



The Stream Watcher

Summer - June 2008

Watershed Management Mission

Protecting and enhancing our watershed through chemical, physical, and biological monitoring, restoration, appropriate action, and education. Volunteers are the key!

WATERSHED MANAGEMENT STAFF

Jim Waltman
Executive Director

Jennifer M. Coffey
Director of Watershed Management

Beth April
Watershed Specialist

Janel Bisacquino
GIS Specialist and Systems Administrator

Susan Charkes
Environmental Planning Specialist

Alyse Greenberg
Watershed Institute Program Coordinator

Peggy Savage
Environmental Scientist

Anneli TerryNelson
Watershed Watch Coordinator

Amy Weaver
Watershed Stewardship Specialist

Andy White
AmeriCorps Watershed Ambassador

Stony Brook-Millstone Watershed Association
J. Seward Johnson, Sr.
Environmental Center
31 Titus Mill Road
Pennington, NJ 08534
Phone: (609) 737-3735
Fax: (609) 737-3075
Web Site:
www.thewatershed.org
Email:
bpapril@thewatershed.org

LOWER MILLSTONE WATER QUALITY



As the Millstone River flows north from Millstone Township, it enters Carnegie Lake in Princeton. Here, it is greeted by people of all ages who enjoy it for fishing, boating, ice skating, and birding. Flowing out of Carnegie Lake and making its way to the Raritan River, it meets forests, residential neighborhoods, and several other streams, including Heathcote Brook, Harry's Brook, Six Mile Run, and Ten Mile Run.

As part of the StreamWatch program, volunteers monitor the Lower Millstone River (the portion from Carnegie Lake to the Raritan River) and its tributaries. One of the goals of this monitoring is to characterize the water quality of these streams. An important question in characterizing water quality is, 'Are our streams becoming cleaner or more polluted?' To best provide an answer through chemical assessments, we need to look at trends in particular indicators. This requires a long-term set of reliable data. Water chemistry measurements are highly valuable, yet very specific to the time and place where the measurements are taken. A long-term (10-20 years) dataset helps to reduce this specificity and increase the likelihood that the measurements are reflecting the actual water quality conditions in the stream.

Since the majority of the water for our streams comes from storm events, the water gets to a stream by traveling over the landscape. This means that how the land is used exerts a strong influence on water quality. Dissolved oxygen (DO), nitrate-nitrogen ($\text{NO}_3\text{-N}$), and pH are three measurements attributable to land use changes. $\text{NO}_3\text{-N}$ represents the most common form of nitrogen found in water. Nitrates in water may come from the soil, fertilizer runoff, leaky septic systems, sewage treatment plants, manure from livestock animal wastes, and car exhaust. DO is one of the most important indicators of water quality for aquatic life, as it is essential

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UPDATES & HAPPENINGS

The New Jersey Department of Environmental Protection (NJDEP) recently announced two important initiatives to limit the amount of phosphorus entering New Jersey's streams. Phosphorus is a vital nutrient for plant growth, but when found in excess amounts leads to unsightly algal blooms and declining dissolved oxygen levels as the algae decays. The NJDEP is partnering with the Rutgers Cooperative Extension and two major fertilizer companies to limit the amount of phosphorus in fertilizers. The fertilizer companies have pledged to reduce the amount of phosphorus in fertilizers by 50% by 2010, while Rutgers will assist in an educational campaign on fertilizer use. In addition, NJDEP signed a policy that will require municipalities in the Passaic River Basin to pass a fertilizer ordinance. This ordinance will require government buildings, schools and other institutions to use fertilizer that does not contain phosphorus, unless a soil test shows that it is necessary or other extenuating circumstances exist. This policy resulted from NJDEP's work on a Total Maximum Daily Load (TMDL) in the Passaic River Basin. NJDEP recently announced work on a TMDL in the Raritan Basin, which includes the Stony Brook-Millstone Watershed. We look forward to similar phosphorus reduction efforts in our Watershed in the future.



Congratulations to Frank Potter and Kathy Easton, who have been volunteering with the StreamWatch program for 10 years! Frank collects chemical data on the Beden Brook, while Kathy walks a portion of the Millstone River, observing such characteristics as water color, odor, and erosion and submitting an extensive list of birds seen and heard. Thanks for your hard work and dedication!

