New Hampshire Volunteer River Assessment Program
2006 Cold River Water Quality Report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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New Hampshire Volunteer River Assessment Program
2006 Cold River Water Quality Report

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Cover Photo: A volunteer collects a water sample from the Cold River

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2006 Cold River Volunteers

Mike Heidorn

Deborah Hinman

Austin Hunter

Tom Rigley

Erik Walker

Howard Weeks

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1.0 INTRODUCTION

1.1. Purpose of Report

Each year the New Hampshire Volunteer River Assessment Program (VRAP) prepares and distributes a water quality report for each volunteer river monitoring group that is based solely on the water quality data collected by that group during a specific year. The reports summarize and interpret the data, particularly as they relate to New Hampshire's surface water quality standards, and serve as a teaching tool and guidance document for future monitoring activities by the individual volunteer groups.

1.2. Report Format

Each report includes the following:

- **Volunteer River Assessment Program (VRAP) Overview**

  This section includes a description of the history of VRAP, the technical support, training and guidance provided by NHDES, and how data is transmitted to the volunteers and used in surface water quality assessments.

- **Monitoring Program Description**

  This section provides a description of the volunteer group's monitoring program including monitoring objectives as well as a table and map showing sample station locations.

- **Results and Recommendations**

  Water quality data collected during the year are summarized on a parameter-by-parameter basis using (1) a data summary table that includes the number of samples collected, data ranges, the number of samples meeting New Hampshire water quality standards, and the number of samples adequate for water quality assessments at each station, (2) a discussion of the data, (3) a river graph showing the range of measured values at each station and (4) a list of applicable recommendations.

  Sample results reported as less than the detection limit were assumed equal to one-half the detection limit on the river graphs. This approach simplifies the understanding of the parameter of interest, and specifically helps one to visualize how the river or watershed is functioning from upstream to downstream. In addition, this format allows the reader to better understand potential pollution areas and target those areas for additional sampling or environmental enhancements. Where applicable,

the river graph also shows New Hampshire surface water quality standards or levels of concern for comparison purposes.

- **Appendix A – Water Quality Data**

  This appendix includes a spreadsheet detailing the data results and additional information such data results which do not meet New Hampshire surface water quality standards, and data that is unusable for assessment purposes due to quality control requirements.

- **Appendix B – Interpreting VRAP Water Quality Parameters**

  This appendix includes a brief description of water quality parameters typically sampled by VRAP volunteers and their importance, as well as applicable state water quality criteria or levels of concern.

- **Appendix C – Glossary of River Ecology Terms**

  This appendix contains a list of terms commonly used when discussing river ecology and water quality.

- **Appendix D – Native Shoreland/Riparian Buffer Plantings for New Hampshire**

  This appendix contains a table of over ninety suggested native shoreland/riparian buffer plantings for New Hampshire. The table contains common name(s), Latin name, height, growth rate, rooting, light preference, soil preference, and associated wildlife and food value of each tree, shrub, and groundcover/herbaceous perennial species.

2.0 PROGRAM OVERVIEW

2.1 Past, Present, and Future

In 1998, the New Hampshire Department of Environmental Services established the New Hampshire Volunteer River Assessment Program (VRAP) to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology and to improve water quality monitoring coverage for the protection of water resources. The water quality data collected by VRAP volunteers provides both NHDES and the program participants with invaluable information on the fluctuating conditions in rivers and streams and helps determine where improvements, restoration, or preservation may benefit the river and the communities it supports.

Today, VRAP continues to serve the public by providing services such as technical assistance, training in water quality monitoring protocols, quality assurance/quality control procedures, educational outreach, GIS assistance, and water quality reports. In 2006, VRAP supported 28 volunteer groups on numerous stream and river watersheds throughout the state. During 2006, VRAP volunteers monitored 298 river and stream stations providing over 9,000 water quality parameter measurements useable for Clean Water Act mandated water quality assessments.

2.2 Technical Support

VRAP lends and maintains water quality monitoring kits for volunteer groups throughout the state. The kits contain electronic meters and supplies for "in-the-field" measurements of water temperature, dissolved oxygen, pH, specific conductance (conductivity), and turbidity. These are the core parameters typically measured by volunteers. However, other water quality parameters, such as nutrients (total phosphorus, total Kjeldahl nitrogen, nitrate), metals, chloride and bacteria (*Escherichia coli*), can also be studied by volunteer groups. VRAP can provide limited to funds to assist groups in laboratory analysis. However due to limited VRAP funds, we encourage VRAP groups to pursue other fundraising activities such as association membership fees, special events, in-kind services (non-monetary contributions from individuals and organizations), and grant writing to assist in laboratory fees or the purchase of water quality monitoring equipment.

VRAP typically recommends sampling every other week during the summer, and volunteer groups are encouraged to organize a long-term sampling program in order to begin to determine trends in river conditions. Each year volunteers design and arrange a sampling schedule in cooperation with NHDES staff. Project designs are created through a review and discussion of existing water quality information, such as known and perceived problem areas or locations of exceptional water quality. The interests, priorities, and resources of the partnership determine monitoring locations, parameters, and frequency.

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine what trends in water quality may be occurring. Water quality results are also used to determine if a river is meeting surface water quality standards. Volunteer monitoring results, meeting NHDES Quality Assurance and Quality Control (QA/QC) requirements, supplement the efforts of NHDES to assess the condition of New Hampshire surface waters. The New Hampshire Surface Water Quality Regulations are available on-line at www.des.nh.gov/rules/desadmin_list#waterq or by calling (603) 271-1975.

