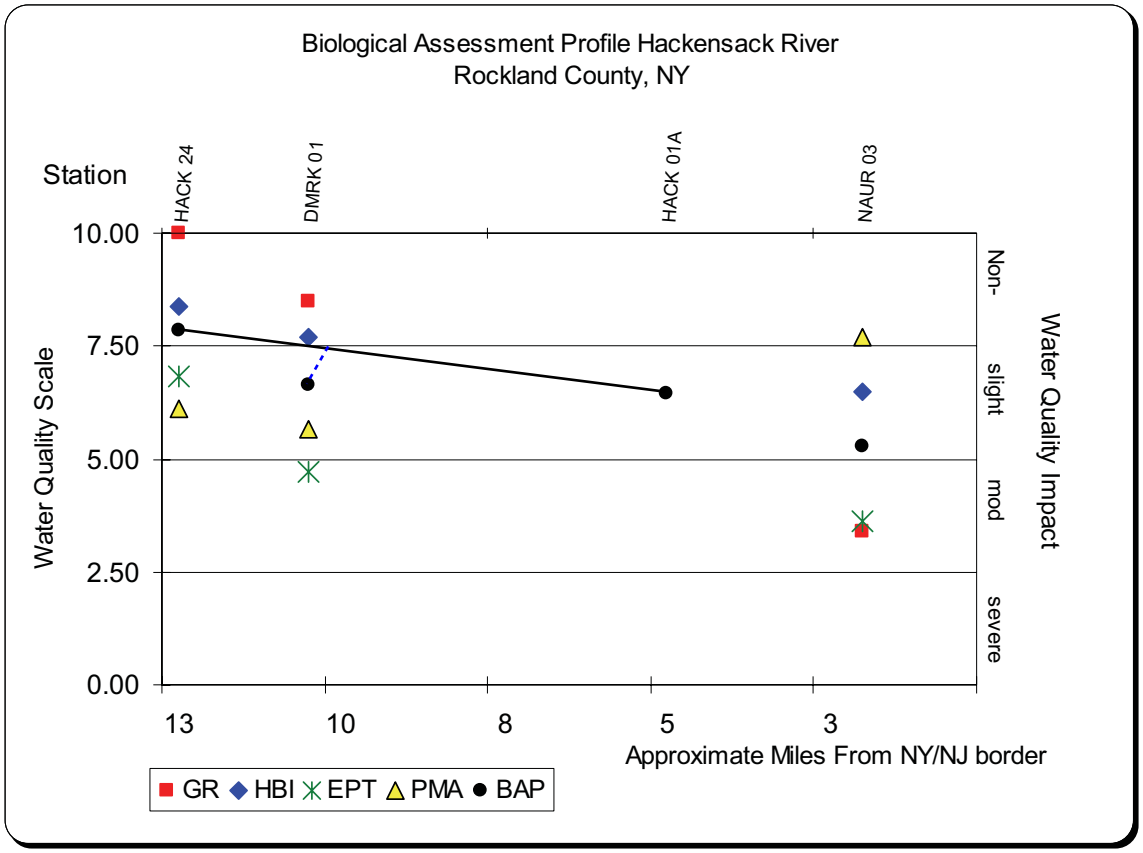


PASC 04 is located approximately 5.4 miles above the NY/NJ border, just off Memorial Park Drive. Water quality, based on the benthic macroinvertebrate community structure, is slightly impacted and the ISD indicates a community structure affected by multiple stressors, including non point source nutrients, toxins, and organic and complex municipal industrial inputs.

Station PASC 02 is located approximately 1.4 miles below station PASC 04. Water quality, based on the benthic macroinvertebrate community structure is slightly impacted and ISD indicates a community structure most similar to a natural community or one affected by non point source nutrients and toxic inputs.

MUDD 02 is located just below the West Washington Avenue Bridge. Water quality is moderately impacted, falling just outside the slightly impacted category by macroinvertebrate community structure. ISD indicated a community structure most similar to one affected by toxic inputs.

Hackensack River



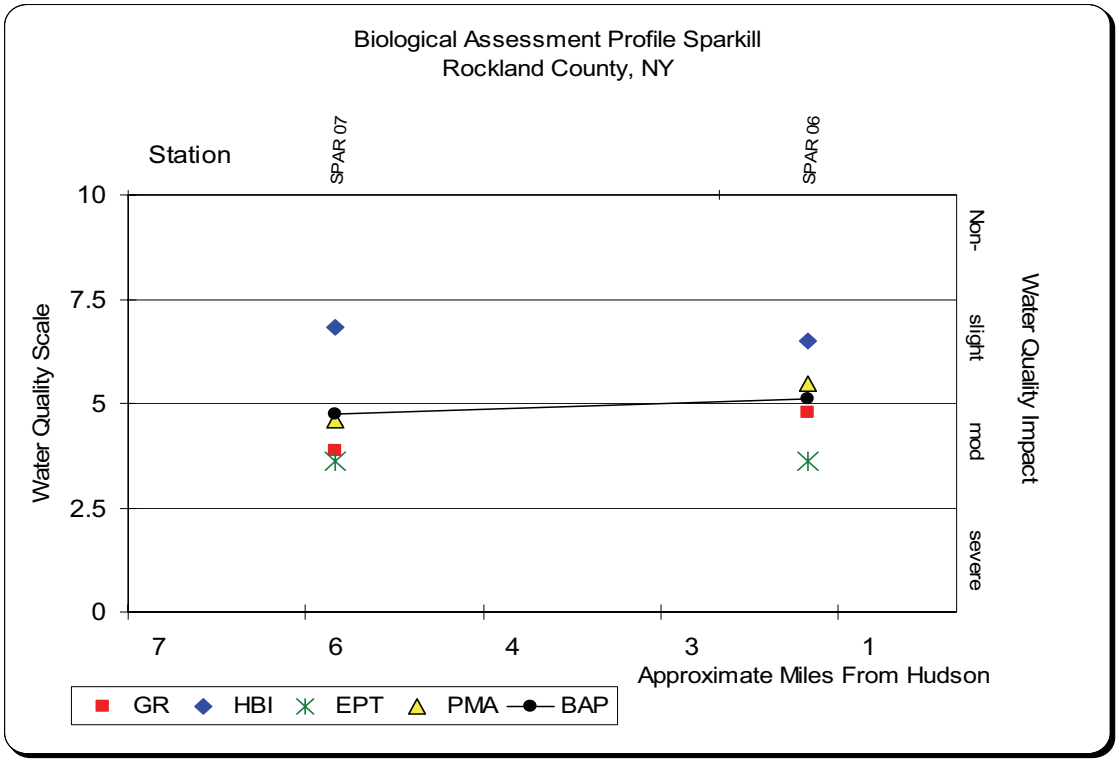
Station HACK 24 is located approximately 13 miles above the NY/NJ border and just above the Old Route 304 Bridge. Water quality, based on the benthic macroinvertebrate community structure, is non-impacted. This station had the highest genera richness of any station assessed, with 30 taxa identified in the sub-sample. ISD indicated a natural non-impacted community structure.

Located just above Sittle Torr Road Bridge, station DMRK 01 was slightly impacted. ISD indicated a community most likely affected by non point source nutrients, complex inputs, and impoundment effects. While the station is located below a small wetland, the dominant surrounding land use is residential and the immediate adjacent land use is a commercial nursery.

Located just below the railroad bridge at the end of Fulton Avenue, station HACK 01A is moderately impacted based on the benthic macroinvertebrate community structure. ISD indicated multiple stressors, including: non point source nutrients, toxins, complex inputs and impoundment effects. The station is located below Lake de Forest, which likely has a major influence on the community structure at this station. Therefore, as outlined in the QAWP (Bode et al., 2002), the BAP was adjusted up one category to reflect genuine water quality and was categorized as slightly impacted.

Station NAUR 03 is located just below the Town Line Road Bridge and the water quality is slightly impacted, though nearing the moderately impacted category. ISD indicates a community most similar to one affected by non point source nutrients and complex municipal and industrial inputs. In 2002, the NYS DEC assessed the stream well below this station as moderately impacted.

Sparkill



Station SPAR 07 is located approximately 4.3 miles above the confluence with the Hudson River, just below the Route 340 Bridge. Based on the benthic macroinvertebrate community structure, water quality is moderately impacted. ISD indicates the community is most likely affected by non point source nutrients and complex municipal and industrial inputs. ISD for impoundment is considered spurious.

Located approximately 4 miles downstream from station SPAR 07 and just below the New Street Bridge, station SPAR 06 is slightly impacted and close to the moderately impacted category. ISD indicates a benthic macroinvertebrate community structure most similar to one affected by toxic and organic inputs. The NYS DEC assessed this station in 2003 and determined the water quality was moderately impacted.

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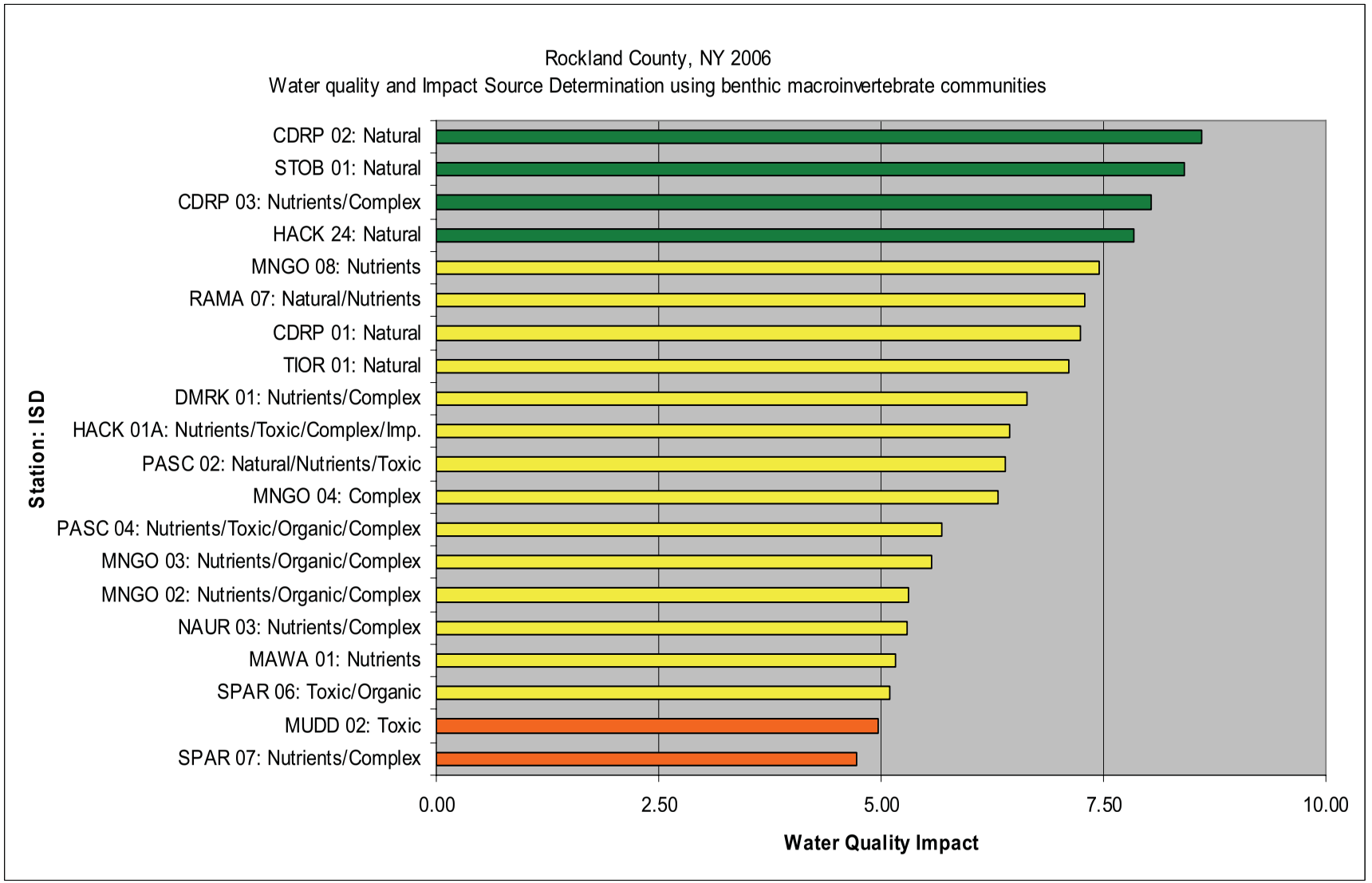


Biological Assessment Profile Scale of Water Quality and impact categories

Figure I. For further explanation of the biological assessment profile and complete definitions of impact categories see appendix II.

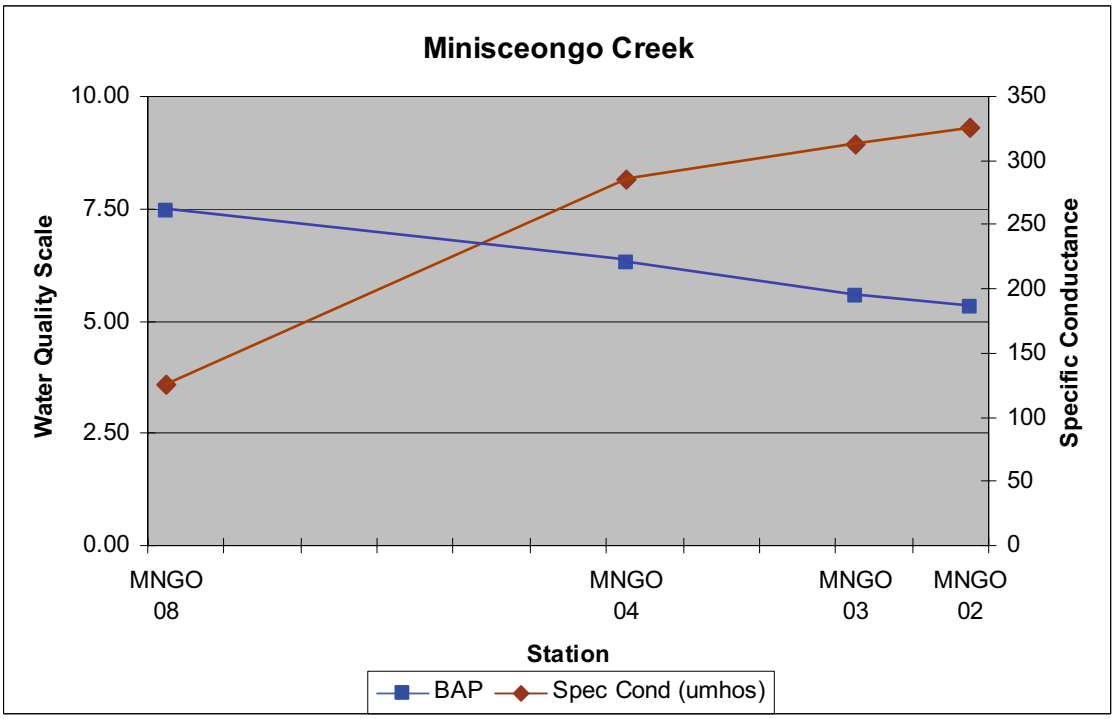
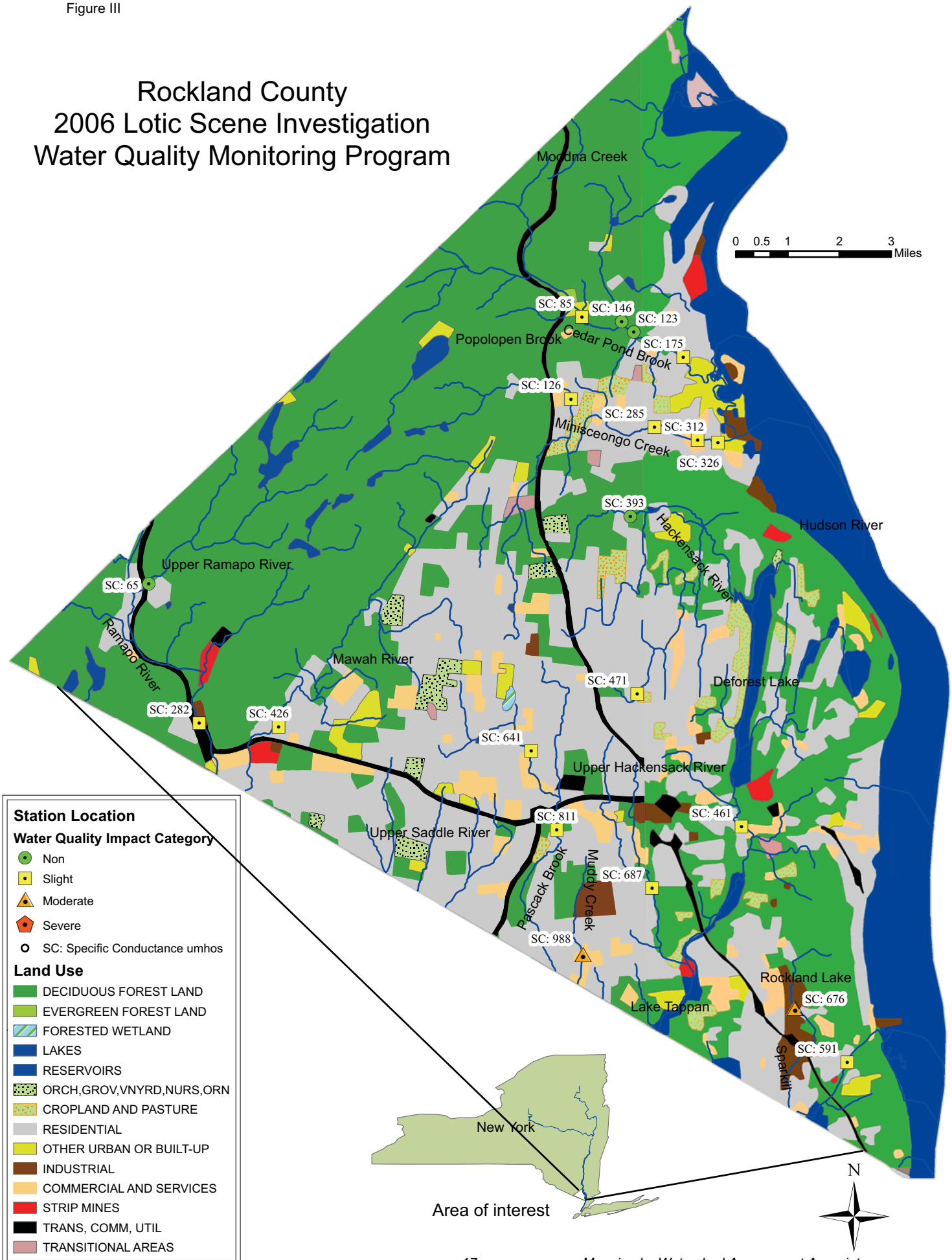