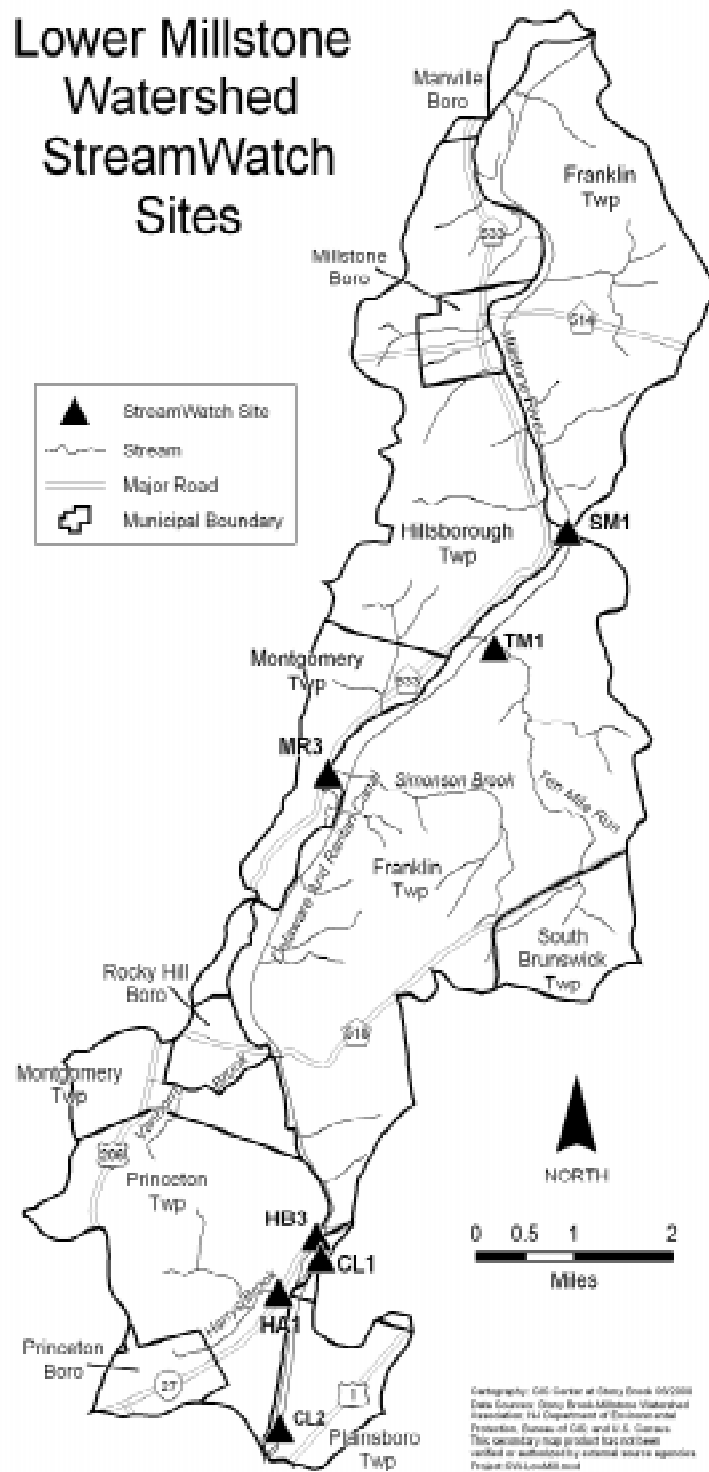
for organisms inhabiting the stream. When oxygen levels fall, fish and aquatic insect species become stressed. At low levels (less than 4.0 ppm), these animals cannot survive. Oxygen is a sensitive parameter because other chemicals present in the water (such as $\text{NO}_3\text{-N}$), natural biological processes, and temperature influence its availability throughout the year. pH measures the alkalinity or acidity of the water and affects many chemical and biological processes. Most aquatic organisms prefer a pH in the range of 6.5-8.5. Levels outside this range cause organisms to become stressed. In addition, low pH can allow bound toxic elements to become available for uptake by plants and animals. pH levels are affected by surrounding rock, wastewater discharges, and acid rain.

This water quality assessment focuses on the Lower Millstone subwatershed, with other subwatersheds highlighted in previous issues of *The StreamWatcher*. The Lower Millstone Watershed contains seven sampling sites (Figure 1).

- CL2 – Carnegie Lake
- CL1 – Millstone River as it exits Carnegie Lake
- HA1 – Harry's Brook at Route 27
- HB3 – Heathcote Brook, just before the confluence with the Millstone River
- MR3 – Millstone River at Griggstown Causeway
- SM1 – Six Mile Run at Canal Road
- TM1 – Ten Mile Run at Canal Road

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Figure 1
 Lower Millstone
 Watershed
 StreamWatch
 Sites



These sites are chemical assessment sites with data on water temperature, dissolved oxygen, nitrate-nitrogen, orthophosphate, pH, and turbidity. Figures 2-8 present chemical data. Biological data is collected at SM1 and TM1 and shown in Figures 9 and 10. Chemical sampling began in 1992 and biological sampling began in 1995.

Volunteers monitor the main stem of the Millstone River, after it flows out of Carnegie Lake, at two sites (Figure 1). Overall, the water quality of the Millstone River is good in regards to some parameters and declining in regards to others. At CL1, annual averages of temperature, nitrate-N, pH, and dissolved oxygen meet the water quality standards established by the NJ Department of Environmental Protection (NJDEP, Figure 2). In addition, there were no individual instances throughout 2007 where water quality standards were not met.