2.3 Training and Guidance

Each VRAP volunteer attends an annual training session to receive a demonstration of monitoring protocols and sampling techniques. Training sessions are an opportunity for volunteers to receive an updated version of monitoring techniques. During the training, volunteers have an opportunity for hands-on use of the VRAP equipment and may also receive instruction in the collection of samples for laboratory analysis. Training is accomplished in approximately two hours, after which volunteers are certified in the care, calibration, and use of the VRAP equipment. In some cases, veteran group coordinators can attend a "train the trainer" session. In these trainings the group coordinator receives an update in sampling protocols and techniques and will then train the individual volunteers of their respective group.

VRAP groups conduct sampling according to a prearranged monitoring schedule and VRAP protocols. NHDES staff from the VRAP program aim to visit each group annually during a scheduled sampling events to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group's monitoring coordinator is notified of the result of the verification visit. VRAP groups forward water quality results to NHDES for incorporation into an annual report and state water quality assessment activities.

2.4 Data Usage

2.4.1 Annual VRAP Water Quality Reports

All data collected by volunteers are summarized in annual VRAP water quality reports that are prepared and distributed after the conclusion of the sampling period (typically fall or winter). Each volunteer group receives copies of the report. The volunteers can use the reports and data as a means of understanding the details of water quality, guiding future sampling efforts, or determining restoration activities.

2.4.2 New Hampshire Surface Water Quality Assessments

Along with data collected from other water quality programs, specifically the State Ambient River Monitoring Program (ARMP), applicable volunteer data are

used to support periodic NHDES surface water quality assessments. VRAP data are entered into NHDES's Environmental Monitoring Database (EMD) and are ultimately uploaded to the Environmental Protection Agency's database. Assessment results and the methodology used to assess surface waters are published by NHDES every two years (i.e., Section 305(b) Water Quality Reports) as required by the federal Clean Water Act. The reader is encouraged to log on to the NHDES web page to review the assessment methodology and list of impaired waters www.des.nh.gov/wmb/swqa/.

2.5 Quality Assurance/Quality Control

In order for VRAP data to be used in the assessment of New Hampshire's surface waters, the data must meet quality control guidelines as outlined in the VRAP Quality Assurance Project Plan (QAPP). The VRAP QAPP was approved by NHDES and reviewed by EPA in the summer of 2003. The QAPP is reviewed annually and is officially updated and approved every five years. The VRAP Quality Assurance/Quality Control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in sampling efforts.

- **Calibration:** Prior to each measurement, the pH and DO meters must be calibrated. Conductivity and turbidity meters are checked against a known standard before the first measurement and after the last one.

- **Replicate Analysis:** A second measurement by each meter is taken from the original sample at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the replicate analysis should be conducted at different stations. Replicates should be measured within 15 minutes of the original measurements.

- **6.0 pH Standard:** A reading of the pH 6.0 buffer is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the 6.0 pH standard check should be conducted at different stations.

- **Zero Oxygen Solution:** A reading of a zero oxygen solution is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the zero oxygen standard check should be conducted at different stations.

- **DI (De-Ionized) Turbidity Blank**: A reading of the DI blank is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.

- **End of the Day Conductivity and Turbidity Meter Check:** At the conclusion of each sampling day, the conductivity and turbidity meters are re-checked against a known standard.

2.5.1 Measurement Performance Criteria

Precision is calculated for field and laboratory measurements through measurement replicates (instrumental variability) and is calculated for each sampling day. The use of VRAP data for assessment purposes is contingent on compliance with a parameter-specific relative percent difference (RPD) as derived from equation 1, below. Any data exceeding the limits of the individual measures are disqualified from surface water quality assessments. All data that exceeds the limits defined by the VRAP QAPP are acknowledged in the data tables with an explanation of why the data was unusable. Table 1 shows typical parameters studied under VRAP and the associated quality control procedures.

(Equation 1)

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100 \ \%$$

where x_1 is the original sample and x_2 is the replicate sample

Table 1. Field Analytical Quality Controls

Water Quality Parameter	QC Check	QC Acceptance Limit	Corrective Action	Person Responsible for Corrective Action	Data Quality Indicator
Temperature	Measurement Replicate	RPD < 10% or Absolute Difference <0.8 C.	Repeat Measurement	Volunteer Monitors	Precision
Dissolved Oxygen	Measurement Replicate	RPD < 10%	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (Zero O_2 Sol.)	RPD < 10% or Absolute Difference <0.4 mg/L	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Relative Accuracy
pH	Measurement Replicate	RPD < 10% or Absolute Difference <0.3 pH units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (pH = 6.0)	± 0.1 std units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Specific Conductance	Measurement Replicate	RPD < 10% or Absolute Difference <5µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (Zero Air Reading)	± 5.0 µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Turbidity	Measurement Replicate	RPD < 10% or Absolute Difference <0.5 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (DI Water)	± 0.1 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Laboratory Parameters	Measurement Replicate	RPD < 20% or Absolute Difference less than ½ the mean value of the parameter in NHDES's Environmental Monitoring Database	Repeat Measurement	Volunteer Monitors	Precision

3.0 METHODS

In 2002, volunteers from the Cold River Local Advisory Committee (CRLAC) began a water quality monitoring program on the Cold River and its tributaries. The goal of this effort was to provide water quality data from the Cold River watershed relative to surface water quality standards and to allow for the assessment of the river for support of aquatic life and primary contact recreation (swimming). The establishment of a long-term monitoring program will allow for an understanding of the river's dynamics, or variations on a station-by-station and year-to-year basis. The data can also serve as a baseline from which to determine any water pollution problems in the river and/or watershed. The Volunteer River Assessment Program has provided field training, financial assistance for laboratory costs, and technical assistance.