Figure II. Graph depicts the inverse relationship between specific conductance and BAP scores for Minisceongo Creek surveyed in Rockland County, NY during 2006.

Figure III

Rockland County
2006 Lotic Scene Investigation
Water Quality Monitoring Program



Mapping by Watershed Assessment Associates

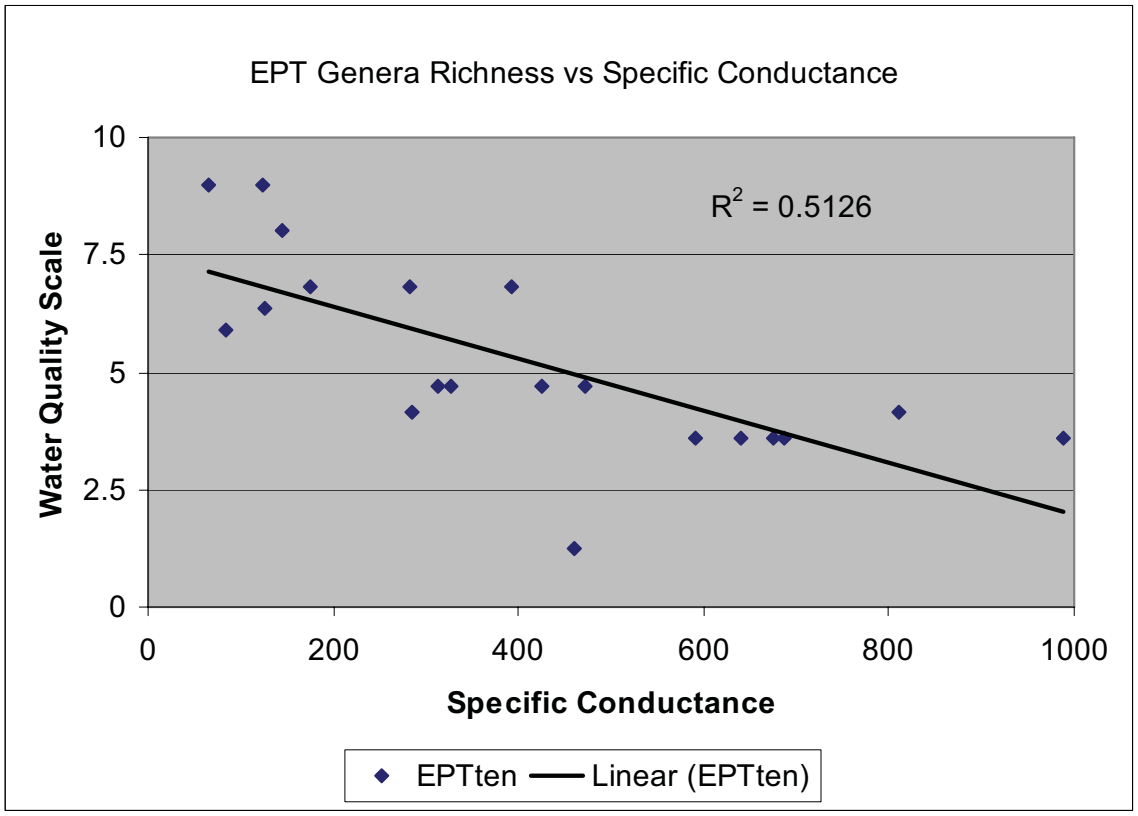
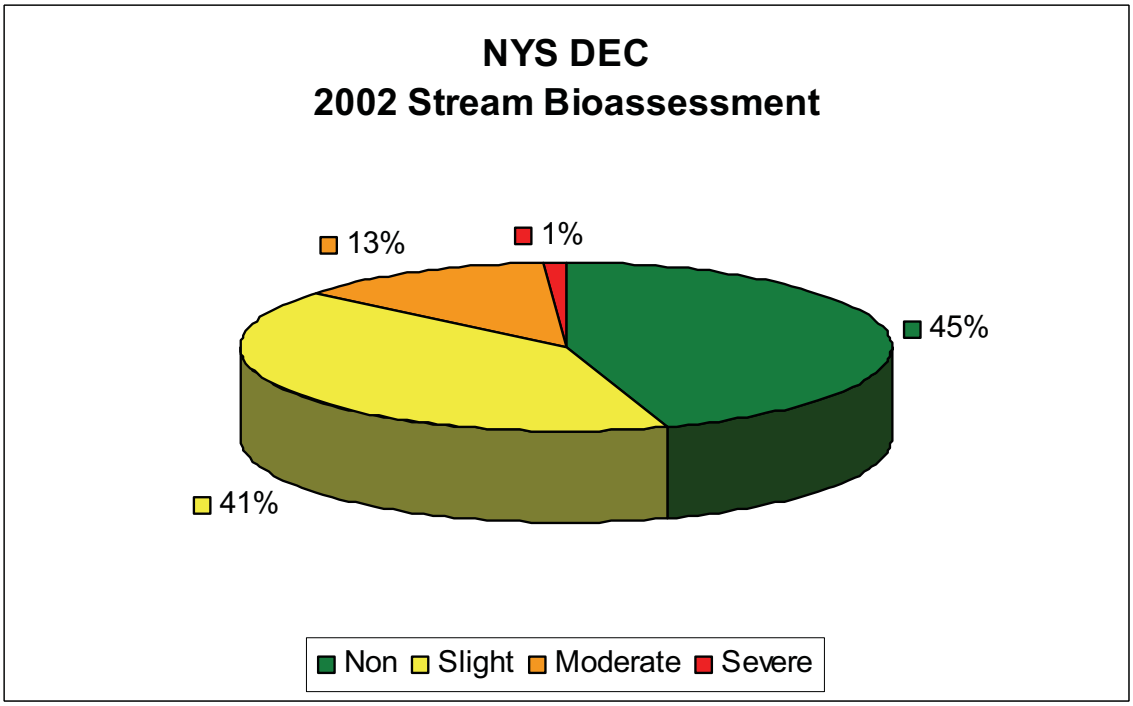


Figure IV. Graph depicts the inverse relationship between specific conductance and EPT richness for 20 stream sites surveyed in Rockland County, NY during 2006. A log trend line r2 = 0.51 is shown in black. Benthic macroinvertebrates can be used as a surrogate measure for the fish community; because loss of EPT taxa corresponds with a decreasing number of sensitive fishes (Kilgour and Barton, 1999: Miltner and Rankin, 1998), it can be used to predict their decline. There is no evidence that specific conductance exerts a negative effect on macroinvertebrates, but instead is a marker of anthropogenic effects within the watershed.



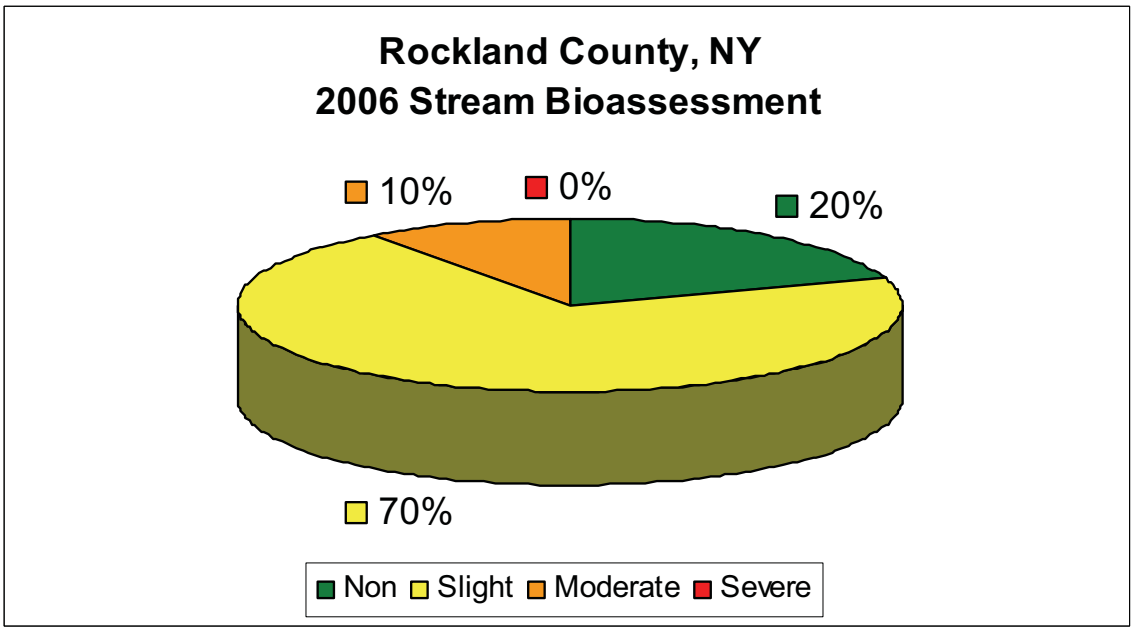


Figure V. Water quality categories of all NY State sites surveyed by NYS DEC in 2002 and all Rockland County sites surveyed by HBRW in 2006.

Glossary

Anthropogenic: caused by man

Assessment: a diagnosis or evaluation of water quality

Benthic: located on the bottom of a body of water or in the bottom sediments or pertaining to bottom-dwelling organisms

Benthos: organisms occurring on or in the bottom substrate of a waterbody

Biomonitoring: the use of biological indicators to measure water quality

Diel cycle: referring to the 24 hr day

Impact: a change in the physical, chemical, or biological condition of a waterbody

Impairment: a detrimental effect caused by an impact

Index: a number, metric, or parameter derived from sample data used as a measure of water quality

Intolerant: unable to survive poor water quality

Macroinvertebrate: a larger-than-microscopic invertebrate animal that lives at least part of its life in aquatic habitats

Non point source: diffuse pollution sources (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet)

Periphyton: are algae that grow on a variety of submerged substrates, such as rocks, plants or debris, in lakes or streams

Point source: a stationary location or fixed facility from which pollutants are discharged or emitted. Also, any single identifiable source of pollution, e.g., a pipe, ditch, ship, ore pit, factory smokestack

Rapid bioassessment: a biological diagnosis of water quality using field and laboratory analysis designed to allow assessment of water quality in a short turn-around-time; usually involves kick sampling and laboratory subsampling of the sample

Station: a sampling site on a waterbody

Stenotherms: organisms having a very narrow thermal tolerance and preferring cooler temperatures

Survey: a set of sampling conducted in succession along a stretch of stream

Tolerant: able to survive poor water quality

Biological Assessment Profile: Conversion of Index Values to Common 10-Scale.

The Biological Assessment Profile of index values, developed by Phil O'Brien, Division of Water NYS DEC, is a method of plotting biological index values on a common scale of water quality impact. Values from the four indices defined previously are converted to a common 0-10 scale using the formulae in the NYS DEC Quality Assurance document (Bode *et al*., 2002).

Water Quality Impact Categories

Non-impacted: Indices reflect very good water quality. The macroinvertebrate community is diverse, usually greater than 13 families in riffle habitats. Mayflies, stoneflies, and caddisflies are well represented; EPT family richness is greater than 7. The biotic index value is 4.50 or less. Percent model affinity is greater than 64. Water quality should not be limiting to fish survival or propagation. This level of water quality includes both pristine habitats and those receiving discharges which minimally alter the biota.

Slightly impacted: Indices reflect good water quality. The macroinvertebrate community is slightly but significantly altered from the pristine state. Family richness usually is 10 -13. Mayflies and stoneflies may be restricted, with EPT values of 3-7. The biotic index value is 4.51-5.50. Percent model affinity is 50-64. Water quality is usually not limiting to fish survival, but may be limiting to fish propagation.

Moderately impacted: Indices reflect poor water quality. The macroinvertebrate community is altered to a large degree from the pristine state. Family richness usually is 7-9. Mayflies and stoneflies are rare or absent, and caddisflies are often restricted; EPT richness is 1-2. The biotic index value is 5.51-7.00. The percent model affinity value is 35-49. Water quality often is limiting to fish propagation, but usually not to fish survival.

Severely impacted: Indices reflect very poor water quality. The macroinvertebrate community is limited to a few tolerant Families. Family richness is less than 7. Mayflies, stoneflies, and caddisflies are rare or absent; EPT richness is 0. The biotic index value is greater than 7.01-10. Percent model affinity is less than 35. The dominant species are almost all tolerant, and are usually midges and worms. Often 1-2 species are very abundant. Water quality is often limiting to both fish propagation and fish survival.

NYS DEC Methods for Impact Source Determination

Definition: Impact Source Determination (ISD) is the procedure for identifying types of impacts that exert deleterious effects on a waterbody. While the analysis of benthic macroinvertebrate communities has been shown to be an effective means of determining severity of water quality impacts, it has been less effective in determining what kind of pollution is causing the impact. Impact Source Determination uses community types or models to ascertain the primary factor influencing the fauna.

Development of methods: The method found to be most useful in differentiating impacts in New York State streams was the use of community types, based on composition by family and genus. It may be seen as an elaboration of Percent Model Affinity (Novak and Bode, 1992), which is based on class and order. A large database of macroinvertebrate data was required to develop ISD methods. The database included several sites known or presumed to be impacted by specific impact types. The impact types were mostly known by chemical data or land use. These sites were grouped into the following general categories: agricultural nonpoint, toxic-stressed, sewage (domestic municipal), sewage/toxic, siltation, impoundment, and natural. Each group initially contained 20 sites. Cluster analysis was then performed within each group, using percent similarity at the family or genus level. Within each group four clusters were identified, each cluster usually composed of 4-5 sites with high biological similarity. From each cluster a hypothetical model was then formed to represent a model cluster community type; sites within the cluster had at least 50 percent similarity to this model. The method was tested by calculating percent similarity to all the models, and determining which model was the most similar to the test site. New models are developed when similar communities are recognized from several streams.