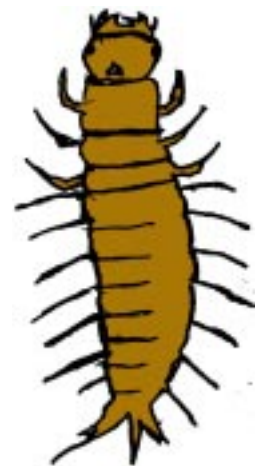
Moving downstream, Site MR3 exhibits healthy water quality for temperature and nitrate-N, but there are some instances in which pH and dissolved oxygen do not meet the state water quality standards (Figure 3). Although annual averages for pH and dissolved oxygen levels meet the state water quality standards, there were five individual sampling events during 2007 in which the pH level was lower than the acceptable limit of 6.5. Dissolved oxygen was lower than the standard of 4.0 parts per million (ppm) seven times during the summer months. Low dissolved oxygen levels can occur when an abundance of bacteria use oxygen to break down vegetation that has accumulated in the stream. Inadequately treated sewage, from leaking sewer pipes and poorly maintained septic systems, is also a source of material consumed by bacteria.

Water quality on the tributaries to the Millstone River, including Harry's Brook, Heathcote Brook, Six Mile Run and Ten Mile Run, is good overall. Water quality at Sites HA1 and HB3 are similar to each other, with the annual averages for water temperature, nitrate-N, pH, and dissolved oxygen meeting the water quality standards (Figures 4 & 5). Trends at these sites show that water quality parameters are remaining constant over time.

At Six Mile Run, annual averages for water temperature, nitrate-N, pH, and dissolved oxygen have always met the state standards since 1994 (Figure 7). There were three violations of the pH standard in 2007. Water quality on Ten Mile Run is good, with annual averages for water temperature, nitrate-N, pH, and dissolved oxygen meeting state water quality standards (Figure 8). However, there were three individual instances in 2007 where the value for pH was lower than the water quality standard. pH levels can be affected by atmospheric deposition, wastewater discharges, and photosynthesis by aquatic plants and algae.

Figure 6 illustrates water quality on Carnegie Lake. Annual averages for water temperature, nitrate-N, and dissolved oxygen have met the state standards since 1992. However, pH levels have been lower than the standard during several years, and during 2007 there were two instances in which pH levels were below the standard of 6.5.

Biological sampling of the macroinvertebrate community at Six Mile Run during 2007 shows an improvement in water quality, with a moderately impaired rating in July and a non-impaired rating in October (Figure 9). This is also an improvement over the severely impaired rating found in July of 2006. At Ten Mile



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Run, the stream was non-impaired in March and moderately impaired in July (Figure 10). Non-impaired streams have quality habitat that supports a diverse community of pollution sensitive insects, while moderately impaired streams have declining habitat and a less diverse, more pollution tolerant community.



Since what happens on the landscape directly impacts water quality, it is important to look at land use and individual actions in assessing and improving water quality. For example, the land uses along the Millstone River and its tributaries include residential housing, agricultural land, and golf courses. All of these land uses may be contributing to water quality problems in these streams via runoff containing fertilizers, pet waste, car oil, and car washing detergents. However, since water quality is good in many areas, it is encouraging to think that businesses and residents are managing their land properly.

Water quality sampling through the StreamWatch program works to determine the long-term health of our streams and ponds. We have much data to thoroughly review and more yet ahead to collect, but with the help of dedicated volunteers, such as you, we can be vigilant in watching our streams and being responsive to keeping our water clean.

The graphs on the following pages (Figures 2-10) highlight the chemical and biological water quality data for the Millstone River (Sites CL1 and MR3), Carnegie Lake (CL2), Harry's Brook (HA1), Heathcote Brook (HB3), Six Mile Run (SM1), and Ten Mile Run (TM1).

Reading the Graphs

1. The State water quality standard for water temperature is 30 degrees Celsius (summer average). Anything above this standard is indicative of potential problems.
2. The State water quality standard for nitrate is 10.0 ppm. Anything above this limit has violated the state water quality standard for drinking. Literature states that anything above 1.0 ppm is indicative of potential ecological problems.
3. The State water quality standard sets a range for pH between 6.5 and 8.5. Anything outside this range is indicative of potential problems.
4. The State water quality standard for dissolved oxygen is 4.0 parts per million (ppm) at any time. Anything below this level has violated the state guideline and is indicative of potential problems. Levels above 4 ppm are beneficial to aquatic organisms. For example, literature states that levels should be at least 6 ppm for growth and activity.
5. Please note that these are annual averages for each parameter. Although annual averages may meet the state water quality standard, there may be individual sampling events throughout the year when standards are violated.
6. For biological data, a black bar (3) indicates severe impairment, a striped bar (2) indicates moderate impairment, a lighter solid bar (1) represents no impairment, and N/A indicates no data available.

