



ACADIA NP • APPALACHIAN NST • BOSTON HARBOR ISLANDS NRA • MARSH-BILLINGS-ROCKEFELLER NHP • MINUTE MAN NHP  
MORRISTOWN NHP • ROOSEVELT-VANDERBILT NHS • SAINT-GAUDENS NHS • SAUGUS IRON WORKS NHS • SARATOGA NHP • WEIR FARM NHS

# Water Quality Monitoring Flows On

## Results of the 2011 Water Quality Monitoring Season for Morristown NHP

### Background

The Northeast Temperate Network (NETN) monitors a variety of natural resource indicators, which it calls “vital signs”, for 12 parks in the northeast and the Appalachian National Scenic Trail. The vital signs for freshwater bodies are water chemistry, nutrient enrichment, water quantity, and the detection of invasive plant species. These were chosen to address the NPS Inventory and Monitoring Program objective to detect change in the status of physical, chemical, or biological attributes of the ecosystem.

### Methods

Detailed descriptions of all monitoring methods can be found in NETN’s Freshwater Monitoring protocol available for download from the network’s website. A total of five park streams are sampled monthly from May through October by a cooperator from the University of Vermont or a NETN hydrologic technician. Physical and water chemistry parameters are measured each month and

water samples are periodically collected for analysis at the University of Maine. All monitoring data are incorporated into a series of comprehensive databases that feed into an EPA data system.

Three of the selected sites are in the Primrose Brook Watershed within the Jockey Hollow Unit. These sites are on the East Branch of Primrose Brook, the West Branch of Primrose Brook, and the main stem of Primrose Brook. The other sites are on the Passaic River and Indian Grove Brook in the New Jersey Brigade Unit. All streams monitored by NETN are classified as cold water fisheries, loosely defined as waters that can support, on a year-round basis, wild and stocked brook trout or other species requiring similar conditions.

Monthly sampling parameters included water quality measurements (pH, specific conductance, temperature, and dissolved oxygen), weather, stream flow (discharge), and stream stage (water level). Water samples obtained in May and August were analyzed for acid neutralizing capacity (ANC), color, and nutrients. Nutrient chemistry parameters were analyzed from a grab sample.

### Results and Findings

Complete details of 2011 monitoring season findings can be found in the full report which is available for downloading from the website. Brief synopses of some findings are available below.

**Specific conductance** measures the ability of water to carry an electrical current. If it increases it can be an indicator of pollutants in the water. Specific conductance values for 2011 were within the appropriate range for Minute Man waters.

The **pH** of a water body reflects how acidic or basic the water is, measured on a scale of 1 to 14, with 7 being neutral. Acid waters are below 7, and alkaline waters are above 7. A one unit change in pH represents a 10-fold change in acidity or alkalinity. New Jersey standards, like those of most northeast states, indicate that a pH between 6.5 and 8.5 is within the acceptable range. pH values from the 2011 monitoring season were generally basic, except for Primrose Brook West Branch, where most readings were slightly acidic. All values were between the upper and lower New Jersey water quality standards.

**Temperature** can affect water chemistry and biology. For example, the amount of oxygen that water can hold is directly related to the temperature of the water: the higher



The Passaic River flows through the forests of Morristown NHP. NPS photo.

the temperature, the less oxygen it can hold. Temperature can also determine the kinds of plants and animals found in the lake or pond. Certain species of fish, insects, and algae will predominate during the cooler temperatures of the spring and fall, yet be less apparent during the warmer temperatures of summer. Surface water temperatures appeared to be within the normal range of variability in 2011, though the July and August values reflected the



Certain species of fish, such as brook trout, need stream and river temperatures between 13° and 18°C (55° and 65°F) to thrive.

contributions of high air temperature and solar radiation.

**Dissolved oxygen (DO)** is a critical indicator of water quality because aquatic life generally needs certain

concentrations to thrive. Low oxygen can directly kill or stress organisms such that they will not be able to successfully reproduce or grow. All park sites were well oxygenated in 2011 with the exception of the July measurement at Primrose Brook West Branch. The low reading is suspect, since the field crew noted their inability to obtain a DO measurement at Primrose Brook confluence during the July monitoring visit due to problems with equipment. All other 2011 DO measurements were above the most stringent state DO standard.