Use of ISD methods: Impact Source Determination is based on similarity to existing models of community types. The model that exhibits the highest similarity to the test data denotes the likely impact source type, or may indicate “natural”, lacking an impact. In the graphic representation of ISD, only the highest similarity of each source type is identified, and similarities that are within 5% of the highest. Similarities less that 50% are considered less conclusive. The determination of impact source type is used in conjunction with assessment of severity of water quality impact to provide an overall assessment of water quality.

Limitations: These methods were developed for data derived from 100-organism subsamples of traveling kick samples from riffles of New York State streams. Application of the methods for data derived from other sampling methods, habitats, or geographical areas would likely require modification of the models.

Field Data Summary

Stream name: **Cedar Pond Brook** Watershed: **Hudson** ID: **TIOR**

Location: **Just above CR 106/210 bridge** Station: **01**

Municipality: **Stony Point** **Rockland Co. NY**

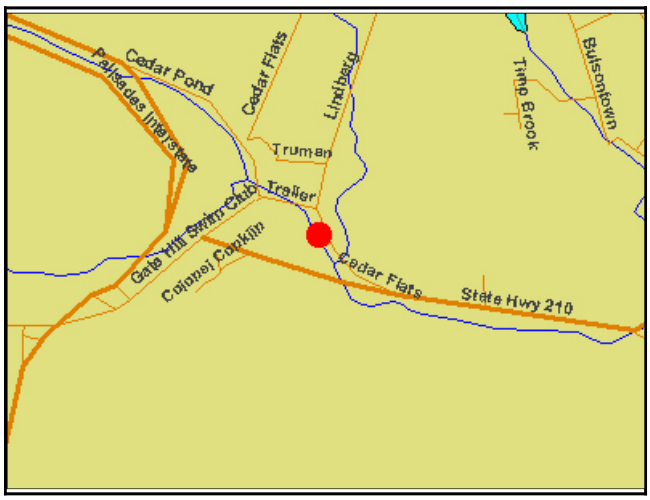
Date sampled: **Friday, July 14, 2006**

Arrival time at station: **5:55 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**6.6**
Depth (meters)	**0.2**
Current (cm/sec)	**1.2**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**10**
Rubble (6.35 - 25.4 cm)	**60**
Gravel (0.2 - 6.35 cm)	**15**
Sand (0.06 - 2.0 cm)	**10**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**19.31**
Specific conductance (umhos)	**85**
DO (mg/l)	**8.42**
DO % saturation	**91.2**
Baro pressure (mm)	**756**
pH	**7**
Salinity (PSS)	**0.04**
Biological Attributes	
Canopy (%)	**60**
Aquatic vegetation	
Algae suspended	
Algae filamentous	
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	**Y**
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	
Simuliidae	
Decapoda	
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	Diptera
Field faunal condition	**Very good**

Notes/observations:



Latitude: 41° 14.294

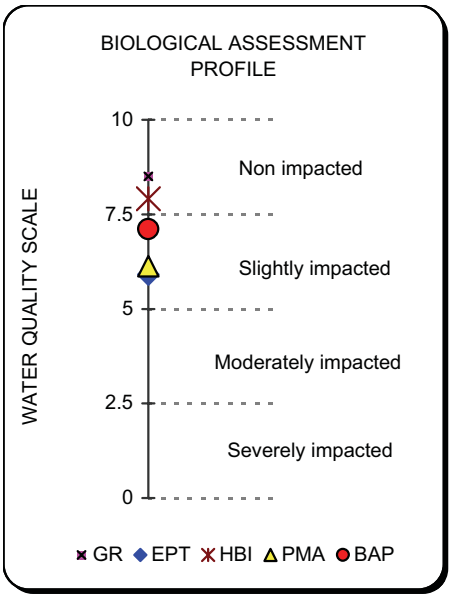
Longitude: 74° 01.329

Deg. Min.

STREAM SITE: Cedar Pond Brook TIOR 01
LOCATION: Just above CR 106/210 bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

ANNELIDA			
OLIGOCHAETA			
		Undetermined Oligochaeta	1
	Sphaeriidae	Undetermined Sphaeriidae	1
ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	7
	Ephemerellidae	Ephemerella sp.	1
PLECOPTERA	Perlidae	Acroneuria sp.	4
		Perlesta sp.	6
	Pteronarcidae	Pteronarcys sp.	1
COLEOPTERA	Psephenidae	Psephenus herricki	2
		Ectopria nervosa	1
TRICHOPTERA	Philopotamidae	Dolophilodes sp.	1
	Hydropsychidae	Hydropsyche sp.	11
DIPTERA	Tipulidae	Hexatoma sp.	8
	Chironomidae	Thienemannimyia gr. spp.	2
		Undetermined Orthocladiinae	1
		Rheocricotopus sp.	2
		Thienemanniella xena	1
		Microtendipes pedellus gr.	1
		Microtendipes rydalensis gr.	2
		Polypedilum aviceps	38
		Polypedilum flavum	1
		Undetermined Chironomini	1
		Rheotanytarsus sp.	3
		Tanytarsus sp.	4

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 23
BIOTIC INDEX: 4.09
EPT RICHNESS: 7
MODEL AFFINITY: 56
ASSESSMENT: 7.11 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL **52**
NUTRIENT ADDITIONS 34
TOXIC 24
ORGANIC 26
COMPLEX 26
SILTATION 26
IMPOUNDMENT 25

Field Data Summary

Stream name: **Cedar Pond Brook** Watershed: **Hudson** ID: **CDRP**

Location: **Just above W. Main Street bridge** Station: **03**

Municipality: **Stony Point** **Rockland Co. NY**

Date sampled: **Friday, July 14, 2006**

Arrival time at station: **8:18 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**4**
Depth (meters)	**0.25**
Current (cm/sec)	**98**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**20**
Rubble (6.35 - 25.4 cm)	**50**
Gravel (0.2 - 6.35 cm)	**15**
Sand (0.06 - 2.0 cm)	**10**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**22.78**
Specific conductance (umhos)	**146**
DO (mg/l)	**8.09**
DO % saturation	**93.6**
Baro pressure (mm)	**759**
pH	**7.13**
Salinity (PSS)	**0.07**
Biological Attributes	
Canopy (%)	**70**
Aquatic vegetation	
Algae suspended	
Algae filamentous	
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	**Y**
Trichoptera	**Y**
Coleoptera	
Megaloptera	**Y**
Odonata	**Y**
Chironomidae	
Simuliidae	
Decapoda	
Gammaridae	
Mollusca	
Oligochaeta	**Y**
Other macroinvertebrates	
Field faunal condition	**Very good**

Notes/observations:

Flow

Flow

Scale: 1 mile

Latitude: 41° 14.210

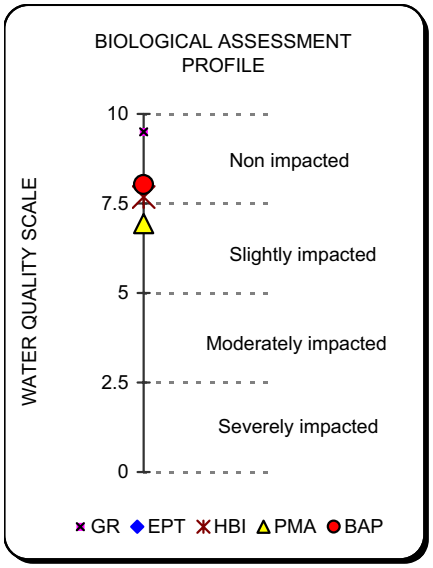
Longitude: 74° 00.446

Deg. Min.

STREAM SITE: Timp Mtn. Brook CDRP 03
LOCATION: Just above W. Main Street bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Isonychiidae	Isonychia sp.	1
	Baetidae	Acentrella sp.	6
		Baetis sp.	7
	Ephemerellidae	Ephemerella sp.	5
PLECOPTERA	Perlidae	Acroneuria sp.	2
ODONATA	Gomphidae	Undetermined Gomphidae	2
MEGALOPTERA	Corydalidae	Corydalus cornutus	1
TRICHOPTERA	Philopotamidae	Chimarra sp.	1
	Hydropsychidae	Cheumatopsyche sp.	21
		Hydropsyche sp.	16
	Rhyacophilidae	Rhyacophila sp.	1
	Hydroptilidae	Hydroptila sp.	1
	Lepidostomatidae	Undetermined Lepidostomatidae	1
DIPTERA	Tipulidae	Antocha sp.	1
		Dicranota sp.	2
		Hexatoma sp.	2
		Undetermined Tipulidae	1
	Empididae	Undetermined Empididae	1
	Chironomidae	Thienemannimyia gr. spp.	4
		Diamesa sp.	1
		Microtendipes pedellus gr.	1
		Microtendipes rydalensis gr.	1
		Polypedilum aviceps	11
		Polypedilum flavum	4
		Rheotanytarsus sp.	6

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 25
BIOTIC INDEX: 4.32
EPT RICHNESS: 11
MODEL AFFINITY: 61
ASSESSMENT: 8 (Non impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 51
NUTRIENT ADDITIONS **58**
TOXIC 42
ORGANIC 47
COMPLEX **56**
SILTATION 39
IMPOUNDMENT 47

Field Data Summary

Stream name: **Cedar Pond Brook** Watershed: **Hudson** ID: **CDRP**

Location: **Just above Reservoir Rd. bridge** Station: **02**

Municipality: **Stony Point** **Rockland Co. NY**

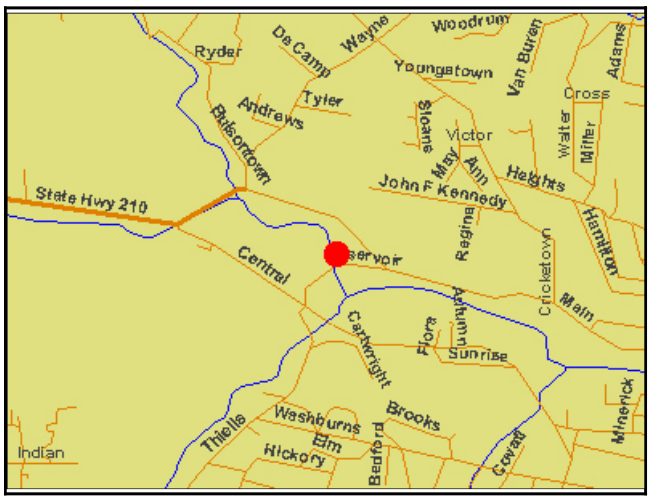
Date sampled: **Friday, July 14, 2006**

Arrival time at station: **7:30 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**9**
Depth (meters)	**0.25**
Current (cm/sec)	**95**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**10**
Rubble (6.35 - 25.4 cm)	**60**
Gravel (0.2 - 6.35 cm)	**15**
Sand (0.06 - 2.0 cm)	**10**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**19.94**
Specific conductance (umhos)	**123**
DO (mg/l)	**8.39**
DO % saturation	**91.9**
Baro pressure (mm)	**760**
pH	**7.14**
Salinity (PSS)	**0.06**
Biological Attributes	
Canopy (%)	**75**
Aquatic vegetation	
Algae suspended	
Algae filamentous	
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	**Y**
Trichoptera	**Y**
Coleoptera	**Y**
Megaloptera	**Y**
Odonata	
Chironomidae	
Simuliidae	
Decapoda	
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	
Field faunal condition	**Very good**

Notes/observations:



Latitude: 41° 14.035

Longitude: 74° 00.180

Deg. Min.

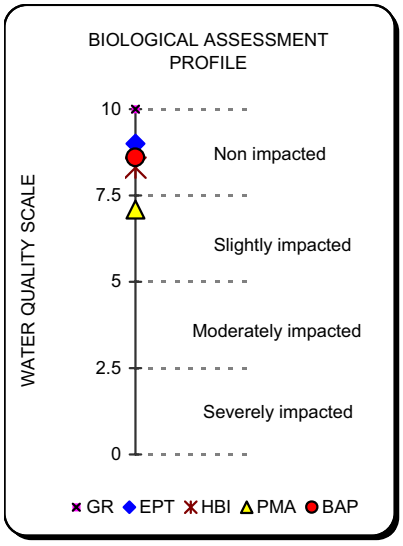
Appendix III

STREAM SITE: Cedar Pond Brook CDRP 02
LOCATION: Just above Reservoir Rd. bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

ARTHROPODA
INSECTA

EPHEMEROPTERA	Baetidae	Acentrella sp.	5
		Baetis sp.	2
	Ephemerellidae	Ephemerella sp.	11
PLECOPTERA	Leuctridae	Leuctra sp.	1
	Perlidae	Perlesta sp.	8
	Perlodidae	Undetermined Perlodidae	1
	Chloroperlidae	Undetermined Chloroperlidae	1
ODONATA	Gomphidae	Stylogomphus sp.	1
COLEOPTERA	Psephenidae	Ectopria nervosa	1
		Psephenus herricki	2
	Elmidae	Promoresia sp.	1
MEGALOPTERA	Corydalidae	Corydalus cornutus	1
TRICHOPTERA	Philopotamidae	Chimarra sp.	1
		Dolophilodes sp.	2
	Hydropsychidae	Cheumatopsyche sp.	9
		Hydropsyche sp.	16
	Limnephilidae	Undetermined Limnephilidae	1
	Odontoceridae	Psilotreta sp.	2
DIPTERA	Tipulidae	Hexatoma sp.	1
	Empididae	Chelifera sp.	1
		Hemerodromia sp.	1
	Chironomidae	Diamesa sp.	2
		Brillia sp.	2
		Parametriocnemus sp.	1
		Microtendipes pedellus gr.	1
		Polypedilum aviceps	20
		Polypedilum flavum	3
		Rheotanytarsus sp.	2

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 28
BIOTIC INDEX: 3.69
EPT RICHNESS: 13
MODEL AFFINITY: 62
ASSESSMENT: 8.6 (Non impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL **55**
NUTRIENT ADDITIONS 43
TOXIC 31
ORGANIC 32
COMPLEX 39
SILTATION 32
IMPOUNDMENT 34

Field Data Summary

Stream name: **Cedar Pond Brook** Watershed: **Hudson** ID: **CDRP**

Location: **Just above Lowland Hill Rd. bridge** Station: **01**

Municipality: **Stony Point** **Rockland Co. NY**

Date sampled: **Friday, July 14, 2006**

Arrival time at station: **6:45 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**8**
Depth (meters)	**0.25**
Current (cm/sec)	**46**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**10**
Rubble (6.35 - 25.4 cm)	**60**
Gravel (0.2 - 6.35 cm)	**15**
Sand (0.06 - 2.0 cm)	**15**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**19.65**
Specific conductance (umhos)	**175**
DO (mg/l)	**8.8**
DO % saturation	**95**
Baro pressure (mm)	**756**
pH	**7.25**
Salinity (PSS)	**0.08**
Biological Attributes	
Canopy (%)	**50**
Aquatic vegetation	
Algae suspended	
Algae filamentous	
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	**Y**
Trichoptera	**Y**
Coleoptera	**Y**
Megaloptera	
Odonata	
Chironomidae	
Simuliidae	
Decapoda	
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	
Field faunal condition	**Very good**

Notes/observations:

Latitude: 41° 13.608

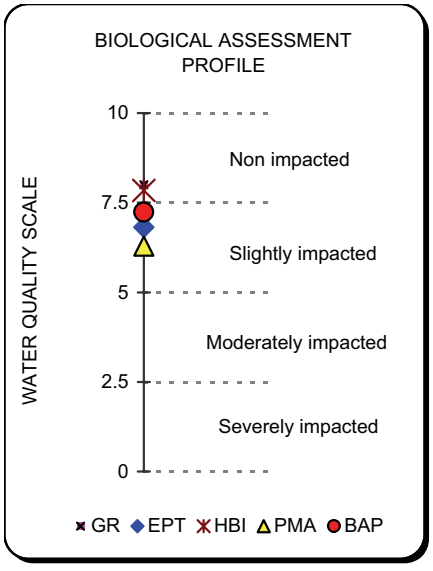
Longitude: 73° 59.079

Deg. Min.

