How Clean the Green? Part I

Report dated 10/30/01 prepared by monitoring coordinator Dick Schlesinger

The Hoosic River Watershed Association has been conducting water quality sampling within the Hoosic River and its tributaries for the past several years. The objectives of the monitoring program include identifying areas of concern, establishing baseline conditions, and following up on previous sampling efforts. This report documents the results from the year 2001 sampling for several chemical and physical water quality indicators within the reach of the Green River that includes the Water Street Mill site and the confluence of Christmas Brook with the Green River.

Background.

This reach of the Green River is classified as suitable for a cold water fishery and for primary recreational activities such as swimming, wading, and fishing (Hudson River Basin 1997 Water Quality Assessment Report, 2000). A suite of seven physical and chemical water quality indicators were measured to determine whether the water quality objectives for these uses were being met. Four of the indicators have specific levels/thresholds that are used to judge whether the water quality is good enough for the classified uses (Massachusetts Surface Water Quality Standards, 314 CMR 4.00). The following list provides the guidance available to judge the water quality.

1. Dissolved Oxygen - Shall not be less than 6.0 mg/l (milligram per liter or parts per million) and natural seasonal and daily variations above these levels shall be maintained; levels shall not be lowered below 75% of saturation.

2. Temperature - Waters in which the maximum mean monthly temperature generally shall not exceed $68^{O}F$ ($20^{O}C$) and the rise in temperature due to a discharge shall not exceed $3^{O}F$ ($1.7^{O}C$) and, when other ecological factors are favorable (such as habitat), are capable of supporting a year-round population of cold water stenothermal aquatic life such as trout (*salmonidae*).

3. pH - Shall be in the range of 6.5 through 8.3 standard units and not more than 0.5 units outside of the background range.

4. Color and Turbidity - These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable. No specific turbidity value is specified. A clear mountain stream might have a turbidity of 1 NTU (nephelometric turbidity units) (Behar, 1996), while a large river might have 10 NTU during dry weather. After rainfall events, turbidity may increase by 5-10 units or more.

5. Conductivity – No specific value is specified. Streams supporting good mixed fisheries have a range of 150 to 500 microsiemens per centimeter (μS/cm) (Behar, 1996).

6. Nitrate nitrogen – No specific value is specified. Natural levels of nitrates are typically 1 mg/l or less (Behar, 1996). Concentrations over 10 mg/l may significantly impact freshwater ecosystems.

7. Orthophosphate – No specific value for phosphorous is specified. It is frequently a limiting factor for plant growth in fresh water systems, and thus any increase may cause a large increase in aquatic plant growth (Behar, 1996). This is of particular concern in lakes and ponds, less so in flowing streams and rivers. In general, any concentration over 0.05 mg/l will likely have an impact.

The following seven sites were sampled on three dates. (See also Fig. 1 for site locations).
GN01.63 on the Green River downstream of the confluence with Christmas Brook.
GC00.00 confluence of Christmas Brook with the Green River.

GC00.34 on Christmas Brook just upstream of where it enters the pipe that carries it the last 340 meters to the Green River.
GN01.74 on the Green River just upstream of the confluence with Christmas Brook.
GN01.94 downstream of the Water St. Mill building.
GN02.06 opposite the Water St. Mill building.
GN02.29 upstream of the Water St. Mill building.

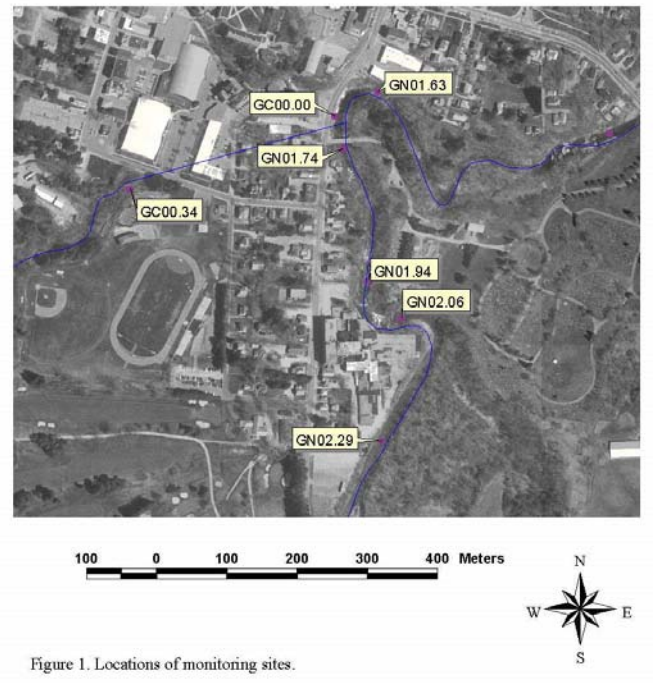

Figure 1. Locations of monitoring sites.