Figure 2: Water Quality at Millstone River (CL1)

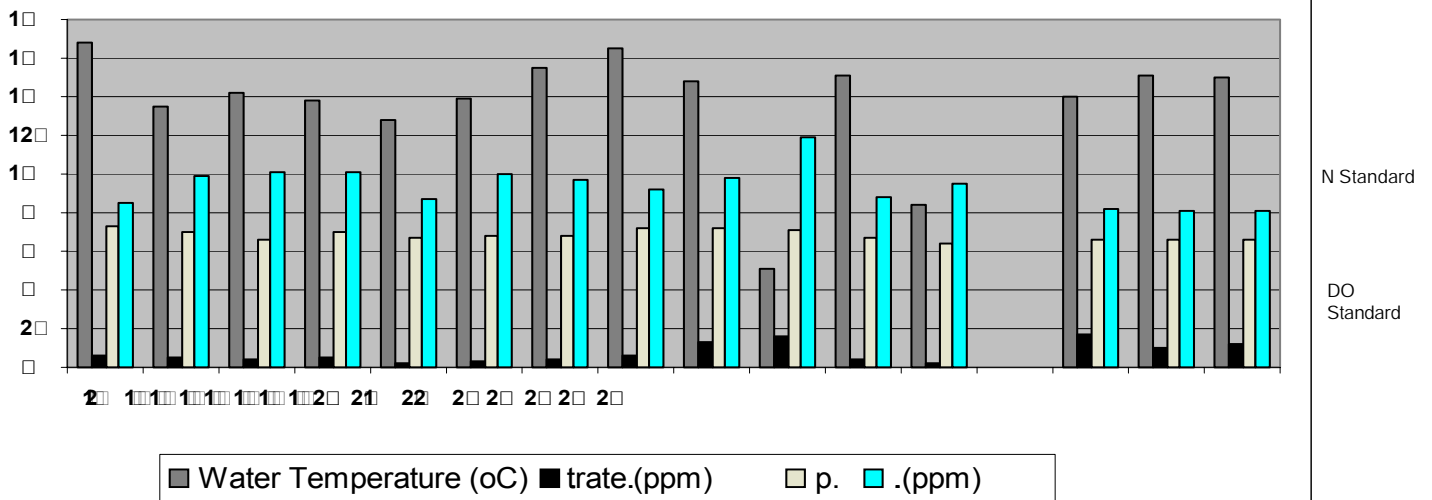


Figure 3: Water Quality at Millstone River (MR3)

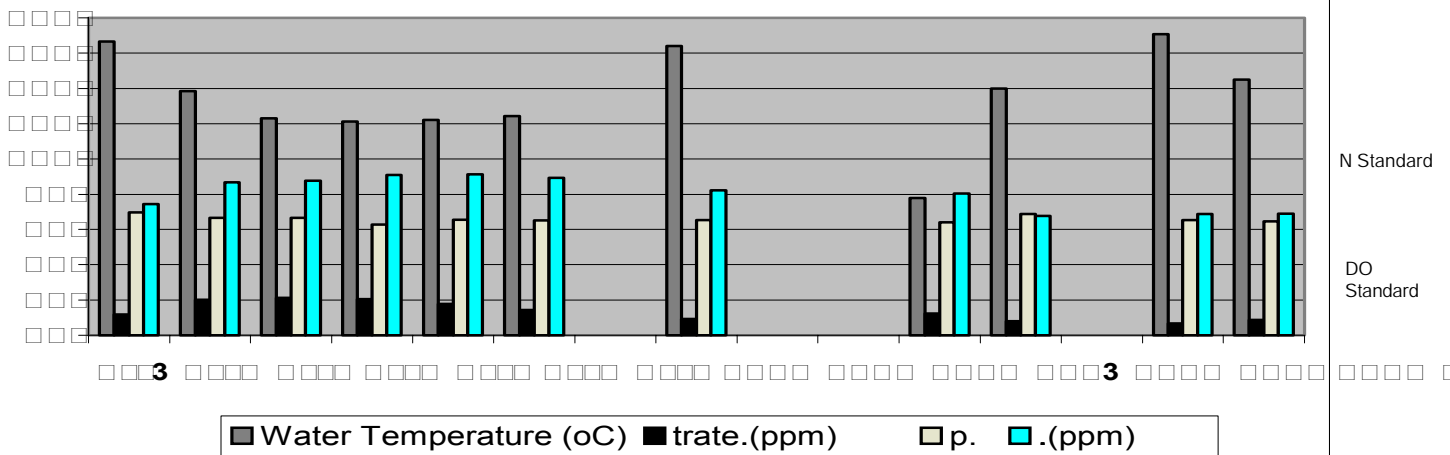


Figure 4: Water Quality at Harry's Brook (HA1)