STREAM SITE: Cedary Pond Brook CDRP 01
LOCATION: Just above Lowland Hill Rd. bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

ANNELIDA			
OLIGOCHAETA			
		Undetermined Oligochaeta	1
ARTHROPODA			
CRUSTACEA			
ISOPODA	Asellidae	Caecidotea sp.	1
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	5
	Ephemerellidae	Ephemerella sp.	5
PLECOPTERA	Perlidae	Acroneuria sp.	2
		Perlesta sp.	3
COLEOPTERA	Psephenidae	Psephenus herricki	5
	Elmidae	Optioservus sp.	2
TRICHOPTERA	Philopotamidae	Chimarra sp.	4
		Dolophilodes sp.	2
	Hydropsychidae	Cheumatopsyche sp.	7
		Hydropsyche sp.	23
	Limnephilidae	Undetermined Limnephilidae	1
DIPTERA	Tipulidae	Antocha sp.	1
	Empididae	Undetermined Empididae	2
	Chironomidae	Diamesa sp.	2
		Cardiocladius obscurus	8
		Tvetenia sp.	1
		Microtendipes pedellus gr.	2
		Polypedilum aviceps	18
		Rheotanytarsus sp.	4
		Tanytarsus sp.	1

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 22
BIOTIC INDEX: 4.16
EPT RICHNESS: 9
MODEL AFFINITY: 57
ASSESSMENT: 7.2 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL **60**
NUTRIENT ADDITIONS 54
TOXIC 32
ORGANIC 42
COMPLEX 40
SILTATION 42
IMPOUNDMENT 46

Field Data Summary

Stream name: **Minisceongo Creek** Watershed: **Hudson** ID: **MNGO**

Location: **Just above Storrs Rd. bridge** Station: **08**

Municipality: **Haverstraw** **Rockland Co. NY**

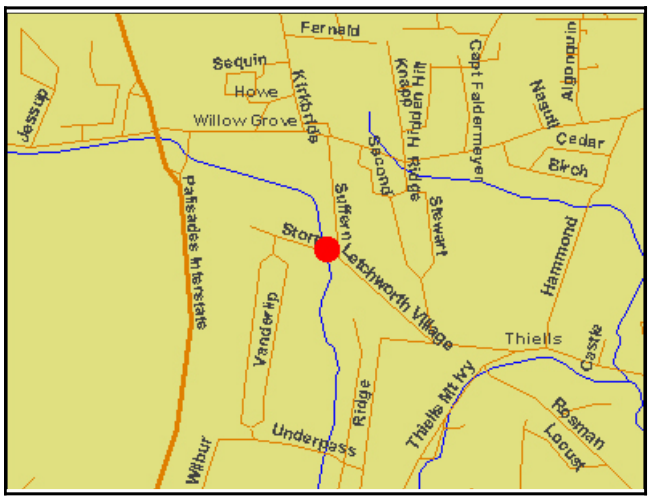
Date sampled: **Friday, July 14, 2006**

Arrival time at station: **8:52 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**6**
Depth (meters)	**0.15**
Current (cm/sec)	**85**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**5**
Rubble (6.35 - 25.4 cm)	**30**
Gravel (0.2 - 6.35 cm)	**30**
Sand (0.06 - 2.0 cm)	**20**
Silt (0.004 - 0.06 cm)	**15**
Embeddedness (%)	**40**
Chemical Measurements	
Temperature (C)	**20.48**
Specific conductance (umhos)	**126**
DO (mg/l)	**8.28**
DO % saturation	**91.5**
Baro pressure (mm)	**753**
pH	**6.6**
Salinity (PSS)	**0.06**
Biological Attributes	
Canopy (%)	**40**
Aquatic vegetation	
Algae suspended	
Algae filamentous	
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	**Y**
Trichoptera	**Y**
Coleoptera	**Y**
Megaloptera	
Odonata	
Chironomidae	
Simuliidae	
Decapoda	**Y**
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	Diptera;
Field faunal condition	**Very good**

Notes/observations: Pteranarcy, an intolerant Stonefly, is noted in the field sample.



Latitude: 41° 12.920

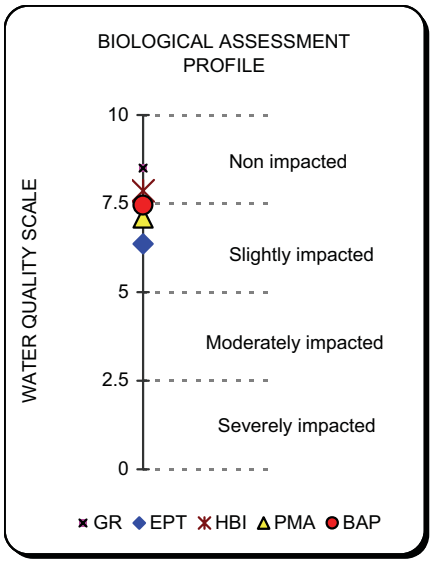
Longitude: 74° 01.583

Deg. Min.

STREAM SITE: Minisceongo Creek MNGO 08
LOCATION: Just above Storrs Rd., bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

NEMERTEA			
		Prostoma graecense	1
		Undetermined Oligochaeta	1
ARTHROPODA			
CRUSTACEA			
DECAPODA	Cambaridae	Undetermined Cambaridae	1
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	6
	Ephemerellidae	Ephemerella sp.	3
PLECOPTERA	Perlidae	Perlesta sp.	2
COLEOPTERA	Psephenidae	Psephenus herricki	20
	Elmidae	Optioservus sp.	1
		Stenelmis sp.	5
TRICHOPTERA	Philopotamidae	Dolophilodes sp.	2
	Hydropsychidae	Cheumatopsyche sp.	3
		Hydropsyche sp.	20
	Glossosomatidae	Glossosoma sp.	1
	Rhyacophilidae	Rhyacophila sp.	2
DIPTERA	Tipulidae	Dicranota sp.	4
		Hexatoma sp.	6
	Chironomidae	Thienemannimyia gr. spp.	1
		Cardiocladius sp.	1
		Orthocladius sp.	4
		Rheocricotopus sp.	1
		Tvetenia sp.	2
		Polypedilum aviceps	7
		Rheotanytarsus sp.	6

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 23
BIOTIC INDEX: 4.14
EPT RICHNESS: 8
MODEL AFFINITY: 62
ASSESSMENT: 7.46 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 48
NUTRIENT ADDITIONS **53**
TOXIC 38
ORGANIC 35
COMPLEX 43
SILTATION 41
IMPOUNDMENT 42

Field Data Summary

Stream name: **Minisceongo Creek** Watershed: **Hudson** ID: **MNGO**

Location: **Just off Church St.** Station: **04**

Municipality: **Haverstraw** **Rockland Co. NY**

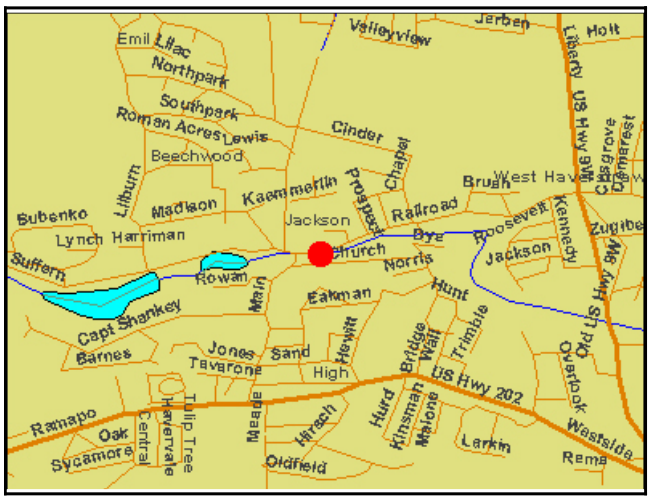
Date sampled: **Friday, July 14, 2006**

Arrival time at station: **9:33 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**12**
Depth (meters)	**0.2**
Current (cm/sec)	**68**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**35**
Rubble (6.35 - 25.4 cm)	**30**
Gravel (0.2 - 6.35 cm)	**10**
Sand (0.06 - 2.0 cm)	**15**
Silt (0.004 - 0.06 cm)	**10**
Embeddedness (%)	**50**
Chemical Measurements	
Temperature (C)	**22.04**
Specific conductance (umhos)	**285**
DO (mg/l)	**8.25**
DO % saturation	**93.8**
Baro pressure (mm)	**760**
pH	**7.27**
Salinity (PSS)	**0.14**
Biological Attributes	
Canopy (%)	**30**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	
Megaloptera	**Y**
Odonata	
Chironomidae	**Y**
Simuliidae	**Y**
Decapoda	
Gammaridae	**Y**
Mollusca	
Oligochaeta	
Other macroinvertebrates	Isopoda;
Field faunal condition	**Good**

Notes/observations:



Latitude: 41° 12.436

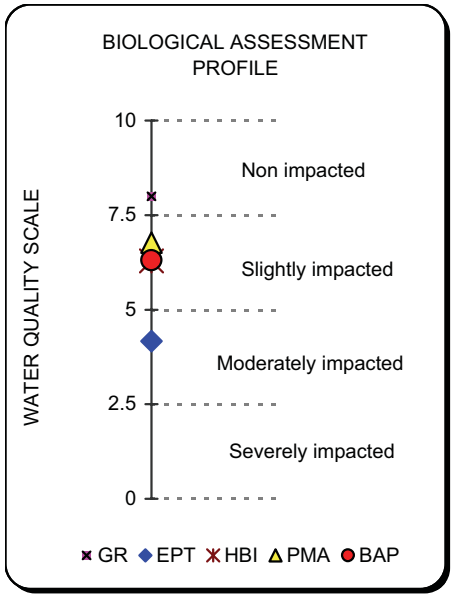
Longitude: 73° 59.729

Deg. Min.

STREAM SITE: Minisceongo Creek MNGO 04
LOCATION: Just off Church St.
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

PLATYHELMINTHES			
TURBELLARIA			
	Planariidae	Undetermined Turbellaria	1
		Undetermined Oligochaeta	1
ARTHROPODA			
CRUSTACEA			
ISOPODA	Asellidae	Caecidotea sp.	4
AMPHIPODA	Crangonyctidae	Crangonyx sp.	1
	Gammaridae	Gammarus sp.	15
INSECTA			
COLEOPTERA	Psephenidae	Psephenus herricki	1
	Elmidae	Stenelmis sp.	3
MEGALOPTERA	Corydalidae	Corydalus cornutus	1
TRICHOPTERA	Philopotamidae	Chimarra sp.	5
	Hydropsychidae	Cheumatopsyche sp.	10
		Hydropsyche sp.	14
DIPTERA	Tipulidae	Antocha sp.	1
	Simuliidae	Simulium sp.	1
	Empididae	Undetermined Empididae	3
	Chironomidae	Diamesa sp.	3
		Cardiocladius sp.	6
		Cricotopus sp.	6
		Orthocladius sp.	1
		Polypedilum aviceps	1
		Polypedilum flavum	18
		Polypedilum illinoense	1
		Rheotanytarsus sp.	3

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 22
BIOTIC INDEX: 5.47
EPT RICHNESS: 4
MODEL AFFINITY: 60
ASSESSMENT: 6.31 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 35
NUTRIENT ADDITIONS 58
TOXIC 54
ORGANIC 45
COMPLEX **69**
SILTATION 49
IMPOUNDMENT 47

Field Data Summary

Stream name: **Minisceongo Creek** Watershed: **Hudson** ID: **MNGO**

Location: **Just above RR bridge accessed from Joseph St.** Station: **03**

Municipality: **Haverstraw** **Rockland Co. NY**

Date sampled: **Friday, July 14, 2006**

Arrival time at station: **11:26 AM**

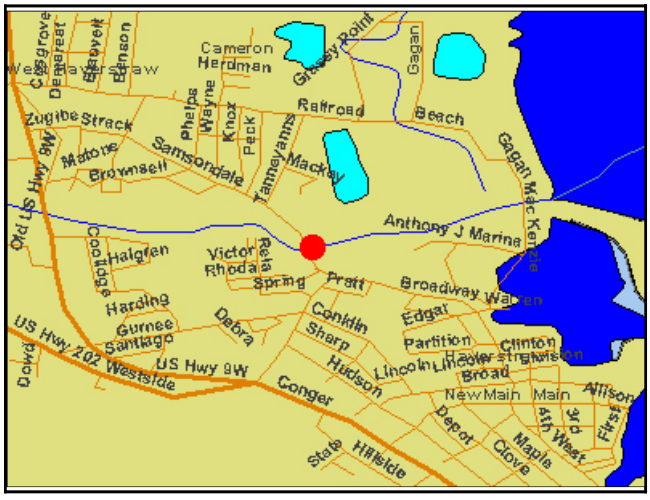
Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**10**
Depth (meters)	**0.25**
Current (cm/sec)	**50**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**5**
Rubble (6.35 - 25.4 cm)	**65**
Gravel (0.2 - 6.35 cm)	**15**
Sand (0.06 - 2.0 cm)	**10**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**40**
Chemical Measurements	
Temperature (C)	**23.36**
Specific conductance (umhos)	**312**
DO (mg/l)	**8.14**
DO % saturation	**95.1**
Baro pressure (mm)	**761**
pH	**7.47**
Salinity (PSS)	**0.15**
Biological Attributes	
Canopy (%)	**25**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	**Y**
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	
Decapoda	
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	
Field faunal condition	**Good**

Notes/observations:

Flow

Flow



Latitude: 41° 12.217

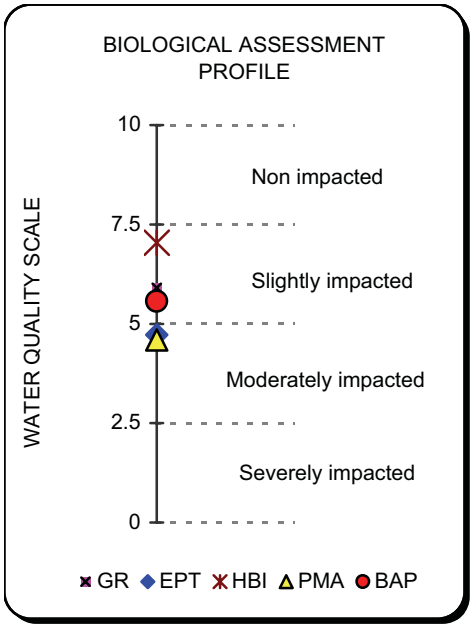
Longitude: 73° 58.769

Deg. Min.