Samples were collected in June, July, and August. During the week prior to the 6/08/01sample, the rainfall was 1.57" on 6/2, 0.67" on 6/3, 0.07" on 6/4. The USGS gage on the Hoosic opposite Treet Cleaners in North Adams showed a peak flow of about 1700 cfs (cubic feet per second) on 6/3, dropping to about 300 cfs at 9:00 am on 6/8. The median flow for this date is about 160 cfs. Thus the flow would be described as above normal, but the sample would be a dry weather sample as it was 5 days after the last rain.

During the week prior to the 7/24/01 sample, the rainfall was 0.49" on 7/17 and 0.01" on 7/18. The Hoosic gage showed the peak flow to be about 160 cfs on 7/17, dropping to about 80 cfs at the time of sampling on 7/24. This was slightly below the median for that date (about 90 cfs). The sample was a dry weather sample at a near normal flow level..

There was no rainfall during the week prior to the 8/31/01 sample. There was rain on the day of sampling, but which started in the evening well after the sampling. The USGS gage record for the date was not available, but the field notes indicated low flow conditions. The sample was a dry weather sample. A sample was not obtained from site GC00.00 on this date.

Methods

Dissolved oxygen levels were measured on site with a YSI Model 55 Dissolved Oxygen meter. The meter also measures water temperature. Then a water sample was collected using a Whirl-Pak bag and placed in a cooler for transport back to the laboratory for further analyses within 2 to 3 hours of collection. Three subsamples (10ml each) were taken from the 400 to 500 ml Whirl-Pak bag samples for nitrate nitrogen, orthophosphate, and turbidity determinations. Then the pH and conductivity of the remaining sample was measured using an Extech Model 34135A meter with its pH probe and its conductivity probe. Nitrate nitrogen and orthophosphate were determined using a LaMotte Smart Colormeter and the corresponding test kits. Turbidity was measured with a LaMotte Model 2020 Turbidity meter.

Results and Discussion

The dissolved oxygen levels in the Green River were well above the minimum level established for a cold water fishery (Fig. 2). The measurements in June were taken between 8:30 and 9:30 am, several hours after the expected predawn minimum. The July readings were taken between 6:00 and 7:00 am and the Aug. readings between 7:00 and 8:00 am, somewhat closer to the expected predawn minimums. Only the Aug. reading upstream of the point where Christmas Brook enters its pipe (GC00.34) was even close to the minimum dissolved oxygen level.