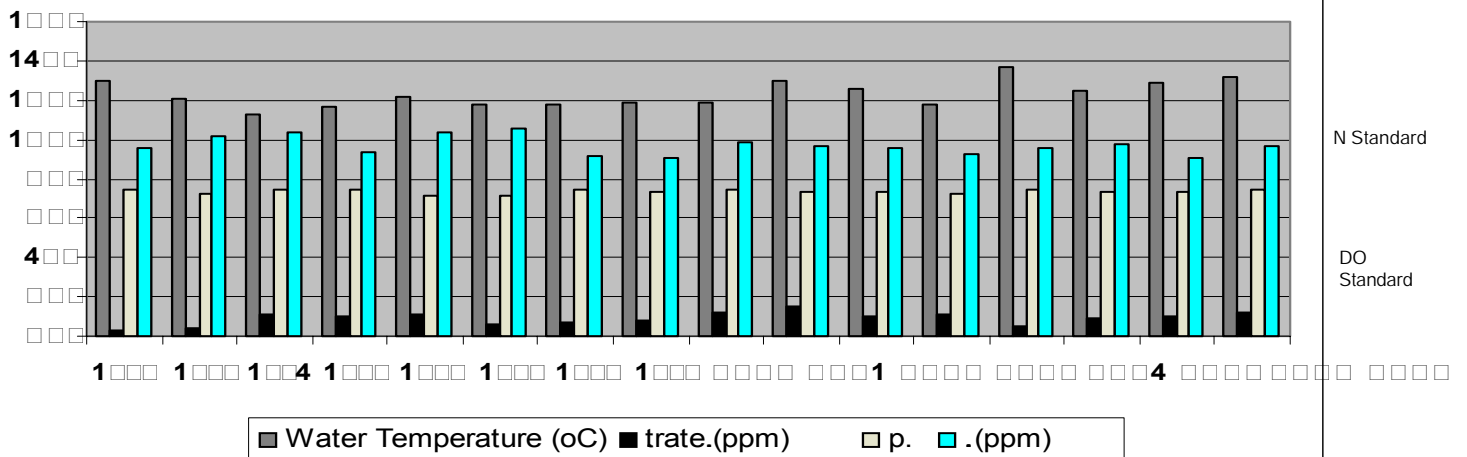


Figure 5: Water Quality at Heathcote Brook (HB3)

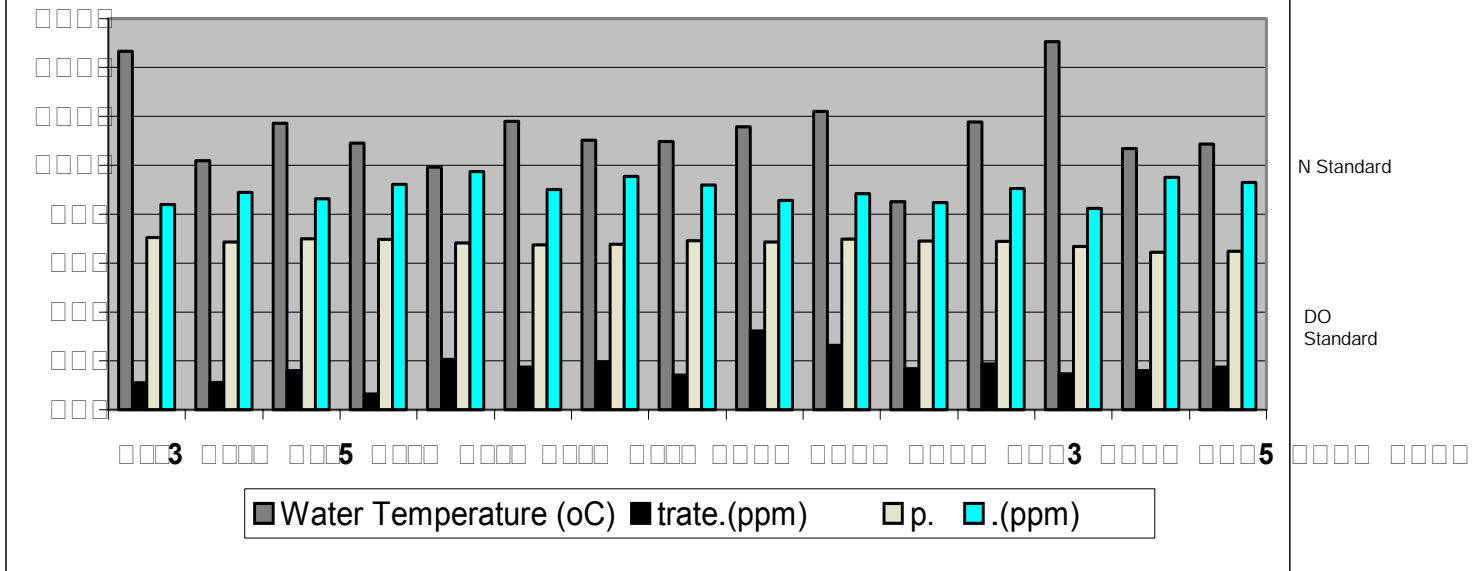


Figure 6: Water Quality at Carnegie Lake (CL2)