STREAM SITE: Minisceongo Creek MNGO 03
LOCATION: Just above RR bridge accessed from Joseph St.
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

PLATYHELMINTHES			
TURBELLARIA			
	Planariidae	Undetermined Turbellaria	1
		Undetermined Oligochaeta	1
ARTHROPODA			
CRUSTACEA			
AMPHIPODA	Gammaridae	Gammarus sp.	2
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	9
COLEOPTERA	Psephenidae	Psephenus herricki	1
	Elmidae	Optioservus sp.	1
		Stenelmis sp.	1
TRICHOPTERA	Philopotamidae	Chimarra sp.	2
	Hydropsychidae	Cheumatopsyche sp.	26
		Hydropsyche sp.	34
	Hydroptilidae	Hydroptila sp.	1
DIPTERA	Tipulidae	Antocha sp.	3
	Empididae	Undetermined Empididae	1
	Chironomidae	Eukiefferiella sp.	1
		Tvetenia sp.	1
		Microtendipes pedellus gr.	1
		Polypedilum flavum	11
		Rheotanytarsus sp.	3

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 18
BIOTIC INDEX: 4.87
EPT RICHNESS: 5
MODEL AFFINITY: 47
ASSESSMENT: 5.57 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)

NATURAL	38
NUTRIENT ADDITIONS	**64**
TOXIC	44
ORGANIC	**60**
COMPLEX	**65**
SILTATION	42
IMPOUNDMENT	**64**

Field Data Summary

Stream name: **Minisceongo Creek** Watershed: **Hudson** ID: **MNGO**

Location: **Aprox 100 meters below Samsondale Ave. bridge** Station: **02**

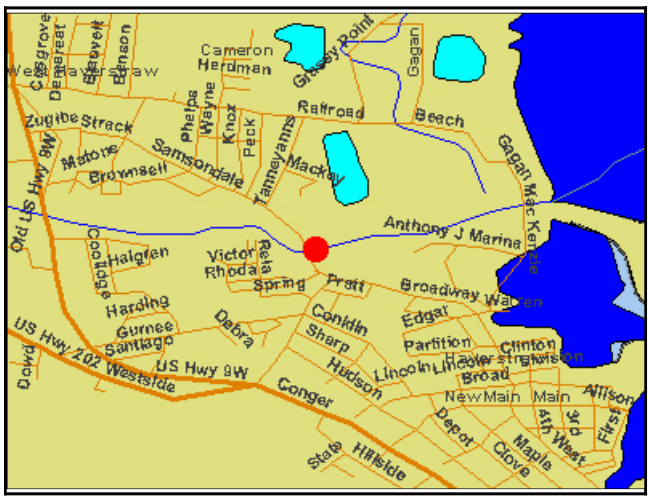
Municipality: **Haverstraw** **Rockland Co. NY**

Date sampled: **Friday, July 14, 2006**

Arrival time at station: **10:43 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**14**
Depth (meters)	**0.25**
Current (cm/sec)	**68**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**5**
Rubble (6.35 - 25.4 cm)	**65**
Gravel (0.2 - 6.35 cm)	**10**
Sand (0.06 - 2.0 cm)	**10**
Silt (0.004 - 0.06 cm)	**10**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**23.22**
Specific conductance (umhos)	**326**
DO (mg/l)	**8.48**
DO % saturation	**9.81**
Baro pressure (mm)	**765**
pH	**7.52**
Salinity (PSS)	**0.16**
Biological Attributes	
Canopy (%)	**85**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	
Decapoda	
Gammaridae	
Mollusca	
Oligochaeta	**Y**
Other macroinvertebrates	
Field faunal condition	**Good**



Notes/observations: The site is located approximately 50 meters below a 12" diameter permitted discharge pipe.

Latitude: 41° 12.169

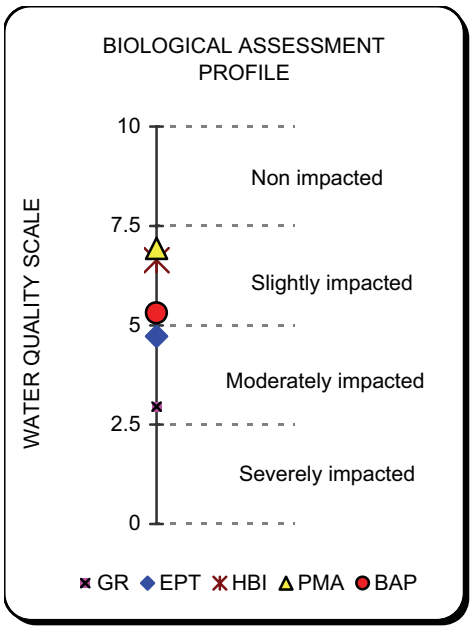
Longitude: 73° 58.316

Deg. Min.

STREAM SITE: Minisceongo Creek MNGO 02
LOCATION: Aprox 100 meters below Samsondale Ave., bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

NEMERTEA			
		Prostoma graecense	3
		Undetermined Oligochaeta	5
ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	25
COLEOPTERA	Psephenidae	Psephenus herricki	1
	Elmidae	Stenelmis sp.	6
TRICHOPTERA	Philopotamidae	Chimarra sp.	1
	Hydropsychidae	Cheumatopsyche sp.	13
		Hydropsyche sp.	34
	Hydroptilidae	Hydroptila sp.	1
DIPTERA	Tipulidae	Antocha sp.	1
	Chironomidae	Diamesa sp.	3
		Polypedilum flavum	7

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 12
BIOTIC INDEX: 5.19
EPT RICHNESS: 5
MODEL AFFINITY: 61
ASSESSMENT: 5.31 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)

NATURAL	46
NUTRIENT ADDITIONS	**62**
TOXIC	49
ORGANIC	**63**
COMPLEX	**65**
SILTATION	46
IMPOUNDMENT	**63**

Field Data Summary

Stream name: **Stoney Brook** Watershed: **Ramapo** ID: **STOB**

Location: **Just above Seven Lakes Rd. bridge** Station: **01**

Municipality: **Ramapo** **Rockland Co. NY**

Date sampled: **Saturday, July 15, 2006**

Arrival time at station: **4:08 PM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**5.5**
Depth (meters)	**0.4**
Current (cm/sec)	**1**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**20**
Rubble (6.35 - 25.4 cm)	**40**
Gravel (0.2 - 6.35 cm)	**20**
Sand (0.06 - 2.0 cm)	**15**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**23.66**
Specific conductance (umhos)	**65**
DO (mg/l)	**8.01**
DO % saturation	**94.4**
Baro pressure (mm)	**752**
pH	**6.67**
Salinity (PSS)	**0.04**
Biological Attributes	
Canopy (%)	**60**
Aquatic vegetation	
Algae suspended	
Algae filamentous	
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	**Y**
Trichoptera	**Y**
Coleoptera	
Megaloptera	**Y**
Odonata	
Chironomidae	
Simuliidae	
Decapoda	
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	Leech;
Field faunal condition	**Very good**

Notes/observations: Pteranarcy, an intolerant Stonefly, is noted in the field sample.

Latitude: 41° 09.857

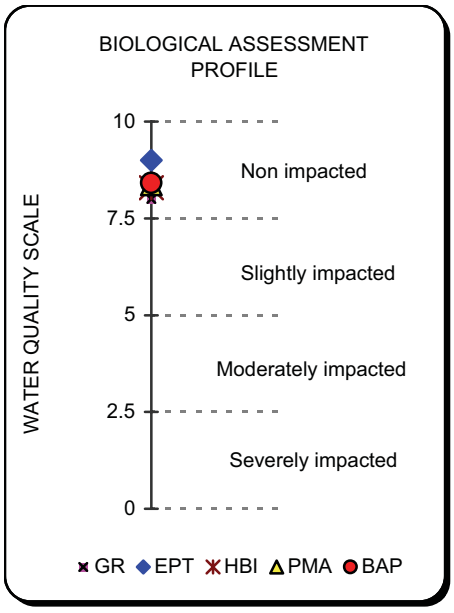
Longitude: 74° 10.991

Deg. Min.

STREAM SITE: Stoney Brook STOB 01
LOCATION: Just above Seven Lakes Rd., bridge
DATE: 15 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

PLATYHELMINTHES			
TURBELLARIA			
	Planariidae	Undetermined Turbellaria	1
		Undetermined Oligochaeta	1
ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Baetidae	Acentrella sp.	19
		Baetis sp.	15
	Heptageniidae	Epeorus (Iron) sp.	2
		Stenonema sp.	4
PLECOPTERA	Perlidae	Acroneuria sp.	4
		Paragnetina sp.	1
		Perlesta sp.	4
	Peltoperlidae	Tallaperla sp.	1
ODONATA	Aeschnidae	Boyeria sp.	1
COLEOPTERA	Psephenidae	Psephenus herricki	2
MEGALOPTERA	Corydalidae	Nigronia serricornis	2
TRICHOPTERA	Philopotamidae	Chimarra sp.	3
		Dolophilodes sp.	7
	Hydropsychidae	Cheumatopsyche sp.	8
		Hydropsyche sp.	9
	Glossosomatidae	Glossosoma sp.	5
DIPTERA	Chironomidae	Orthocladius sp.	4
		Rheocricotopus sp.	1
		Tvetenia vitracies	1
		Polypedilum aviceps	5

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 22
BIOTIC INDEX: 3.71
EPT RICHNESS: 13
MODEL AFFINITY: 73
ASSESSMENT: 8.41 (Non impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL **63**
NUTRIENT ADDITIONS 43
TOXIC 41
ORGANIC 32
COMPLEX 34
SILTATION 33
IMPOUNDMENT 32

Field Data Summary

Stream name: **Mahwah River** Watershed: **Ramapo** ID: **MAWA**

Location: **Aprox 100 meters above Montebello Rd. bridge** Station: **01**

Municipality: **Ramapo** **Rockland Co. NY**

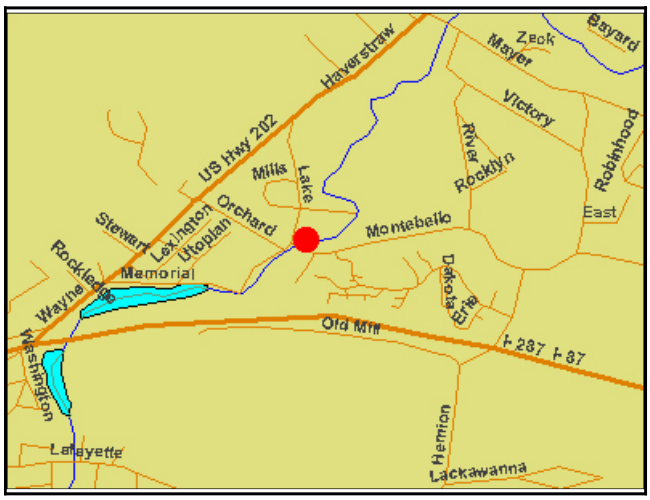
Date sampled: **Saturday, July 15, 2006**

Arrival time at station: **2:36 PM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**6.5**
Depth (meters)	**0.22**
Current (cm/sec)	**40**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**5**
Rubble (6.35 - 25.4 cm)	**30**
Gravel (0.2 - 6.35 cm)	**30**
Sand (0.06 - 2.0 cm)	**30**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**22.99**
Specific conductance (umhos)	**426**
DO (mg/l)	**8.41**
DO % saturation	**99.1**
Baro pressure (mm)	**752**
pH	**7.57**
Salinity (PSS)	**0.21**
Biological Attributes	
Canopy (%)	**70**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**N**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	**Y**
Megaloptera	**Y**
Odonata	
Chironomidae	**Y**
Simuliidae	
Decapoda	**Y**
Gammaridae	**Y**
Mollusca	**Y**
Oligochaeta	
Other macroinvertebrates	
Field faunal condition	**Good**

Notes/observations:



Latitude: 41° 07.440

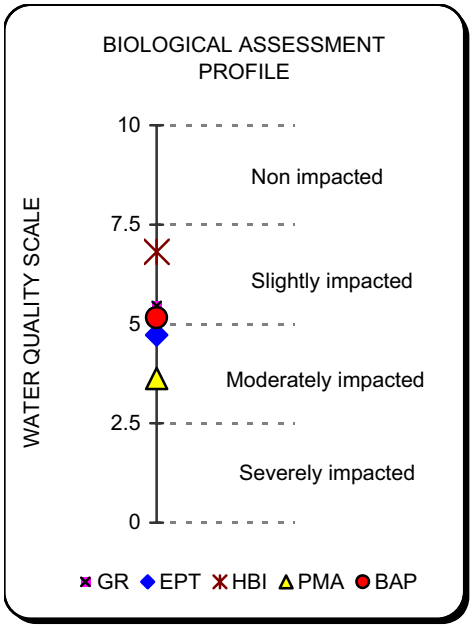
Longitude: 74° 08.118

Deg. Min.

STREAM SITE: Mahwah River MAWA 01
LOCATION: Aprox 100 meters above Montebello Rd., bridge
DATE: 15 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

MOLLUSCA			
PELECYPODA			
	Sphaeriidae	Undetermined Sphaeriidae	4
ARTHROPODA			
CRUSTACEA			
AMPHIPODA	Gammaridae	Gammarus sp.	23
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	4
	Heptageniidae	Stenonema sp.	4
COLEOPTERA	Psephenidae	Psephenus herricki	5
	Elmidae	Optioservus sp.	16
		Stenelmis sp.	28
MEGALOPTERA	Corydalidae	Corydalus cornutus	1
		Nigronia serricornis	2
TRICHOPTERA	Philopotamidae	Chimarra sp.	1
	Hydropsychidae	Cheumatopsyche sp.	4
		Hydropsyche sp.	1
DIPTERA	Chironomidae	Thienemannimyia gr. spp.	2
		Brillia sp.	1
		Parametriocnemus sp.	1
		Polypedilum flavum	2
		Stictochironomus sp.	1

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 17
BIOTIC INDEX: 5.05
EPT RICHNESS: 5
MODEL AFFINITY: 41
ASSESSMENT: 5.2 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 40
NUTRIENT ADDITIONS **61**
TOXIC 38
ORGANIC 24
COMPLEX 41
SILTATION 33
IMPOUNDMENT 41

Field Data Summary

Stream name: **Ramapo River** Watershed: **Ramapo** ID: **RAMA**

Location: **Just above Fourth St. bridge** Station: **07**

Municipality: **Ramapo** **Rockland Co. NY**

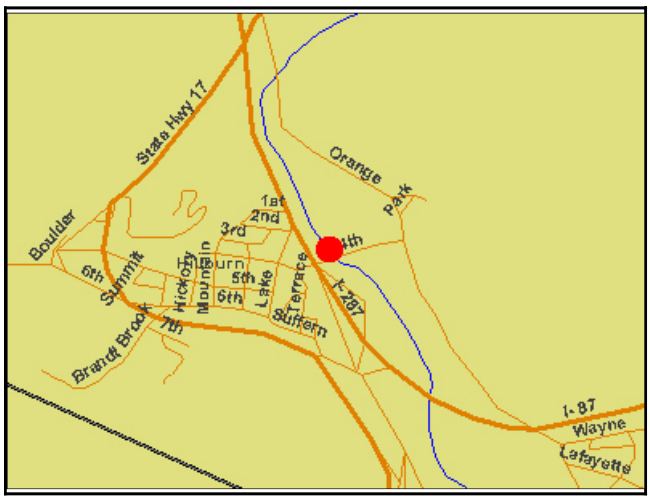
Date sampled: **Saturday, July 15, 2006**

Arrival time at station: **3:20 PM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**22**
Depth (meters)	**0.3**
Current (cm/sec)	**80**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**10**
Rubble (6.35 - 25.4 cm)	**25**
Gravel (0.2 - 6.35 cm)	**30**
Sand (0.06 - 2.0 cm)	**20**
Silt (0.004 - 0.06 cm)	**15**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**23.66**
Specific conductance (umhos)	**282**
DO (mg/l)	**8.38**
DO % saturation	**98.3**
Baro pressure (mm)	**754**
pH	**7.4**
Salinity (PSS)	**0.14**
Biological Attributes	
Canopy (%)	**20**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	**Y**
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	
Decapoda	**Y**
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	
Field faunal condition	**Very good**

Notes/observations:



Scale: 1 mile

Latitude: 41° 07.516

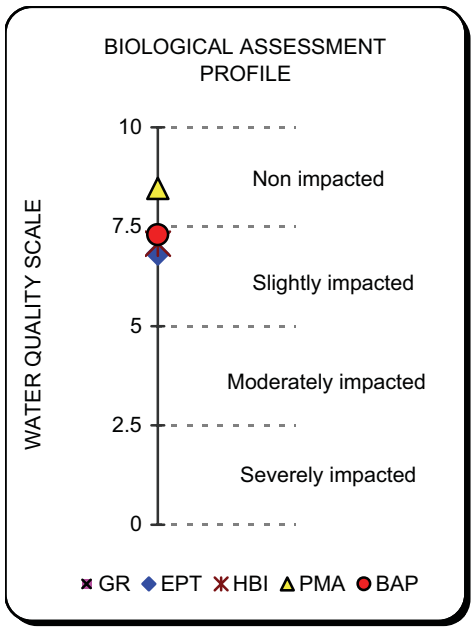
Longitude: 74° 09.880

Deg. Min.