On October 9, 2005 the Cold River watershed experienced one of the worst floods in New Hampshire history. The watershed was severely damaged both in terms of property/infrastructure impacts and alteration of the physical structure of the lower Cold River and Warren Brook. The value of the CRLAC monitoring program became extremely evident as they and NHDES sought to study the impact of the flood on water quality and what short and long term problems resulted. The monitoring conducted in 2006 represents the first full season of monitoring conducted since the flood. Where applicable, this report will discuss the impacts of the flood on water quality and how data collected by the CRLAC volunteers has detected changes since the flood.

During 2006, trained volunteers from the CRLAC monitored water quality at 29 stations along the mainstem of the Cold River and its tributaries (Figure 1, Table 2). Newell Pond was also monitored with sampling techniques appropriate for VLAP or other lake monitoring. In addition, one station on the Cold River and one on Crane Brook were monitored by NHDES using water temperature dataloggers. The same Crane Brook station was also monitoring by NHDES using a multiparameter submersible datalogger.

Stations IDs are designated using a three letter code to identify the waterbody name plus a number indicating the relative position of the station. The higher the station number the more upstream the station is in the watershed. All surface waters in the Cold River Watershed are designated as Class B waters. This classification is used to apply the appropriate water quality standards.

Water quality monitoring was conducted from July to October. In-situ measurements of water temperature, air temperature, dissolved oxygen, pH, turbidity and specific conductance were taken using a multiparameter In-Situ Troll. This meter was also used to conduct a vertical profile in Newall Pond. Samples for *E.coli*, metals, nutrients, and chloride were taken using bottles supplied by the NHDES laboratory and were stored on ice during transport from the field to the lab. Table 3 summarizes the parameters measured, laboratory standard methods, and equipment used.

Table 2. Sampling Stations for Cold River Watershed, NHDES VRAP, 2006

Station ID	Waterbody Name	Location	Town	Elevation*
09-CLD	Cold River	Crescent Lake Road Bridge	Lempster	1200
08-CLD	Cold River	Allen Road Bridge	Acworth	1000
01-XDB	Unnamed Tributary to Dodge Pond	Unamed Tributary Upstream of Dodge Pond	Lempster	1200
01-XJR	Unnamed Tributary to Dodge Brook	Downstream of Jolly Roger Racetrack	Lempster	1100
01-DOB	Dodge Brook	East Acworth Road Bridge	Acworth	900
01-HNY	Honey Brook	Route 123A Bridge	Acworth	900
07-CLD	Cold River	Grout Hill Rd Bridge	Acworth	900
06M-CLD	Cold River	½ mile downstream of Grout Hill Road	Acwroth	800
01-BOB	Bowers Brook	Route 123A Bridge	Acworth	700
06D-CLD	Cold River	Deep Hole	Acworth	700
06-CLD	Cold River	Route 123A Pulloff	Acworth	700
01-MIB	Milliken Brook	Route 123A Bridge	Acworth	700
NEWALSD	Newall Pond	Deep Spot	Acworth	1400
09-THB	Thayer Brook	Newell Pond Road Bridge	Alstead	1400
02-THB	Thayer Brook	Forrest Road Bridge	Acworth	800
05A-CLD	Cold River	Forrest Road Bridge	Acworth	700

01-CRB	Crane Brook	Upstream of Confluence with Cold River	Acworth	600
04M-CLD	Cold River	McDermott Bridge	Langdon	600
12-WAB	Warren Brook	Prentice Hill Road Bridge	Alstead	1200
09-WAB	Warren Brook	Second crossing of 123, downstream of Lake Warren Dam	Alstead	1000
01-WAB	Warren Brook	Route 123A Bridge	Alstead	400
03T-CLD	Cold River	Wooden Dam Downstream of Warren Brook	Alstead	400
03-CLD	Cold River	Route 123 Bridge	Alstead	400
01-DAB	Darby Brook	Comstock Road Bridge	Alstead	400
02D-CLD	Cold River	700' Upstream of 02-CLD	Walpole	400
02-CLD	Cold River	Drewsville	Walpole	400
01T-CLD	Cold River	Tinkers Bridge, Upstream of Confluence with Great Brook	Langdon	400
01-GRB	Great Brook	Cold River Road Bridge	Langdon	400
01-MTB	Mountain Brook	Cold River Road Bridge	Walpole	300
01-CLD	Cold River	Arch Bridge	Walpole	200

*Elevations have been rounded off to 100-foot increments for calibration of dissolved oxygen meter