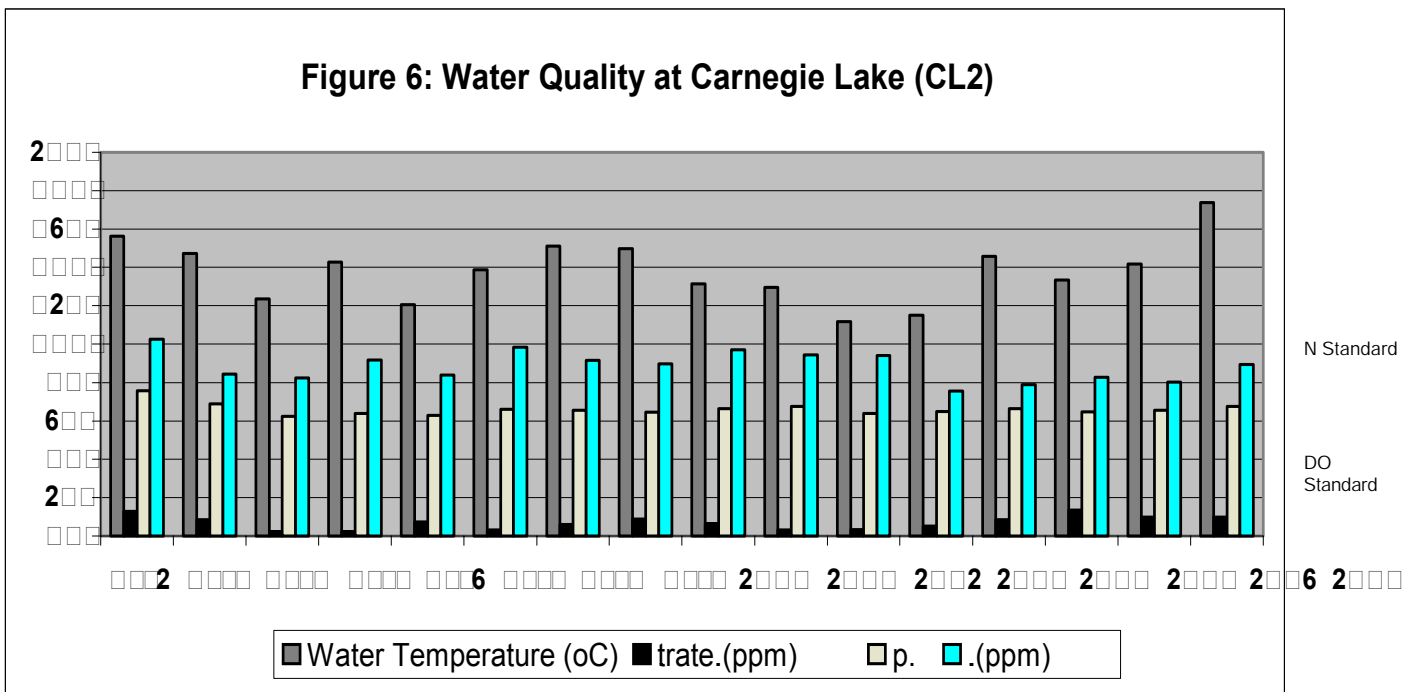


Figure 7: Water Quality at Six Mile Run (SM1)

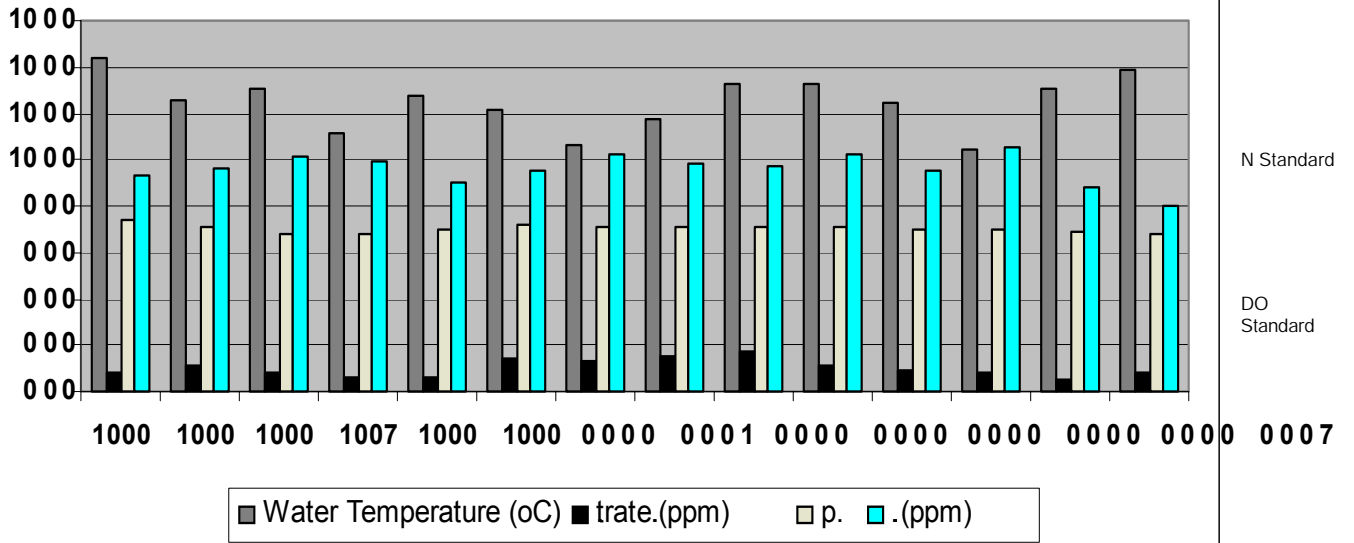


Figure 8: Water Quality at Ten Mile Run (TM1)