STREAM SITE: Ramapo River RAMA 07
LOCATION: Just above Fourth St., bridge
DATE: 15 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

ARTHROPODA			
CRUSTACEA			
AMPHIPODA	Gammaridae	Gammarus sp.	1
INSECTA			
EPHEMEROPTERA	Baetidae	Acentrella sp.	1
		Baetis sp.	25
	Caenidae	Caenis sp.	2
PLECOPTERA	Capniidae	Undetermined Capniidae	1
	Perlidae	Paragnetina sp.	2
COLEOPTERA	Psephenidae	Psephenus herricki	7
	Elmidae	Optioservus sp.	5
		Stenelmis sp.	3
TRICHOPTERA	Philopotamidae	Chimarra sp.	6
	Psychomyiidae	Lype diversa	1
	Hydropsychidae	Cheumatopsyche sp.	13
		Hydropsyche sp.	11
DIPTERA	Tipulidae	Antocha sp.	3
	Chironomidae	Diamesa sp.	2
		Cardiocladius sp.	9
		Eukiefferiella sp.	2
		Orthocladius sp.	2
		Tvetenia sp.	1
		Polypedilum flavum	3

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 20
BIOTIC INDEX: 4.84
EPT RICHNESS: 9
MODEL AFFINITY: 74
ASSESSMENT: 7.29 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL **56**
NUTRIENT ADDITIONS **56**
TOXIC 50
ORGANIC 31
COMPLEX 45
SILTATION 39
IMPOUNDMENT 42

Field Data Summary

Stream name: **Pascack Brook** Watershed: **Hackensack** ID: **PASC**

Location: **Just off Memorial Park Dr.** Station: **04**

Municipality: **Ramapo** **Rockland Co. NY**

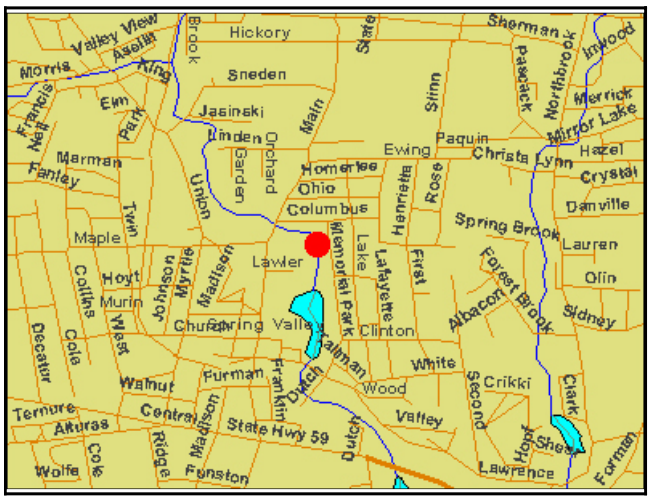
Date sampled: **Saturday, July 15, 2006**

Arrival time at station: **12:35 PM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**10.8**
Depth (meters)	**0.07**
Current (cm/sec)	**0.37**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**5**
Rubble (6.35 - 25.4 cm)	**10**
Gravel (0.2 - 6.35 cm)	**35**
Sand (0.06 - 2.0 cm)	**40**
Silt (0.004 - 0.06 cm)	**10**
Embeddedness (%)	**50**
Chemical Measurements	
Temperature (C)	**23.6**
Specific conductance (umhos)	**641**
DO (mg/l)	**7.17**
DO % saturation	**84.6**
Baro pressure (mm)	**750**
pH	**7.35**
Salinity (PSS)	**0.31**
Biological Attributes	
Canopy (%)	**5**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	
Decapoda	**N**
Gammaridae	**Y**
Mollusca	
Oligochaeta	**Y**
Other macroinvertebrates	Isopoda;
Field faunal condition	**Good**

Notes/observations: There is abundant litter noted at the station.



Latitude: 41° 07.020

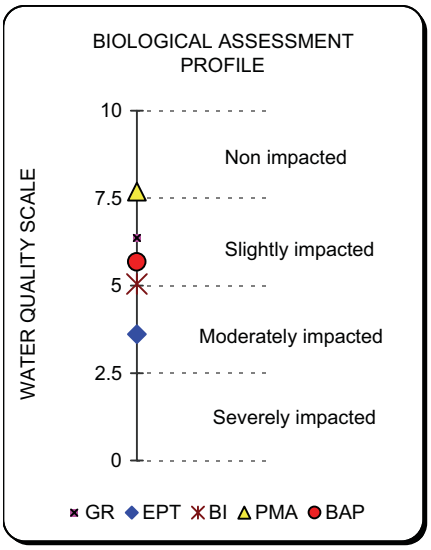
Longitude: 74° 02.506

Deg. Min.

STREAM SITE: Pascack Creek PASC 04
LOCATION: Just off Memorial Park Dr.
DATE: 15 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

NEMERTEA		Prostoma graecense	1
OLIGOCHAETA		Undetermined Oligochaeta	7
	Glossiphoniidae	Undetermined Hirudinea	1
ARTHROPODA			
CRUSTACEA			
ISOPODA	Asellidae	Caecidotea sp.	10
AMPHIPODA	Crangonyctidae	Crangonyx sp.	9
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	22
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	3
		Hydropsyche sp.	6
DIPTERA	Empididae	Undetermined Empididae	1
	Chironomidae	Natarsia sp. A	1
		Thienemannimyia gr. spp.	6
		Cricotopus sp.	9
		Endochironomus sp.	1
		Parametriocnemus sp.	1
		Polypedilum flavum	2
		Polypedilum illinoense	8
		Polypedilum scalaenum gr.	7
		Rheotanytarsus sp.	4
		Tanytarsus sp.	1

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 19
BIOTIC INDEX: 6.45
EPT RICHNESS: 3
MODEL AFFINITY: 66
ASSESSMENT: 5.68 (Slightiy impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 46
NUTRIENT ADDITIONS **53**
TOXIC **58**
ORGANIC **56**
COMPLEX **56**
SILTATION 51
IMPOUNDMENT 41

NUTRIENT BIOTIC INDEX (NBI)
NBI-P 7.23
NBI-N 5.68

Field Data Summary

Stream name: **Pascack Brook** Watershed: **Hackensack** ID: **PASC**

Location: **Just below Blue Heron Rd. bridge** Station: **02**

Municipality: **Clarkstown** **Rockland Co. NY**

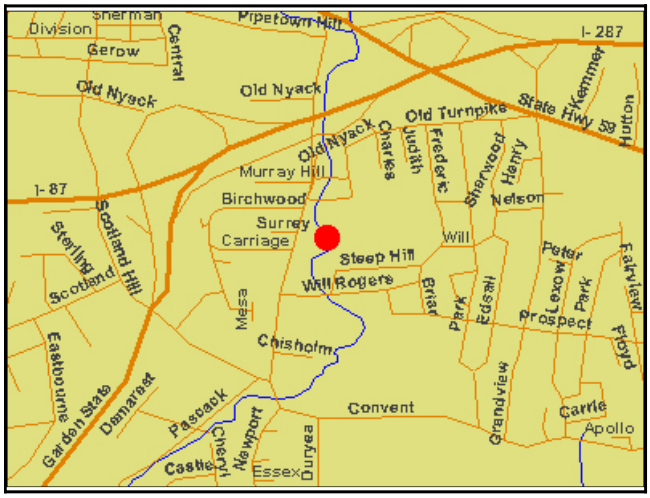
Date sampled: **Saturday, July 15, 2006**

Arrival time at station: **11:13 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**5**
Depth (meters)	**0.14**
Current (cm/sec)	**47**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**5**
Rubble (6.35 - 25.4 cm)	**50**
Gravel (0.2 - 6.35 cm)	**20**
Sand (0.06 - 2.0 cm)	**15**
Silt (0.004 - 0.06 cm)	**10**
Embeddedness (%)	**50**
Chemical Measurements	
Temperature (C)	**21.5**
Specific conductance (umhos)	**811**
DO (mg/l)	**7.56**
DO % saturation	**86.2**
Baro pressure (mm)	**754**
pH	**7.07**
Salinity (PSS)	**0.4**
Biological Attributes	
Canopy (%)	**10**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	**Y**
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	
Decapoda	
Gammaridae	**Y**
Mollusca	
Oligochaeta	
Other macroinvertebrates	Isopoda;
Field faunal condition	**Good**

Notes/observations: There is discarded litter noted at the station.



Scale: 1 mile

Latitude: 41° 05.698

Longitude: 74° 01.951

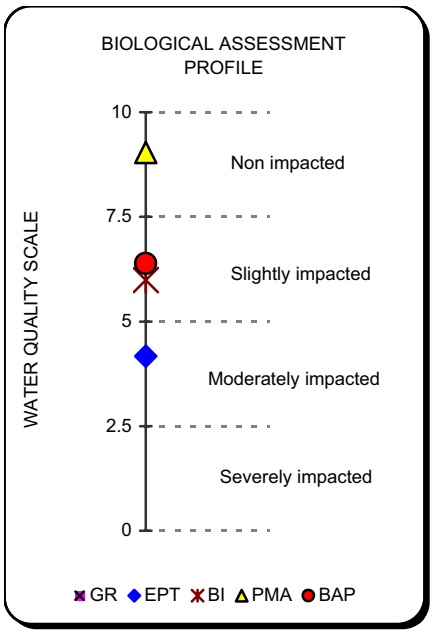
Deg. Min.

STREAM SITE:	Pascack Brook	PASC 02	
LOCATION:	Just below Blue Heron Rd., bridge		
DATE:	15 July 2006		
SAMPLE TYPE:	Kick sample		
SUBSAMPLE:	100		

PLATYHELMINTHES			
TURBELLARIA			
	Planariidae	Undetermined Turbellaria	1
		Undetermined Oligochaeta	2
	Glossiphoniidae	Undetermined Hirudinea	1
ARTHROPODA			
CRUSTACEA			
ISOPODA	Asellidae	Caecidotea sp.	2
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	38
COLEOPTERA	Elmidae	Stenelmis sp.	1
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	10
		Hydropsyche sp.	10
	Hydroptilidae	Hydroptila sp.	1
DIPTERA	Tipulidae	Antocha sp.	2
	Simuliidae	Simulium sp.	1
	Empididae	Undetermined Empididae	2
	Chironomidae	Diamesa sp.	3
		Cardiocladius obscurus	2
		Cricotopus sp.	8
		Orthocladius sp.	6
		Parametriocnemus sp.	1
		Tvetenia sp.	3
		Polypedilum flavum	6

BIOLOGICAL ASSESSMENT PROFILE (BAP)

GENERA RICHNESS:	19
BIOTIC INDEX:	5.71
EPT RICHNESS:	4
MODEL AFFINITY:	80
ASSESSMENT:	6.39 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)

NATURAL	59
NUTRIENT ADDITIONS	55
TOXIC	58
ORGANIC	46
COMPLEX	42
SILTATION	44
IMPOUNDMENT	41

Field Data Summary

Stream name: **Muddy Creek** Watershed: **Hackensack** ID: **MUDD**

Location: **Just below W. Washington Ave. bridge** Station: **02**

Municipality: **Orangetown** **Rockland Co. NY**

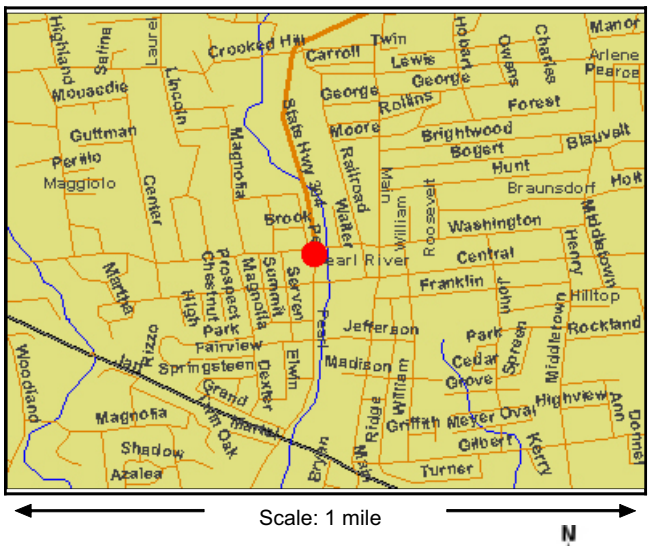
Date sampled: **Saturday, July 15, 2006**

Arrival time at station: **1:35 PM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**3.5**
Depth (meters)	**0.11**
Current (cm/sec)	**0.4**
Substrate (%)	
Rock (>25.4 cm or bedrock)	
Rubble (6.35 - 25.4 cm)	**10**
Gravel (0.2 - 6.35 cm)	**20**
Sand (0.06 - 2.0 cm)	**35**
Silt (0.004 - 0.06 cm)	**35**
Embeddedness (%)	**75**
Chemical Measurements	
Temperature (C)	**22.6**
Specific conductance (umhos)	**988**
DO (mg/l)	**6.91**
DO % saturation	**80.3**
Baro pressure (mm)	**756**
pH	**7**
Salinity (PSS)	**0.49**
Biological Attributes	
Canopy (%)	**10**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	
Decapoda	**Y**
Gammaridae	**Y**
Mollusca	
Oligochaeta	
Other macroinvertebrates	
Field faunal condition	**Good**

Notes/observations:



Latitude: 41° 03.602

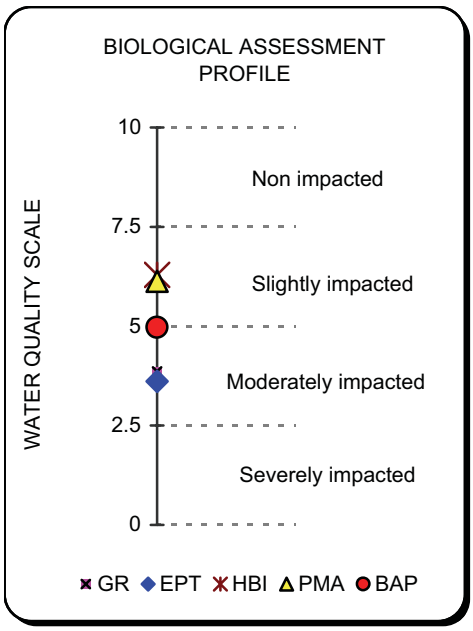
Longitude: 74° 01.410

Deg. Min.

STREAM SITE: Muddy Creek MUDD 02
LOCATION: Just below W. Washington Ave., bridge
DATE: 15 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

ARTHROPODA			
CRUSTACEA			
ISOPODA	Asellidae	Caecidotea sp.	4
AMPHIPODA	Gammaridae	Gammarus sp.	8
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	6
COLEOPTERA	Elmidae	Stenelmis sp.	44
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	9
		Hydropsyche sp.	6
DIPTERA	Empididae	Undetermined Empididae	2
	Chironomidae	Thienemannimyia gr. spp.	11
		Cricotopus sp.	2
		Parametriocnemus sp.	2
		Tvetenia sp.	2
		Microtendipes pedellus gr.	1
		Polypedilum flavum	1
		Stictochironomus sp.	2

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 14
BIOTIC INDEX: 5.47
EPT RICHNESS: 3
MODEL AFFINITY: 56
ASSESSMENT: 4.97 (Moderately impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 34
NUTRIENT ADDITIONS 52
TOXIC **61**
ORGANIC 35
COMPLEX 45
SILTATION 40
IMPOUNDMENT 62

Field Data Summary

Stream name: **Hackensack Creek** Watershed: **Hackensack** ID: **HACK**

Location: **Just above Old Route 304 bridge** Station: **24**

Municipality: **Clarkstown** **Rockland Co. NY**

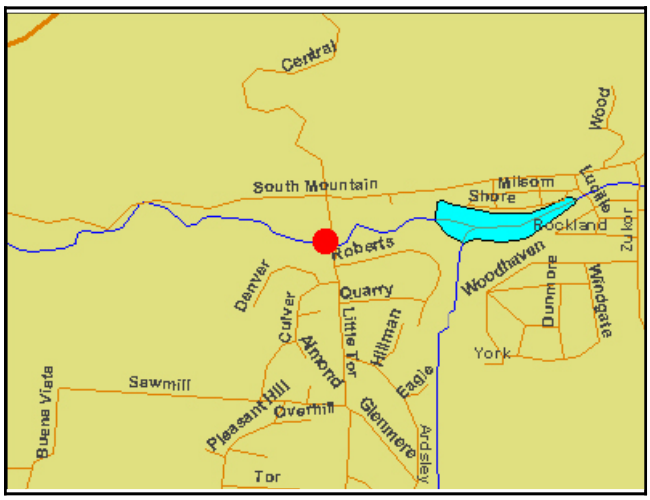
Date sampled: **Saturday, July 15, 2006**

Arrival time at station: **7:30 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**4.5**
Depth (meters)	**0.17**
Current (cm/sec)	**0.87**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**10**
Rubble (6.35 - 25.4 cm)	**50**
Gravel (0.2 - 6.35 cm)	**15**
Sand (0.06 - 2.0 cm)	**20**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**18.17**
Specific conductance (umhos)	**393**
DO (mg/l)	**8.2**
DO % saturation	**87.4**
Baro pressure (mm)	**758**
pH	**7.38**
Salinity (PSS)	**0.19**
Biological Attributes	
Canopy (%)	**60**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	**Y**
Trichoptera	**Y**
Coleoptera	**Y**
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	
Decapoda	**Y**
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	
Field faunal condition	**Very good**

Notes/observations:



Latitude: 41° 10.949

Longitude: 74° 00.279

Deg. Min.