Figure 1. Cold River Watershed and Monitoring Stations 2006

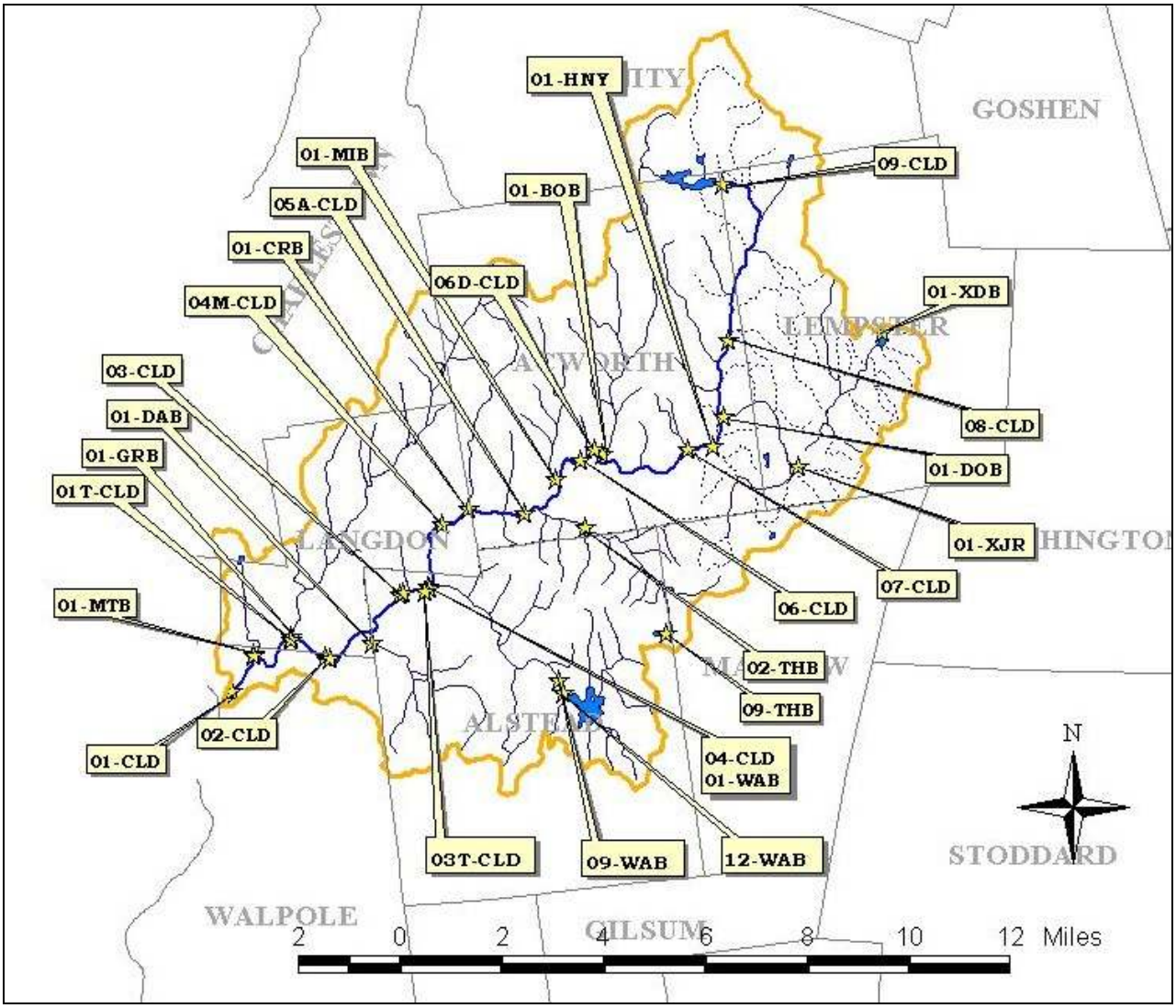


Table 3. Sampling and Analysis Methods

Parameter	Sample Type	Standard Method	Equipment Used	Laboratory
Temperature	Instantaneous	SM 2550	In-Situ Troll 9000	------
	Datalogger	SM 2550	YSI 600 XLM	------
	Datalogger	SM 2550	Onset HOBO Water Temp Pro	------
Dissolved Oxygen	Instantaneous	SM 4500 O G	In-Situ Troll 9000	------
	Datalogger	SM 4500 O G	YSI 600 XLM	------
pH	Instantaneous	SM 4500 H+	In-Situ Troll 9000	------
	Datalogger	SM 4500 H+	YSI 600 XLM	------
Specific Conductance	Instantaneous	SM 2510	In-Situ Troll 9000	------
	Datalogger	SM 2510	YSI 600 XLM	------
Turbidity	Instantaneous	EPA 180.1	In-Situ Troll 9000	------
Velocity	Instantaneous	------	Global F P 201	------
Stage	Instantaneous	------	Measuring Tape	------
Nitrate	Bottle	EPA 353.2	------	NHDES
Total Phosphorous	Bottle (w/Preservative)	EPA 365.3	------	NHDES
E.coli	Bottle (Sterile)	SM 19 9213 D.3	------	NHDES
Chloride	Bottle	EPA 325.2	------	NHDES
Aluminum	Bottle (w/Preservative)	EPA 200	------	NHDES
Hardness	Bottle (w/Preservative)	EPA 200	------	NHDES
Coppper	Bottle (w/Preservative)	EPA 200	------	NHDES
Lead	Bottle (w/Preservative)	EPA 200	------	NHDES
Zinc	Bottle (w/Preservative)	EPA 200	------	NHDES

4.0 RESULTS AND RECOMMENDATIONS

4.1 Dissolved Oxygen

Between one and seven measurements were taken in the field for dissolved oxygen concentration at 25 stations in the Cold River watershed (Table 4). Of the 85 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for dissolved oxygen includes a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 % of saturation. In other words, there are criteria for both concentration and saturation that must be met before the river can be assessed as meeting dissolved oxygen standards. Table 4 reports only dissolved oxygen concentration as more detailed analysis is required to determine if instantaneous dissolved oxygen saturation measurements are above or below water quality standards.