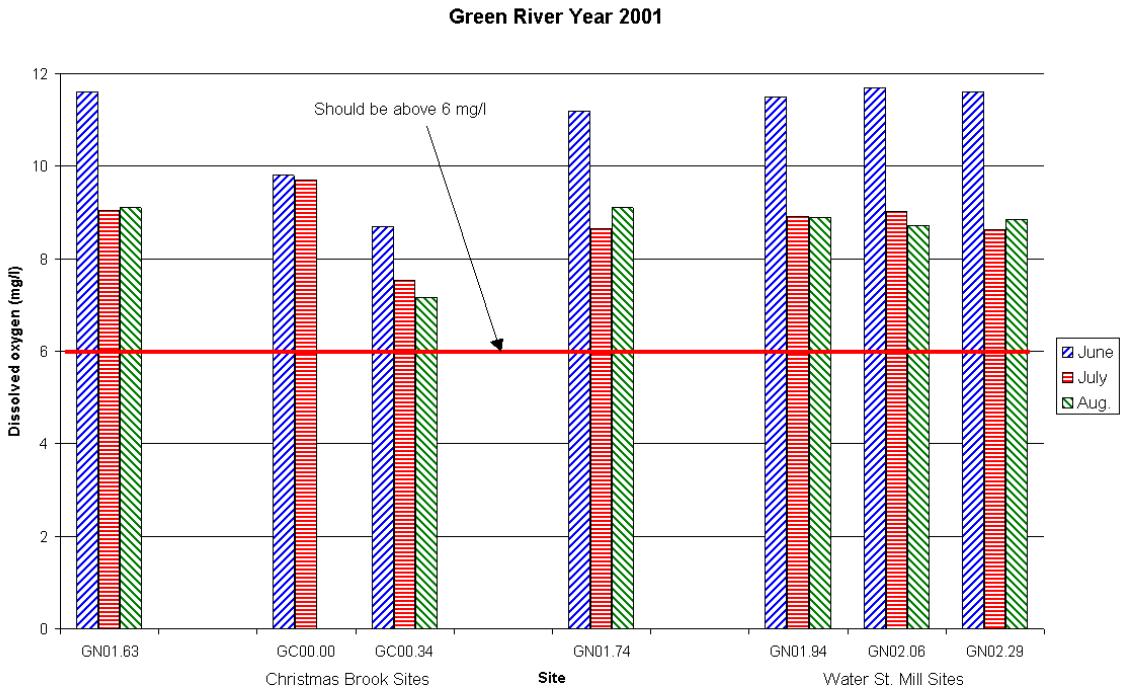

Figure 2. Dissolved oxygen levels on three dates at seven sites.

The levels at all three Water St. Mill sites were nearly the same, indicating that there was no adverse influence of the mill site on this indicator of water quality. The two sites downstream of the Mill that bracket the Christmas Brook confluence were also nearly the same. Although the levels in Christmas Brook were lower, the drainage area of this tributary to the Green River is only 2.4% of the total drainage area of the Green River, and thus its influence on the dissolved oxygen levels was not noticeable after mixing with the waters of the Green River .

The water temperature was 11^{O}C at the Green River sites at the time of the June sample and 14^{O}C in Christmas Brook. In July, Christmas Brook was the cooler of the two, 16^{O}C, while the Green River was almost 20^{O}C. Christmas Brook was also slightly cooler in Aug., 17^{O}C versus 19^{O}C. These few morning temperature readings are not sufficient to determine whether the mean maximum monthly temperature is below the 20^{O}C threshold for a cold water fishery.

The pH was measured in July and Aug. only. In July, it was between 7.6 and 7.9 standard units, and between 8.0 and 8.3 in Aug. These values are quite high, but still within the desired range. These high values are not unexpected in a watershed with considerable limestone bedrock.

Turbidity was generally highest at the time of the June sample, when the flow was slightly above normal (Fig. 3). However, it was well within the normal range for rivers during dry sampling conditions. And it was quite low in July and Aug. in the Green River. Turbidity in Christmas Brook was considerably higher than in the Green River, perhaps as a result of the construction activities for the American Legion building at the corner of Spring St. and Latham St. The water quality adjacent to the Water St. Mill showed no signs of being altered by the presence of the Mill. However, wet weather sampling when runoff from the impervious surfaces of the site might be occurring should to conducted.

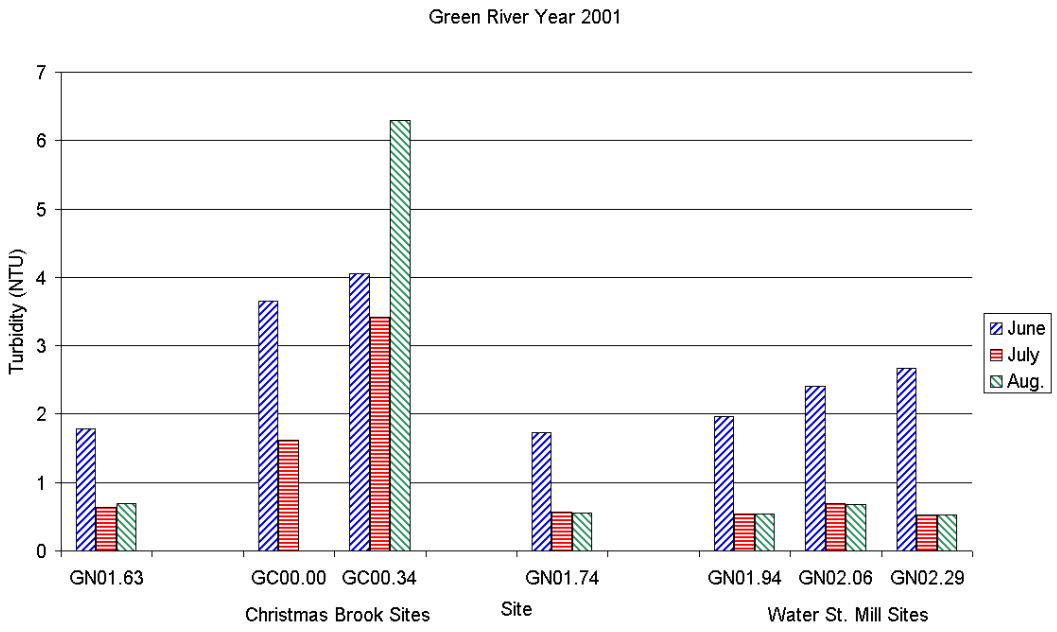

Figure 3. Turbidity.