STREAM SITE: Hackensack Creek HACK 24
LOCATION: Just above Old Route 304 bridge
DATE: 15 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

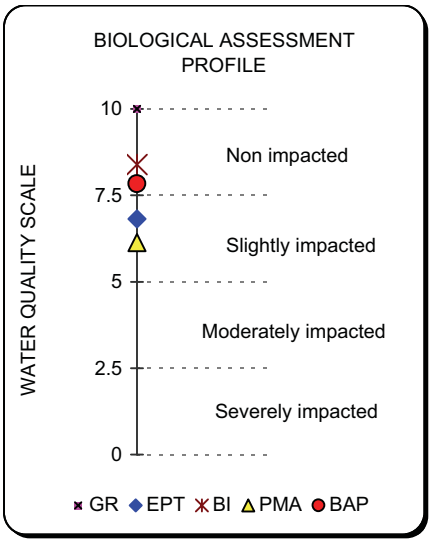
ANNELIDA			
OLIGOCHAETA			
		Undetermined Oligochaeta	1
ARTHROPODA			
CRUSTACEA			
ISOPODA	Asellidae	Caecidotea sp.	1
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	6
PLECOPTERA	Leuctridae	Leuctra sp.	3
	Perlidae	Acroneuria sp.	10
COLEOPTERA	Psephenidae	Ectopria nervosa	1
		Psephenus herricki	3
	Elmidae	Optioservus sp.	6
		Promoresia sp.	6
		Stenelmis sp.	2
TRICHOPTERA	Philopotamidae	Chimarra sp.	1
		Dolophilodes sp.	4
	Hydropsychidae	Cheumatopsyche sp.	2
		Hydropsyche sp.	9
	Rhyacophilidae	Rhyacophila sp.	2
	Glossosomatidae	Glossosoma sp.	1
DIPTERA	Tipulidae	Antocha sp.	5
	Simuliidae	Simulium sp.	1
	Empididae	Undetermined Empididae	1
	Chironomidae	Diamesa sp.	9
		Cardiocladius sp.	1
		Eukiefferiella sp.	1
		Orthocladius sp.	1
		Synorthocladius nr. semivirens	1
		Tvetenia sp.	5
		Polypedilum aviceps	12
		Polypedilum flavum	1
		Polypedilum illinoense	1
		Sublettea coffmani	1
		Rheotanytarsus sp.	2

BIOLOGICAL ASSESSMENT PROFILE (BAP)

GENERA RICHNESS:	30
BIOTIC INDEX:	3.61
EPT RICHNESS:	9
MODEL AFFINITY:	56
ASSESSMENT:	7.83 (Non impacted)

IMPACT SOURCE DETERMINATION (ISD)

NATURAL	**61**
NUTRIENT ADDITIONS	44
TOXIC	28
ORGANIC	31
COMPLEX	27
SILTATION	30
IMPOUNDMENT	32



Field Data Summary

Stream name: **Hackensack Creek** Watershed: **Hackensack** ID: **DMRK**

Location: **Just above Sittle Torr Rd. bridge** Station: **01**

Municipality: **Clarkstown** **Rockland Co. NY**

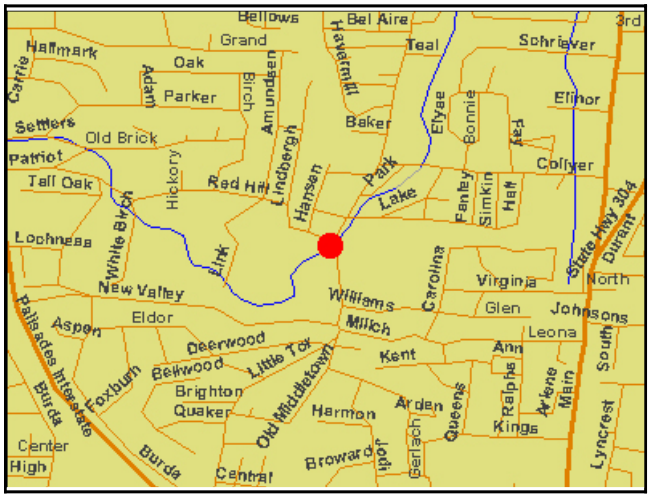
Date sampled: **Friday, July 14, 2006**

Arrival time at station: **12:44 PM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**3.5**
Depth (meters)	**0.1**
Current (cm/sec)	**40**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**50**
Rubble (6.35 - 25.4 cm)	**30**
Gravel (0.2 - 6.35 cm)	**10**
Sand (0.06 - 2.0 cm)	**5**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**25**
Chemical Measurements	
Temperature (C)	**19.38**
Specific conductance (umhos)	**471**
DO (mg/l)	**8.88**
DO % saturation	**96.7**
Baro pressure (mm)	**756**
pH	**6.84**
Salinity (PSS)	**0.23**
Biological Attributes	
Canopy (%)	**85**
Aquatic vegetation	
Algae suspended	
Algae filamentous	
Diatoms	**Y**
Macrophytes	**Y**
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	**Y**
Decapoda	**Y**
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	Diptera
Field faunal condition	**Good**

Notes/observations:



Scale: 1 mile

Latitude: 41° 07.972

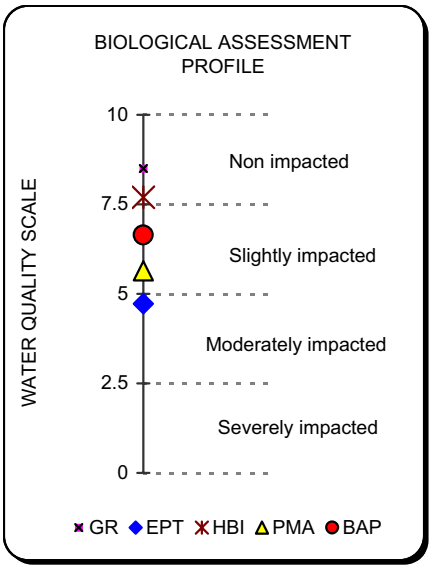
Longitude: 74° 00.144

Deg. Min.

STREAM SITE: Hackensack River Branch DMRK 01
LOCATION: Just above Sittle Torr Rd., bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

ANNELIDA			
OLIGOCHAETA			
		Undetermined Oligochaeta	2
ARTHROPODA			
CRUSTACEA			
ISOPODA	Asellidae	Caecidotea sp.	1
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	11
TRICHOPTERA	Philopotamidae	Dolophilodes sp.	20
	Hydropsychidae	Cheumatopsyche sp.	14
		Hydropsyche sp.	6
	Hydroptilidae	Hydroptila sp.	1
DIPTERA	Tipulidae	Antocha sp.	2
	Simuliidae	Simulium sp.	1
	Tabanidae	Tabanus sp.	1
	Empididae	Undetermined Empididae	7
	Chironomidae	Diamesa sp.	3
		Cardiocladius sp.	1
		Cricotopus sp.	1
		Orthocladius sp.	1
		Parametriocnemus sp.	7
		Tvetenia sp.	4
		Undetermined Orthocladiinae	1
		Polypedilum aviceps	7
		Polypedilum illinoense	1
		Undetermined Chironomini	1
		Undetermined Tanytarsini	1
		Micropsectra sp.	6

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 23
BIOTIC INDEX: 4.3
EPT RICHNESS: 5
MODEL AFFINITY: 53
ASSESSMENT: 6.6 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 49
NUTRIENT ADDITIONS **56**
TOXIC 45
ORGANIC 36
COMPLEX **53**
SILTATION 37
IMPOUNDMENT **52**

Field Data Summary

Stream name: **Hackensack Creek** Watershed: **Hackensack** ID: **HACK**

Location: **Just below RR bridge at end of Fulton Ave.** Station: **01A**

Municipality: **Clarkstown** **Rockland Co. NY**

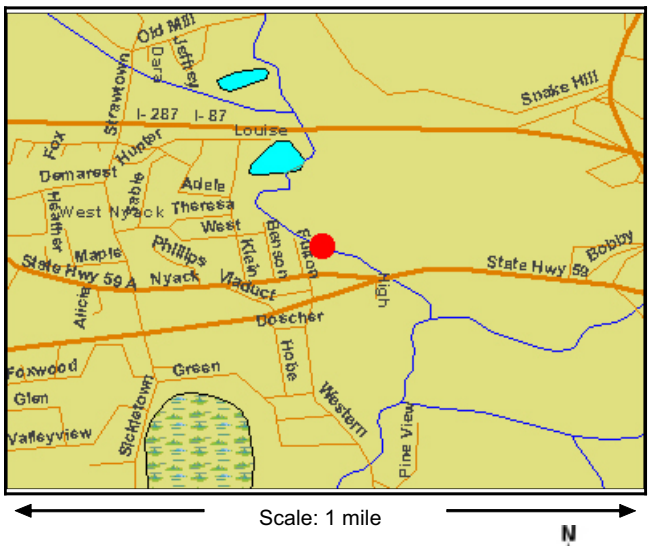
Date sampled: **Saturday, July 15, 2006**

Arrival time at station: **9:36 AM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**8.5**
Depth (meters)	**0.3**
Current (cm/sec)	**48**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**10**
Rubble (6.35 - 25.4 cm)	**30**
Gravel (0.2 - 6.35 cm)	**30**
Sand (0.06 - 2.0 cm)	**15**
Silt (0.004 - 0.06 cm)	**15**
Embeddedness (%)	**50**
Chemical Measurements	
Temperature (C)	**24.1**
Specific conductance (umhos)	**461**
DO (mg/l)	**5.26**
DO % saturation	**62.4**
Baro pressure (mm)	**760**
pH	**6.84**
Salinity (PSS)	**0.22**
Biological Attributes	
Canopy (%)	**10**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	**Y**
Occurance of macroinvertebrates	
Ephemeroptera	
Plecoptera	
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	
Decapoda	**Y**
Gammaridae	**Y**
Mollusca	
Oligochaeta	**Y**
Other macroinvertebrates	
Field faunal condition	**Poor**

Notes/observations:



Latitude: 41° 05.732

Longitude: 73° 57.845

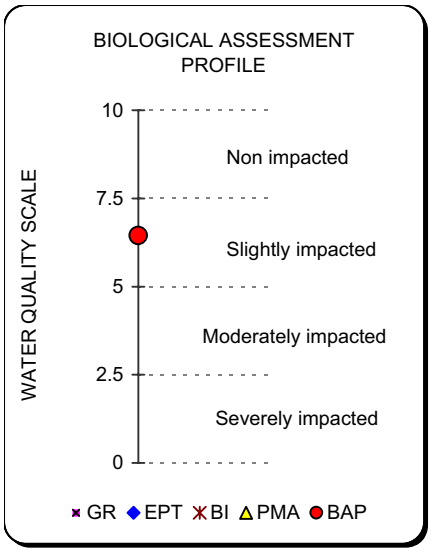
Deg. Min.

STREAM SITE: Hackensack River HACK 01A
LOCATION: Just below RR bridge at end of Fulton Ave.
DATE: 15 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

PLATYHELMINTHES			
TURBELLARIA			
	Planariidae	Undetermined Turbellaria	1
		Undetermined Oligochaeta	3
	Glossiphoniidae	Undetermined Hirudinea	1
ARTHROPODA			
CRUSTACEA			
AMPHIPODA	Gammaridae	Gammarus sp.	34
INSECTA			
COLEOPTERA	Elmidae	Ancyronyx variegatus	1
		Dubiraphia sp.	1
		Optioservus sp.	1
		Stenelmis sp.	26
NEUROPTERA	Sisyridae	Undetermined Sisyridae	2
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	19
DIPTERA	Empididae	Undetermined Empididae	3
	Chironomidae	Cricotopus sp.	1
		Glyptotendipes sp.	1
		Microtendipes pedellus gr.	1
		Polypedilum flavum	2
		Polypedilum scalaenum gr.	3

BIOLOGICAL ASSESSMENT PROFILE (BAP)

GENERA RICHNESS: 16
BIOTIC INDEX: 5.63
EPT RICHNESS: 1
MODEL AFFINITY: 41
ASSESSMENT: 6.45* (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)

NATURAL 31
NUTRIENT ADDITIONS **50**
TOXIC **55**
ORGANIC 42
COMPLEX **53**
SILTATION 48
IMPOUNDMENT **54**

Field Data Summary

Stream name: **Nauraushaun Brook** Watershed: **Hackensack** ID: **NAUR**

Location: **Just below Town Line Rd. bridge** Station: **03**

Municipality: **Orangetown** **Rockland Co. NY**

Date sampled: **Friday, July 14, 2006**

Arrival time at station: **1:35 PM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**4.5**
Depth (meters)	**0.1**
Current (cm/sec)	**50**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**4**
Rubble (6.35 - 25.4 cm)	**40**
Gravel (0.2 - 6.35 cm)	**40**
Sand (0.06 - 2.0 cm)	**10**
Silt (0.004 - 0.06 cm)	**5**
Embeddedness (%)	**40**
Chemical Measurements	
Temperature (C)	**25.55**
Specific conductance (umhos)	**687**
DO (mg/l)	**8.27**
DO % saturation	**101.3**
Baro pressure (mm)	**756**
pH	**7.77**
Salinity (PSS)	**0.33**
Biological Attributes	
Canopy (%)	**50**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	
Simuliidae	
Decapoda	**Y**
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	Planarian
Field faunal condition	**Good**

Notes/observations:

Latitude: 41° 04.714

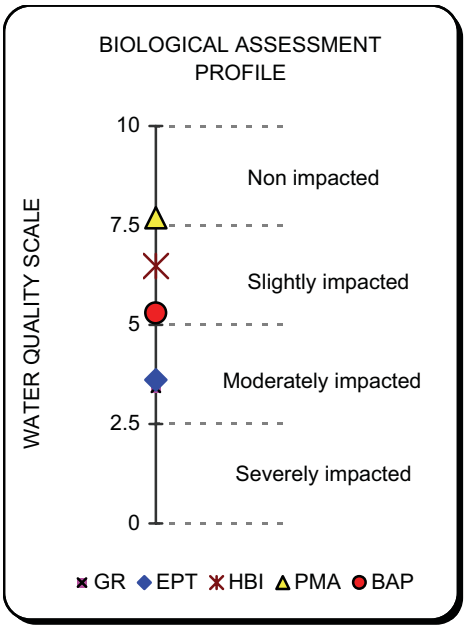
Longitude: 73° 59.840

Deg. Min.