Table 4. Dissolved Oxygen Concentration Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
09-CLD	3	8.46 - 8.76	0	3
08-CLD	4	8.46 - 8.76	0	4
01-XBD	1	8.82	0	1
01-XJR	2	8.80 - 9.72	0	2
01-DOB	3	9.35 - 9.80	0	3
01-HNY	3	10.06 - 10.56	0	3
07-CLD	3	9.40 - 10.11	0	3
01-BOB	4	9.44 - 10.42	0	4
06-CLD	3	9.43 - 10.02	0	3
01-MIB	3	9.83 - 10.35	0	3
NEWALSD	1 (profile)	8.23 - 8.74[A]	0	1
09-THB	1	8.44	0	1
02-THB	3	9.94 - 10.42	0	3
05A-CLD	3	9.68 - 10.10	0	3
01-CRB	5	8.96 - 9.79	0	5
04M-CLD	3	9.68 - 10.10	0	3
12-WAB	4	6.98 - 11.57	0	4

09-WAB	1	8.01	0	1
01-WAB	6	8.81 - 11.09	0	6
03-CLD	7	9.23 - 11.96	0	7
01-DAB	4	9.87 - 10.37	0	4
02-CLD	5	9.12 - 10.09	0	5
01-GRB	5	9.54 - 10.80	0	5
01-MTB	4	9.37 - 10.34	0	4
01-CLD	4	9.52 - 10.33	0	4
Total	**85**	_____	**0**	**85**

[A] Range for dissolved oxygen levels in epilimnion

Dissolved oxygen concentration levels were well above the Class B New Hampshire surface water quality standard at all stations and on all occasions (Figure 2). The average concentration of dissolved oxygen was consistently above the Class B standard at all stations ranging from 7.55 mg/L to 11.96 mg/L.

Figure 3 depicts the results of a vertical profile done for Newall Pond. Stratified ponds such as Newell Pond must have dissolved oxygen levels above the Class B standard of at least 75% saturation based on a daily average and an instantaneous minimum of at least 5.0 mg/L throughout the epilimnion. The epilimnion is the warmer upper layer of a thermally stratified lake or pond that extends from the surface to the thermocline. The thermocline forms the boundary between the warmer upper layers of the epilimonion and the lower, colder, and less circulated waters of the hypolimnion. In this case Newall Pond had dissolved oxygen levels above the Class B standard throughout the epilimnion.

Figure 2. Dissolved Oxygen Statistics for the Cold River Watershed
July 8 - October 1, 2006, NHDES VRAP

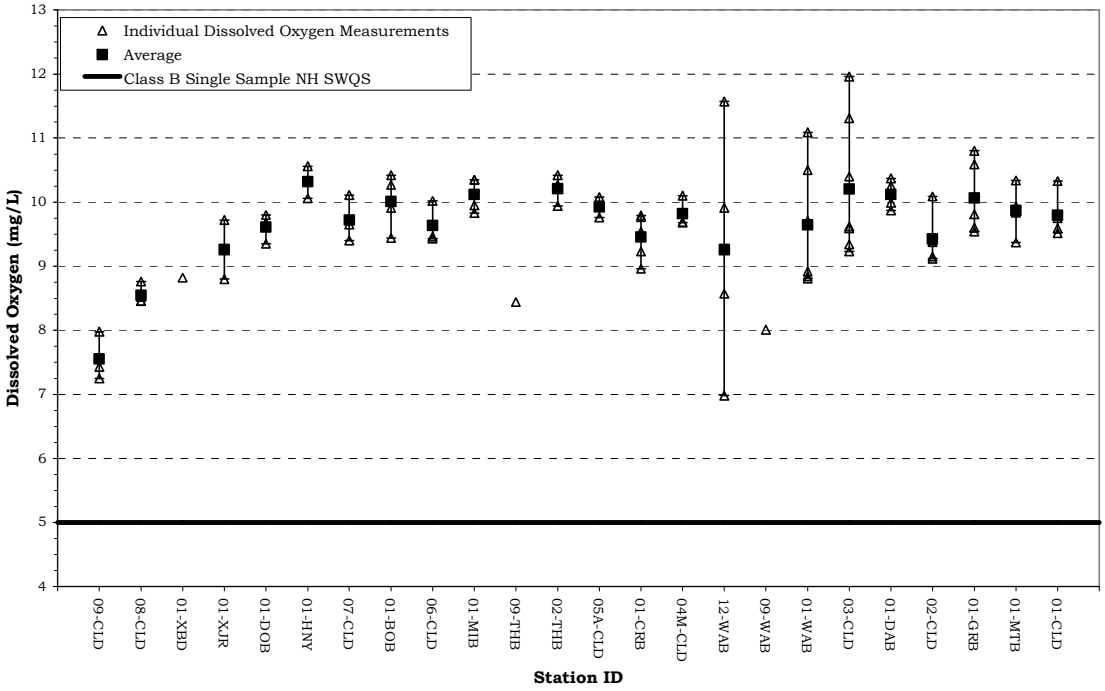
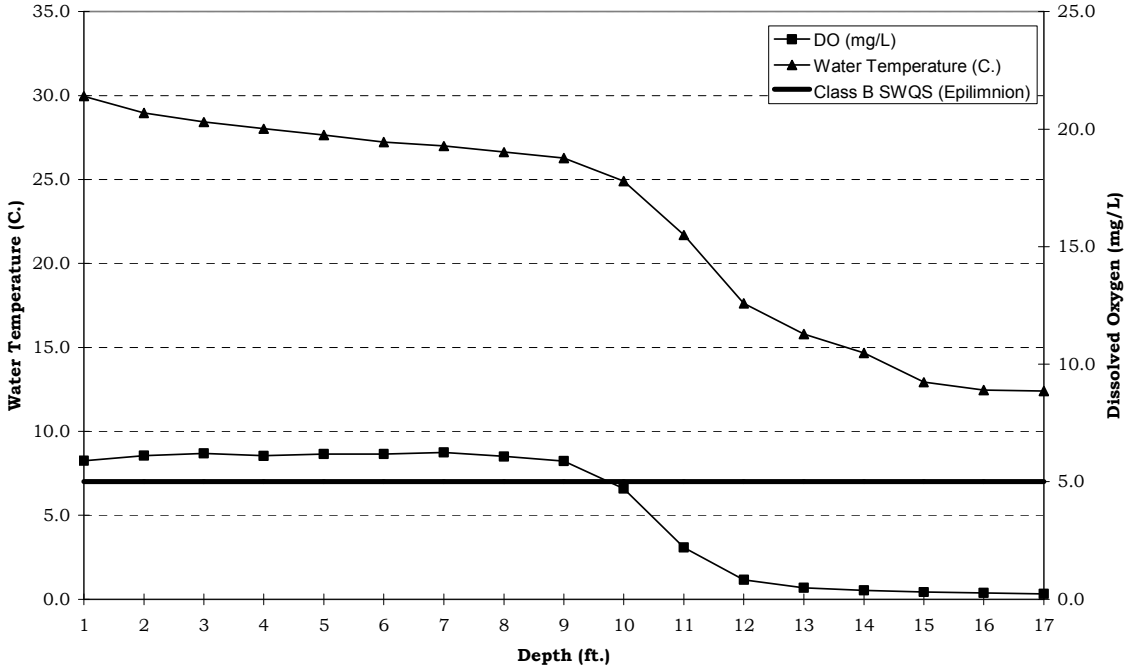