Electrical conductivity, which is a general water quality indicator that depends upon the concentration of chemical ions in the water, supports the same conclusions (Fig. 4). It is lower during the higher flow conditions, which would tend to reduce the concentration, but is well within the expected limits.

On the Green River, it is even below the expected level, indicating excellent water quality. The values for Christmas Brook are much higher than on the Green. As was true for turbidity, there was no significant change in conductivity as the Green River flows past the Water St. Mill site, nor is there a noticeable change in conductivity from the

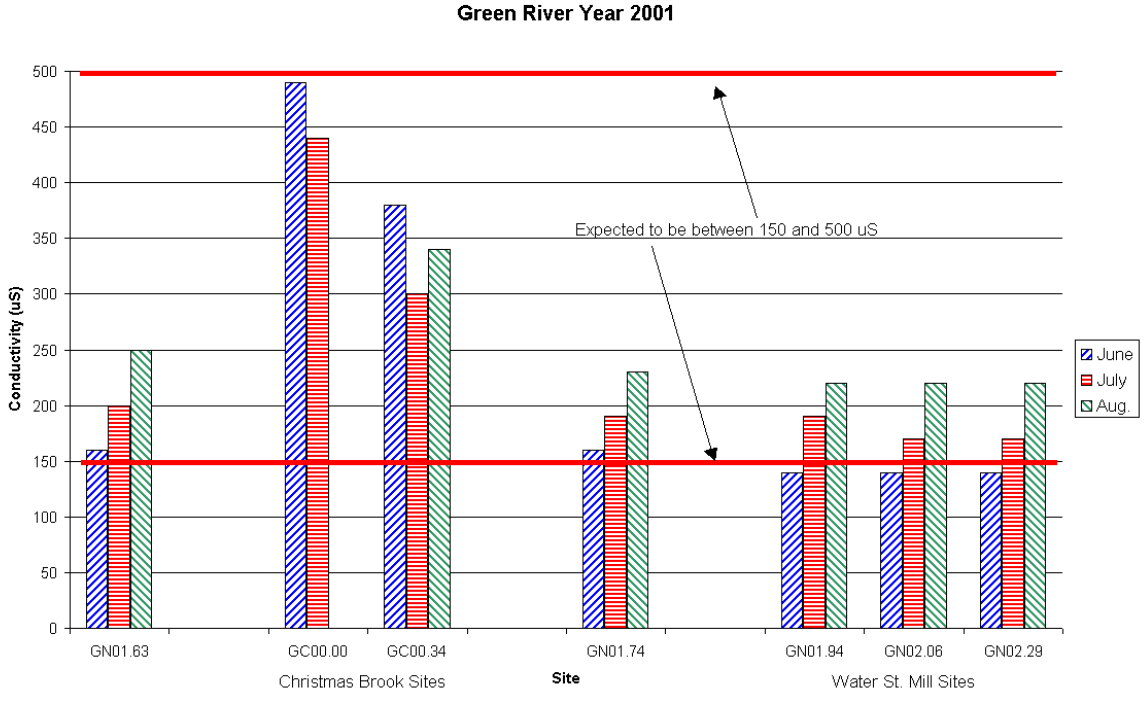

Figure 4. Conductivity readings.

mixing with Christmas Brook.

The nitrate nitrogen results are likewise within the desired limits for freshwater ecosystems (Fig. 5). Even the highest reading (at the Christmas Brook outfall in June) was below 1 mg/l. The other readings were generally less than 0.5 mg/l and were especially low in Aug. during the low flow conditions. This water quality indicator shows the same pattern as the others, i.e. lower quality in Christmas Brook than in the Green River, no significant change in quality within the vicinity of the Water St. Mill, and no significant degradation of quality of the Green River by Christmas Brook.