STREAM SITE: Nauraushaun Brook NAUR 03
LOCATION: Just below Town Line Rd., bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

ANNELIDA			
OLIGOCHAETA			
		Undetermined Oligochaeta	2
ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	19
COLEOPTERA	Elmidae	Stenelmis sp.	8
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	25
		Hydropsyche sp.	10
DIPTERA	Tipulidae	Antocha sp.	4
	Empididae	Undetermined Empididae	3
	Chironomidae	Diamesa sp.	7
		Orthocladius sp.	1
		Parametriocnemus sp.	1
		Tvetenia sp.	1
		Cryptochironomus sp.	1
		Polypedilum flavum	18

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 13
BIOTIC INDEX: 5.32
EPT RICHNESS: 3
MODEL AFFINITY: 66
ASSESSMENT: 5.29 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 44
NUTRIENT ADDITIONS **60**
TOXIC 54
ORGANIC 55
COMPLEX **61**
SILTATION 47
IMPOUNDMENT 50

Field Data Summary

Stream name: **Sparkill** Watershed: **Hudson** ID: **SPAR**

Location: **Just below Rt. 340 bridge** Station: **07**

Municipality: **Orangetown** **Rockland Co. NY**

Date sampled: **Friday, July 14, 2006**

Arrival time at station: **2:40 PM**

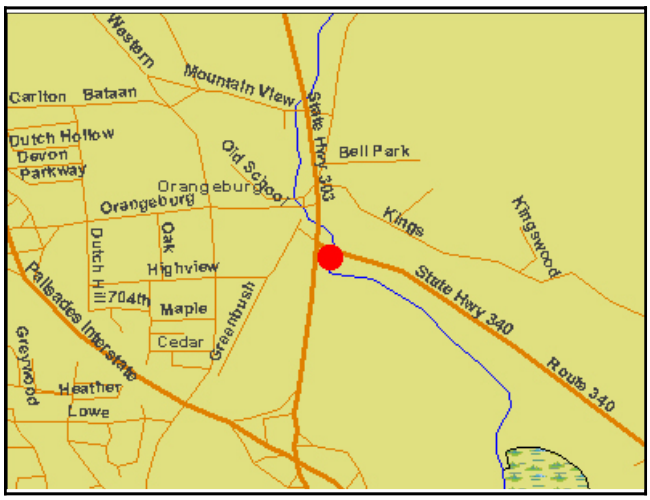
Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**3.5**
Depth (meters)	**0.2**
Current (cm/sec)	**45**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**15**
Rubble (6.35 - 25.4 cm)	**40**
Gravel (0.2 - 6.35 cm)	**20**
Sand (0.06 - 2.0 cm)	**10**
Silt (0.004 - 0.06 cm)	**15**
Embeddedness (%)	**50**
Chemical Measurements	
Temperature (C)	**20.8**
Specific conductance (umhos)	**676**
DO (mg/l)	**7.49**
DO % saturation	**83.4**
Baro pressure (mm)	**762**
pH	**6.92**
Salinity (PSS)	**0.33**
Biological Attributes	
Canopy (%)	**80**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	
Plecoptera	
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	**Y**
Decapoda	
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	
Field faunal condition	**Poor**

Notes/observations: There is a grayish cast to the water and heavy brown algae growth on the substrate.

Flow

Flow



Scale: 1 mile

Latitude: 41° 02.676

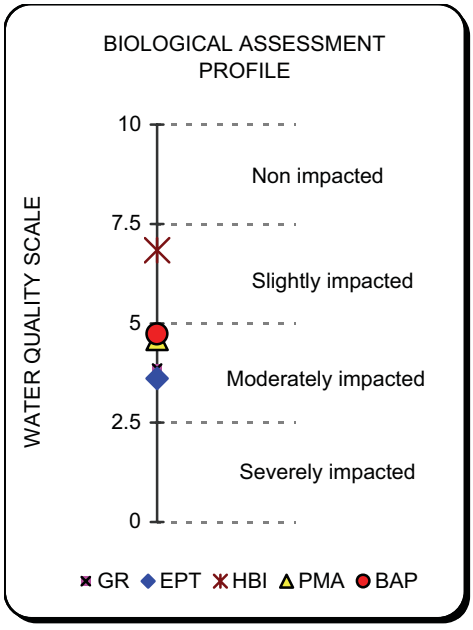
Longitude: 73° 56.708

Deg. Min.

STREAM SITE: Sparkill SPAR 07
LOCATION: Just below Rt., 340 bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

NEMERTEA			
		Prostoma graecense	1
	Planariidae	Undetermined Turbellaria	1
ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	3
COLEOPTERA	Elmidae	Stenelmis sp.	4
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	16
		Hydropsyche sp.	22
DIPTERA	Simuliidae	Simulium sp.	1
	Empididae	Undetermined Empididae	8
	Chironomidae	Thienemannimyia gr. spp.	1
		Diamesa sp.	33
		Orthocladius sp.	3
		Tvetenia sp.	1
		Rheotanytarsus sp.	5
		Tanytarsus sp.	1

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 14
BIOTIC INDEX: 5.03
EPT RICHNESS: 3
MODEL AFFINITY: 47
ASSESSMENT: 4.73 (Moderately impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 29
NUTRIENT ADDITIONS **51**
TOXIC 43
ORGANIC 48
COMPLEX **53**
SILTATION 44
IMPOUNDMENT **52**

Field Data Summary

Stream name: **Sparkill** Watershed: **Hudson** ID: **SPAR**

Location: **Just below New St. bridge** Station: **06**

Municipality: **Orangetown** **Rockland Co. NY**

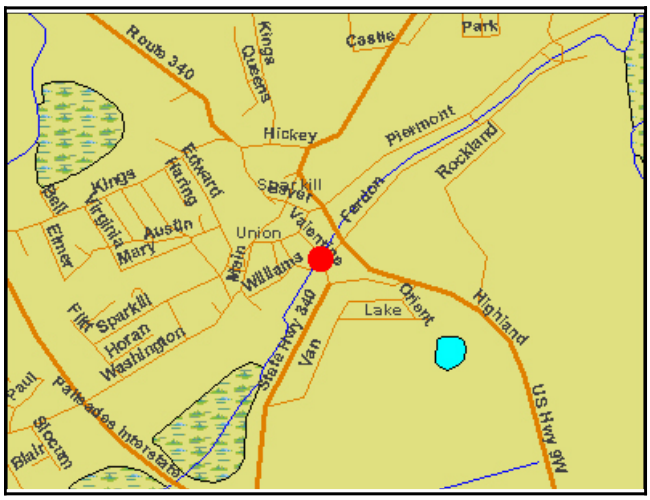
Date sampled: **Friday, July 14, 2006**

Arrival time at station: **3:14 PM**

Field personnel involved: **J. Kelly Nolan**

Physical Characteristics	
Width (meters)	**5.4**
Depth (meters)	**0.2**
Current (cm/sec)	**86**
Substrate (%)	
Rock (>25.4 cm or bedrock)	**10**
Rubble (6.35 - 25.4 cm)	**55**
Gravel (0.2 - 6.35 cm)	**20**
Sand (0.06 - 2.0 cm)	**5**
Silt (0.004 - 0.06 cm)	**10**
Embeddedness (%)	**50**
Chemical Measurements	
Temperature (C)	**22.66**
Specific conductance (umhos)	**591**
DO (mg/l)	**6.47**
DO % saturation	**74.3**
Baro pressure (mm)	**763**
pH	**6.83**
Salinity (PSS)	**0.29**
Biological Attributes	
Canopy (%)	**60**
Aquatic vegetation	
Algae suspended	
Algae filamentous	**Y**
Diatoms	**Y**
Macrophytes	
Occurance of macroinvertebrates	
Ephemeroptera	**Y**
Plecoptera	
Trichoptera	**Y**
Coleoptera	
Megaloptera	
Odonata	
Chironomidae	**Y**
Simuliidae	**Y**
Decapoda	
Gammaridae	
Mollusca	
Oligochaeta	
Other macroinvertebrates	Isopoda; Planarian
Field faunal condition	**Good**

Notes/observations: There is a grayish cast to the water and abundant brown algae growth on the substrate.



Latitude: 41° 01.765

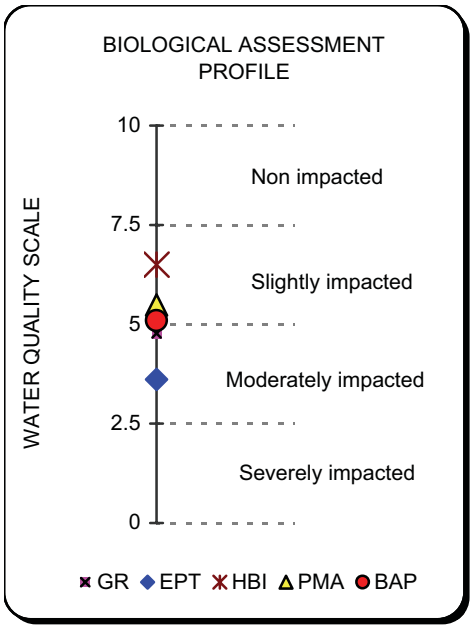
Longitude: 73° 55.535

Deg. Min.

STREAM SITE: Sparkill SPAR 06
LOCATION: Just below New St., bridge
DATE: 14 July 2006
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

ANNELIDA			
OLIGOCHAETA			
		Undetermined Oligochaeta	2
ARTHROPODA			
CRUSTACEA			
ISOPODA	Asellidae	Caecidotea sp.	5
AMPHIPODA	Crangonyctidae	Undetermined Crangonyctidae	2
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis sp.	1
NEUROPTERA	Sisyridae	Sisyra sp.	1
COLEOPTERA	Elmidae	Ancyronyx variegatus	1
		Stenelmis sp.	27
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	19
		Hydropsyche sp.	15
DIPTERA	Empididae	Undetermined Empididae	8
	Chironomidae	Thienemannimyia gr. spp.	1
		Diamesa sp.	4
		Tvetenia sp.	1
		Undetermined Orthocladiinae	1
		Polypedilum flavum	10
		Rheotanytarsus sp.	2

BIOLOGICAL ASSESSMENT PROFILE (BAP)
GENERA RICHNESS: 16
BIOTIC INDEX: 5.3
EPT RICHNESS: 3
MODEL AFFINITY: 52
ASSESSMENT: 5.09 (Slightly impacted)



IMPACT SOURCE DETERMINATION (ISD)
NATURAL 36
NUTRIENT ADDITIONS 54
TOXIC **69**
ORGANIC **68**
COMPLEX 63
SILTATION 61
IMPOUNDMENT 63

Water Chemistry and Temperature

Cedar Pond Brook

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
TIOR 01	7/14/2006	5:55 AM	19.31	85	8.42	91.2	7	0.04
CDRP 01	7/14/2006	6:45 AM	19.65	175	8.8	95	7.25	0.08
CDRP 02	7/14/2006	7:30 AM	19.94	123	8.39	91.9	7.14	0.06
CDRP 03	7/14/2006	8:18 AM	22.78	146	8.09	93.6	7.13	0.07

Hackensack Creek

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
DMRK 01	7/14/2006	12:44 PM	19.38	471	8.88	96.7	6.84	0.23
HACK 24	7/15/2006	7:30 AM	18.17	393	8.2	87.4	7.38	0.19
HACK 01A	7/15/2006	9:36 AM	24.1	461	5.26	62.4	6.84	0.22

Mahwah River

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
MAWA 01	7/15/2006	2:36 PM	22.99	426	8.41	99.1	7.57	0.21

Minisceongo Creek

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
MNGO 08	7/14/2006	8:52 AM	20.48	126	8.28	91.5	6.6	0.06
MNGO 04	7/14/2006	9:33 AM	22.04	285	8.25	93.8	7.27	0.14
MNGO 02	7/14/2006	10:43 AM	23.22	326	8.48	9.81	7.52	0.16
MNGO 03	7/14/2006	11:26 AM	23.36	312	8.14	95.1	7.47	0.15

Muddy Creek

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
MUDD 02	7/15/2006	1:35 PM	22.6	988	6.91	80.3	7	0.49

Nauraushaun Brook

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
NAUR 03	7/14/2006	1:35 PM	25.55	687	8.27	101.3	7.77	0.33

Pascack Brook

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
PASC 02	7/15/2006	11:13 AM	21.5	811	7.56	86.2	7.07	0.4
PASC 04	7/15/2006	12:35 PM	23.6	641	7.17	84.6	7.35	0.31

Ramapo River

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
RAMA 07	7/15/2006	3:20 PM	23.66	282	8.38	98.3	7.4	0.14

Sparkill

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
SPAR 07	7/14/2006	2:40 PM	20.8	676	7.49	83.4	6.92	0.33
SPAR 06	7/14/2006	3:14 PM	22.66	591	6.47	74.3	6.83	0.29

Stoney Brook

Station	*Date*	*Time*	*Temp. (C)*	*SC (umhos)*	*DO (mg/L)*	*DO % Sat.*	*pH*	*Sal. (PSS)*
STOB 01	7/15/2006	4:08 PM	23.66	65	8.01	94.4	6.67	0.04

Rockland County, NY

Benthic Macroinvertebrate Taxa Collected ***July 14 and 15, 2006***

ORDER	***FAMILY***	***GENUS/SPECIES***
TUBIFICIDA	Oligochaeta	
AMPHIPODA	Crangonyctidae	
		Crangonyx sp.
	Gammaridae	*Gammarus sp.*
DECAPODA	Cambaridae	
ISOPODA	Asellidae	*Caecidotea sp.*
COLEOPTERA	Elmidae	*Ancyronyx variegatus*
		Dubiraphia sp.
		Optioservus sp.
		Promoresia sp.
		Stenelmis sp.
	Psephenidae	*Ectopria nervosa*
		Psephenus herricki
DIPTERA	Chironomidae	*Brillia sp.*
		Cardiocladius obscurus
		Cardiocladius sp.
		Chironomini
		Cricotopus sp.
		Cryptochironomus sp.
		Diamesa sp.
		Endochironomus sp.
		Eukiefferiella sp.
		Glyptotendipes sp.
		Micropsectra sp.
		Microtendipes pedellus gr.
		Microtendipes rydalensis gr.
		Natarsia sp. A
		Orthocladiinae
		Orthocladius sp.
		Parametriocnemus sp.
		Polypedilum aviceps
		Polypedilum flavum
		Polypedilum illinoense
		Polypedilum scalaenum gr.
		Rheocricotopus sp.
		Rheotanytarsus sp.
		Stictochironomus sp.
		Sublettea coffmani
		Synorthocladius nr. semivirens

Rockland County, NY

Benthic Macroinvertebrate Taxa Collected ***July 14 and 15, 2006***

ORDER	*FAMILY*	*GENUS/SPECIES*
DIPTERA	Chironomidae	*Tanytarsini*
		Tanytarsus sp.
		Thienemanniella xena
		Thienemannimyia gr. spp.
		Tvetenia sp.
		Tvetenia vitracies
	Empididae	
		Chelifera sp.
		Hemerodromia sp.
	Simuliidae	*Simulium sp.*
	Tabanidae	*Tabanus sp.*
	Tipulidae	
		Antocha sp.
		Dicranota sp.
		Hexatoma sp.
EPHEMEROPTERA	Baetidae	*Acentrella sp.*
		Baetis sp.
	Caenidae	*Caenis sp.*
	Ephemerellidae	*Ephemerella sp.*
	Heptageniidae	*Epeorus (Iron) sp.*
		Stenonema sp.
	Isonychiidae	*Isonychia sp.*
MEGALOPTERA	Corydalidae	*Corydalus cornutus*
		Nigronia serricornis
NEUROPTERA	Sisyridae	
		Sisyra sp.
ODONATA	Aeschnidae	*Boyeria sp.*
	Gomphidae	
		Stylogomphus sp.
PLECOPTERA	Capniidae	
	Chloroperlidae	
	Leuctridae	*Leuctra sp.*
	Peltoperlidae	*Tallaperla sp.*
	Perlidae	*Acroneuria sp.*
		Paragnetina sp.
		Perlesta sp.
	Perlodidae	*Perlodidae*
	Pteronarcidae	*Pteronarcys sp.*
TRICHOPTERA	Glossosomatidae	*Glossosoma sp.*

Rockland County, NY

Benthic Macroinvertebrate Taxa Collected ***July 14 and 15, 2006***

ORDER	*FAMILY*	*GENUS/SPECIES*
TRICHOPTERA	Hydropsychidae	*Cheumatopsyche sp.*
		Hydropsyche sp.
	Hydroptilidae	*Hydroptila sp.*
	Lepidostomatidae	
	Limnephilidae	
	Odontoceridae	*Psilotreta sp.*
	Philopotamidae	*Chimarra sp.*
		Dolophilodes sp.
	Psychomyiidae	*Lype diversa*
	Rhyacophilidae	*Rhyacophila sp.*
RHYNCHOBDELLIDA	Glossiphoniidae	*Hirudinea*
UNIONIDA	Sphaeriidae	
HOPLONEMERTEA	Tetrastemmatidae	*Prostoma graecense*
TRICLADIDA	Planariidae	*Turbellaria*