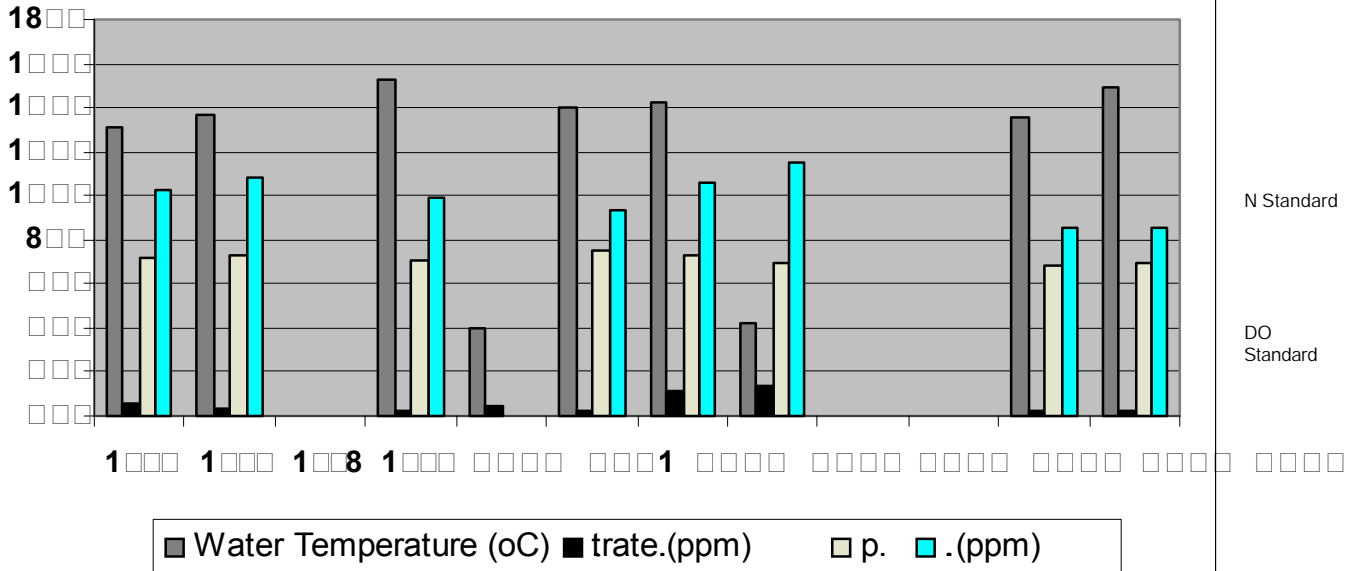


Figure 9: **History of Biological Assessment Impairment Scores for Site 0000S**

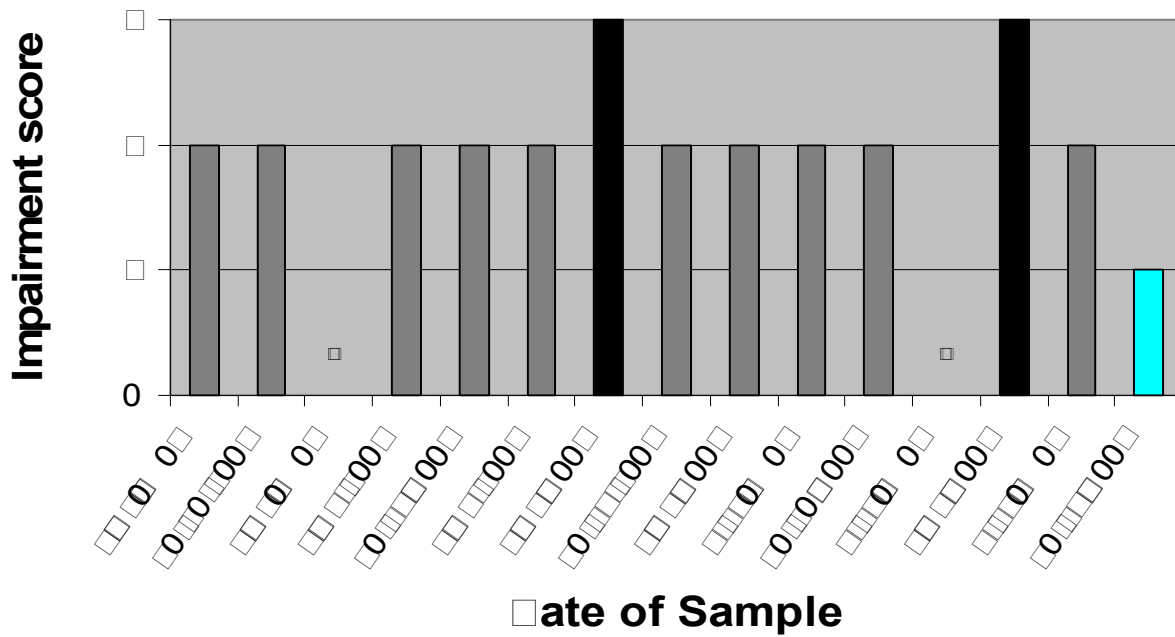
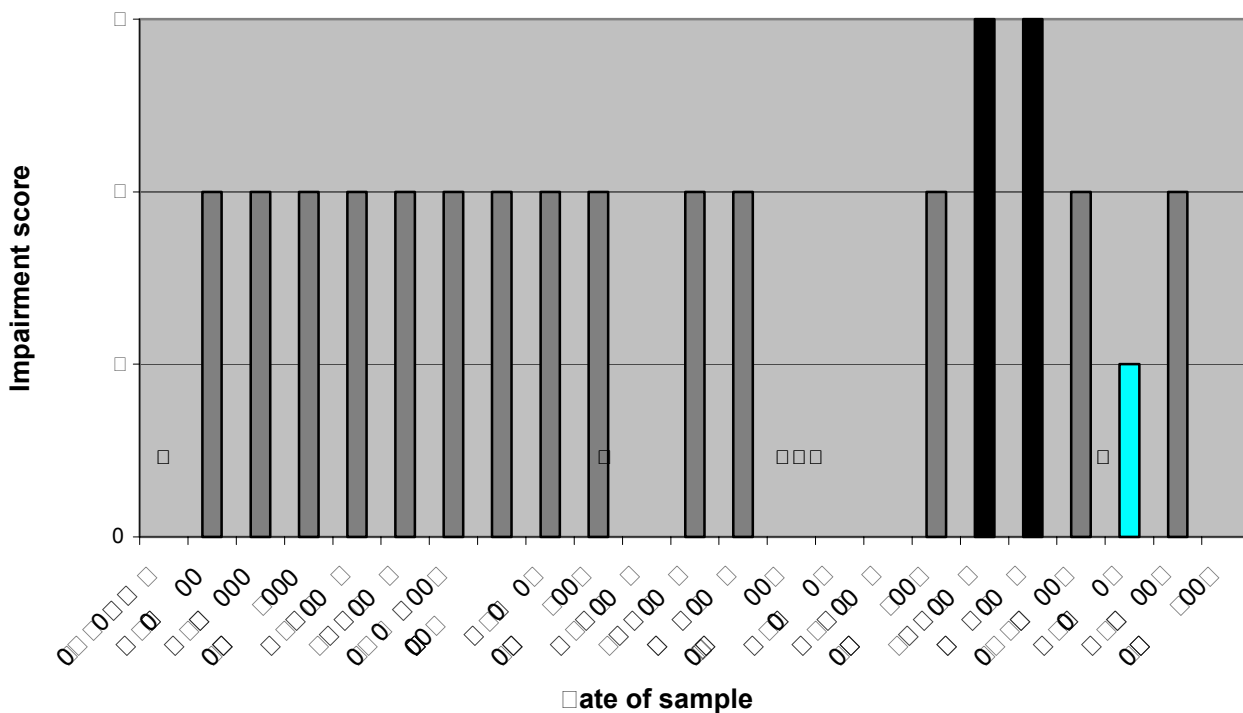


Figure 10: **History of Biological Assessment Impairment Scores for Site 00000**



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DATES TO REMEMBER

July

RAT Month! Time to walk your stream beats! Contact Beth April at (609) 737-3735 x. 17 or bapril@thewatershed.org for more information.

July 12th

CATs testing weekend.

July 19th

BATs Identification Day, 9 am to 4 pm at the Watershed Reserve. Contact Beth April for more information and to pick up your equipment.

July 26th

CATs testing weekend.

August 9th

CATs testing weekend

August 9th

Butterfly Festival at the Watershed Reserve, 10 am to 4 pm. Contact Nancy Apple or Lisa Jordan for more details at (609) 737-3735 x. 10.

August 23rd

CATs testing weekend.

September 6th

CATs testing weekend.

September 9th

CATs QA/QC Session, 6-8:30 pm. Contact Beth April for more information and to register.

September 13th

CATs QA/QC Session, 9:30 to 12:00. Contact Beth April for more information and to register.

September 20th

CATs testing weekend.

September 27th

Watershed FEST. Support the Watershed by donating items to our Live and Silent Auctions and/or purchasing a ticket for dinner. Contact Nancy Apple or Lisa Jordan for more information.