Our test procedures have a minimum detection level (MDL) of 0.01 mg/l orthophosphate. The June results for the seven sites were either 0.01 or 0.00. In July, the four of the five Green River sites were 0.00 while the most upstream site (GC02.29) was 0.02. The two Christmas Brook sites were 0.03 and 0.06, respectively for sites GC00.34 and GC00.00. In Aug., all of the readings were at or below the MDL. The amount of phosphorous associated with the July phosphate readings in Christmas Brook would be 0.01 and 0.02 mg/l, which are still well below the 0.05 mg/l level that would likely have an impact.

Conclusions

The limited sampling conducted during the year 2001 season shows the Green River to be in good condition within the vicinity of the Water St. Mill and upstream and downstream of the Christmas Brook confluence. Christmas Brook itself was not in as good condition, but as a fairly small tributary, apparently did not significantly lower the water quality in the Green River itself. However, this first year of chemical/physical monitoring by HooRWA can not by itself provide sufficient information to fully assess whether the Green River meets the "fishable/swimmable" goal. We especially need more information on water quality during and immediately after storm events. This year's monitoring has provided a base upon which to build.

Most of the previous monitoring of the Green River has been for bacteria (fecal coliform). This type of monitoring was also conducted this year at 16 sites on the Green River, including 4 of the 7 sites described in this report. However, the 3 Water St. Mill sites were not part of that effort and thus those results will be presented in a future report.

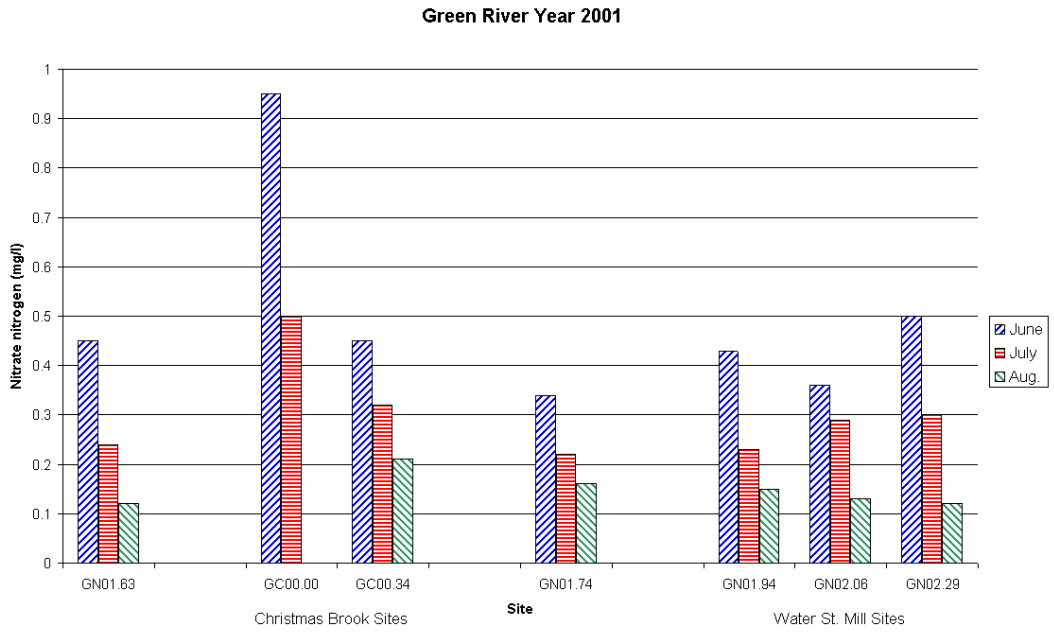

Figure 5. Nitrate nitrogen amounts.

Acknowledgements

We greatly appreciate the financial support of Village Ventures, which allowed us to expand our monitoring to include the Water St. Mill sites. Our analysis equipment was obtained with a grant from Mass. EOEA through their volunteer monitoring grant program. And last, but certainly not least, we gratefully acknowledge volunteer Jasmine Alibozek for her able assistance in collecting and analyzing the Aug. samples.

References Cited

Hudson River Basin 1997 Water Quality Assessment Report. 2000. Report # 11/12/13-AC-1. Prepared by: Laurie E. Kennedy and Mollie J. Weinstein. 98 pages.

Massachusetts Surface Water Quality Standards, 314 CMR 4.00.

Testing the Waters Chemical and Physical Vital Signs of a River. 1997. By Sharon Behar. 211 pages.