Figure 3. Newall Pond - Verticle Profile of Dissolved Oxygen (mg/L) and
Water Temperature (C.) September 9. 2006, NHDES, VRAP



Figures 4 and 5 illustrate the results of dissolved oxygen concentration and saturation levels obtained at station 01-CRB using a submersible datalogger that was deployed from August 15 through August 22. The meter was programmed to take dissolved oxygen readings every 15 minutes. Data from this meter is generally analyzed in 24 hour sections. During this deployment six full 24-hour periods were measured.

The daily average of dissolved oxygen % saturation was well above the Class B standard on all occasions during deployment. Dissolved oxygen concentration levels were also well above the standard on all occasions during deployment.

Figure 4. Dissolved Oxygen Saturation Statistics for the Crane Brook, New Hampshire August 15 - 22, 2006, NHDES VRAP

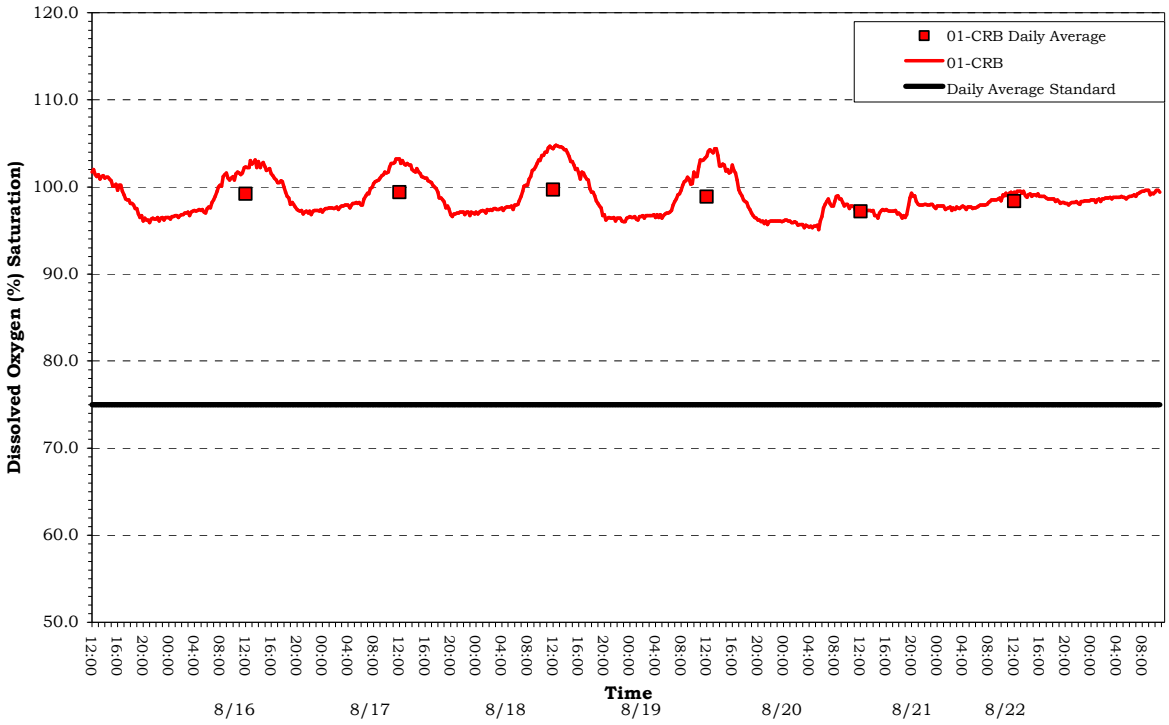
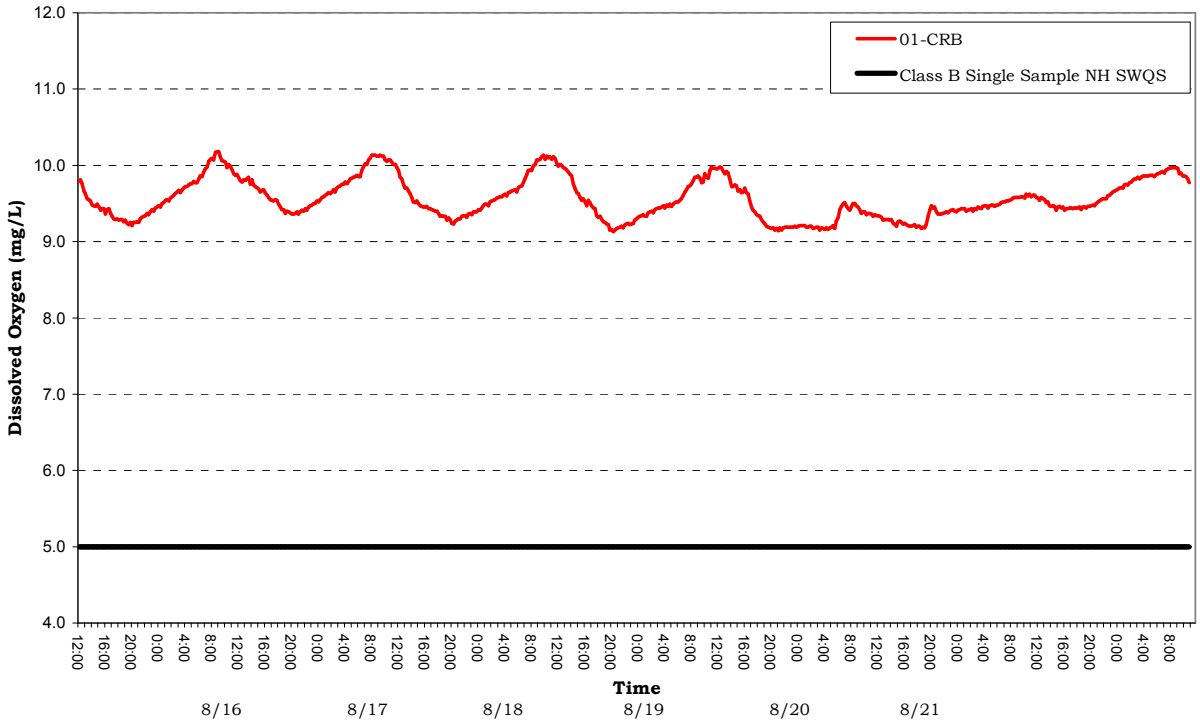