Color in pond and stream water is caused by natural metallic ions, humus and peat materials, plankton, weeds, and industrial wastes. **Apparent color** is determined using water samples that have not had suspended particles filtered out. Color can be a rough indicator for organic acidity. Median color values from 2006 to 2011 monitoring show most streams to be moderately colored. The elevated color measured in the May 2011 samples further indicates the possibility of substantial runoff and sediment input to the streams prior to the May monitoring visit, especially since the samples were not filtered before analysis. Field notes indicate that the August 2011 monitoring at Primrose Brook West Branch was conducted during a heavy rain event that caused extremely turbid water (described as appearing “like chocolate milk”) and an exceptionally high apparent color measurement. Monthly turbidity measurements, which began during the current monitoring season, may provide additional information on the impacts to park streams from episodic runoff events.

**Acid neutralizing capacity (ANC)** is also known as alkalinity, or buffering capacity. It is due primarily to the presence of naturally available bicarbonate, carbonate, and hydroxide ions, with bicarbonate being the major form. 2011 acid neutralizing capacity measurements showed that park streams were well-buffered, likely due to the underlying geology. Four of five May ANC measurements were the lowest in NETN data history at the park. These values, along with lower May pH values, may illustrate the effects of episodic acidification from spring snowmelt and runoff (as well as the ability of the robust ANC to counteract the acidification pulses).

**Nutrient enrichment** and the acceleration of eutrophication (when waters become rich in mineral and organic nutrients that promote a proliferation of plant life - especially algae) have been identified in most NETN parks as one of the stressors of greatest concern. Several forms of total and dissolved phosphorus and nitrogen are measured to give managers information regarding the status and productivity of freshwater systems. Test results for several forms of nitrogen were moderately high in most 2011 samples. Results for NO<sub>2</sub> were low at all sites. All ammonia (NH<sub>3</sub>) test results were below the method reporting limit.

## Summary

Most water quality parameters for the streams monitored in Morristown National Historical Park were within state standards, and are generally within the range of non-regulatory EPA ecoregional criteria, where applicable. The majority of values are within the ranges of the historic NETN monitoring data from park waters. Apparent color, TP, and TN measurements from the August Primrose Brook confluence samples clearly demonstrate the effects of the substantial precipitation and runoff event that occurred during the sampling visit.

Monitoring under the NETN protocol builds on the historic water quality monitoring by park staff and other agencies to provide critical baseline information on the chemical and physical status of the water resources of Morristown National Historical Park. Several changes have been implemented during the 2012 monitoring season, including taking monthly stream turbidity measurements, and the addition of sulfate, chloride, and dissolved organic carbon (DOC) analyses to the spring and summer water chemistry testing. These changes will expand the scope and usefulness of the monitoring data. As more data are collected, the ability to detect changes outside this natural range of variability will increase, which in turn will more clearly indicate the status of the vital signs of water quality, nutrient enrichment, water quantity, and the detection of invasive plant species.

## More Information

|                                                                                                                                                            |                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| <b>Bill Gawley</b><br>Biologist (Air / Water / Data Mgmt)                                                                                                  | <b>E-mail</b><br>bill_gawley@nps.gov                                  |
| <b>Brian Mitchell</b><br>NETN Program Manager                                                                                                              | <b>Phone/E-mail</b><br>802-457-3368 ext. 37<br>brian_mitchell@nps.gov |
| <b>Full Report online at:</b><br><a href="http://science.nature.nps.gov/im/units/NETN/index.cfm">http://science.nature.nps.gov/im/units/NETN/index.cfm</a> |                                                                       |



Northeast Temperate Network  
54 Elm Street, Woodstock, Vermont 05091  
802-457-3368  
<http://www.science.nature.nps.gov/im/units/netn/>