Figure 5. Dissolved Oxygen Concentration Statistics for the Crane Brook, New Hampshire August 15 - 22, 2006, NHDES VRAP



Figures 4 and 5 also depict the typical cyclical variations in dissolved oxygen measurements one would expect to see during a 24-hour period in the summer. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.

Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- If possible, take measurements between 5 a.m. and 10 a.m., which is when dissolved oxygen is usually the lowest, and between 2 p.m. and 7 p.m. when dissolved oxygen is usually the highest. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.
- Continue to incorporate the use of in-situ dataloggers to automatically record dissolved oxygen saturation levels during a period of several days. This will allow for the calculation of the daily average for dissolved oxygen per cent saturation. Dataloggers can be put in the water for a period of several days and collect data at specific time intervals (e.g. every 15 minutes). The use of these instruments is dependent upon availability, and requires coordination with NHDES.

4.2 pH

Between one and six measurements were taken in the field for pH at 25 stations in the Cold River watershed [Table 5]. Of the 84 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard is 6.5 - 8.0, unless naturally occurring.

Table 5. pH Data Summary - Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (standard units)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
09-CLD	3	5.89 - 6.38	3	3
08-CLD	4	5.66 - 6.27	4	4
01-XBD	1	5.87	1	1
01-XJR	2	5.55 - 6.09	2	2
01-DOB	3	6.27 - 6.54	3	3
01-HNY	3	5.80 - 6.25	3	3
07-CLD	3	6.16 - 6.76	1	3
01-BOB	4	6.09 - 6.42	4	4
06-CLD	3	6.03 - 6.47	3	3
01-MIB	3	6.04 - 6.68	2	3
NEWALSD	1 (profile)	4.81 - 6.51[A]	1	1
09-THB	1	6.23	1	1
02-THB	3	5.69 - 6.57	2	3
05A-CLD	3	6.06 - 6.78	1	3
01-CRB	5	6.65 - 7.19	0	5
04M-CLD	3	6.45 - 6.85	0	3
12-WAB	4	5.92 - 6.62	3	4
09-WAB	1	6.42	1	1
01-WAB	6	6.30 - 7.01	1	6
03-CLD	7	5.91 - 7.24	4	7
01-DAB	4	6.48 - 7.12	1	4
02-CLD	5	6.22 - 7.05	1	5
01-GRB	5	6.31 - 7.13	2	5
01-MTB	4	6.07 - 7.12	2	4
01-CLD	4	6.45 - 7.29	2	4
Total	**85**	_____	**48**	**85**

[A] Represents pH levels for full profile of Newall Pond

With the exception of station 01-CRB, all other stations had pH measurements that were below the minimum New Hampshire surface water quality standard (Figure 6). Newall Pond (which is not included in Figure 6) had pH measurements throughout the profile that were also below the minimum New Hampshire surface water quality standard for pH.

Lower pH measurements are likely the result of natural conditions such as the soils, geology, or the presence of wetlands in the area. Rain and snow falling in New Hampshire is relatively acidic, which can also affect pH levels; after the spring melt or significant rain events, surface waters will generally have a lower pH.

Figure 6. pH Statistics for the Cold River Watershed
July 8 - October 1, 2006, NHDES VRAP

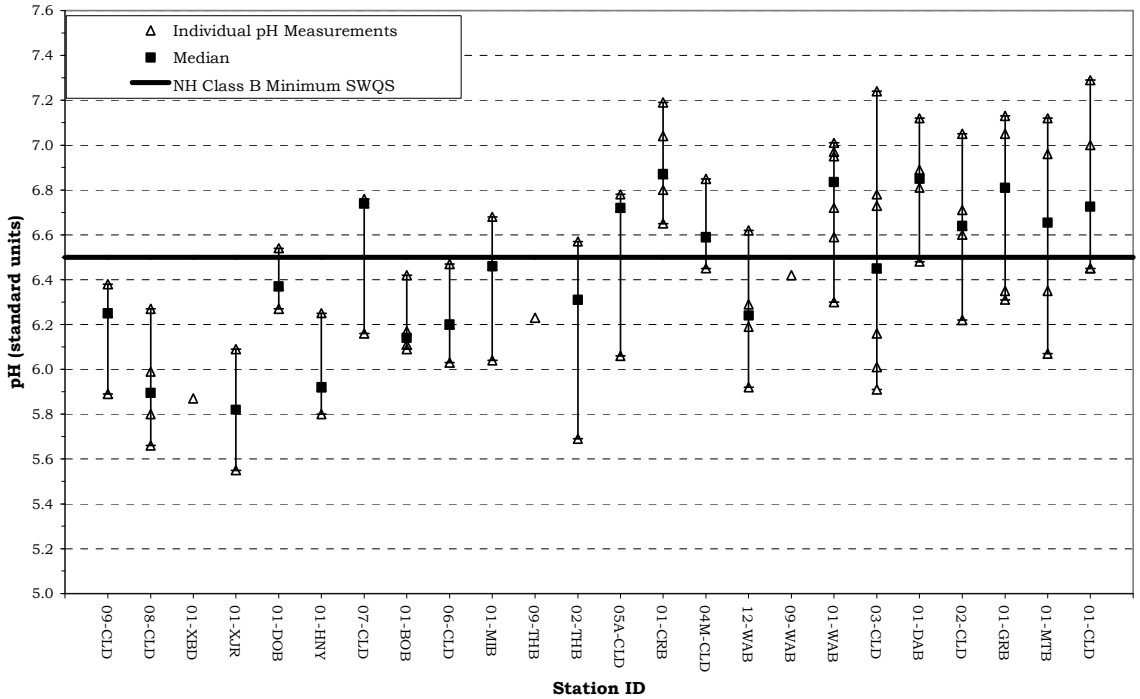
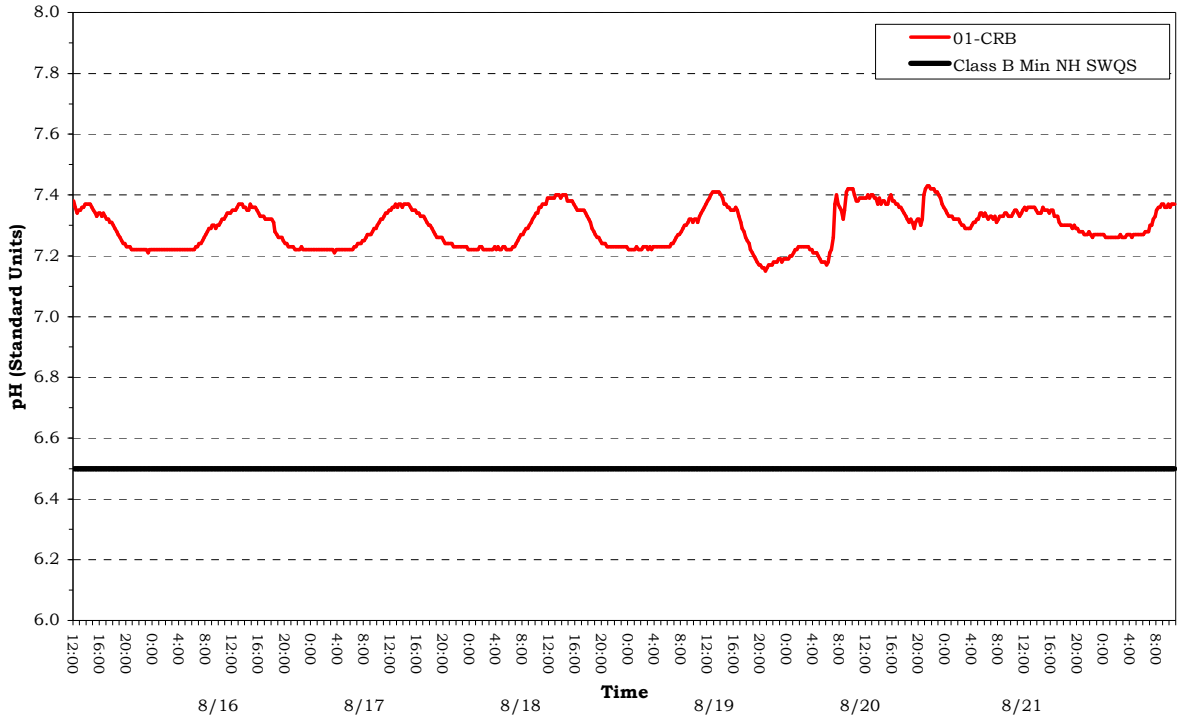


Figure 7 illustrates the results of pH measurements obtained at station 01-CRB using a submersible datalogger that was deployed from August 15 through August 27. The meter was programmed to take pH readings every 15 minutes over a multiple day period. pH measurements were well above the standard on all occasions during deployment.

Figure 7. pH Statistics for the Crane Brook, New Hampshire
August 15 - 22, 2006, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- Consider sampling for pH in some of the tributaries and wetland areas that are influencing the pH of stations with measurements below state standards. Site conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. Wetlands can lower the pH of a river naturally by releasing tannic and humic acids from decaying plant material. If the sampling location is influenced by wetlands or other natural conditions, then the low pH measurements are not considered a violation of water quality standards. It is important to note that the New Hampshire water quality standard for pH is fairly conservative, thus pH levels slightly below the standard are not necessarily harmful to aquatic life. In this case, additional information about factors influencing pH levels is needed.

4.3 Turbidity

Between one and seven measurements were taken in the field for turbidity at 24 stations in the Cold River watershed [Table 6]. Of the 81 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for turbidity is less than 10 NTU above background.

Table 6. Turbidity Data Summary - Cold River Watershed, 2006

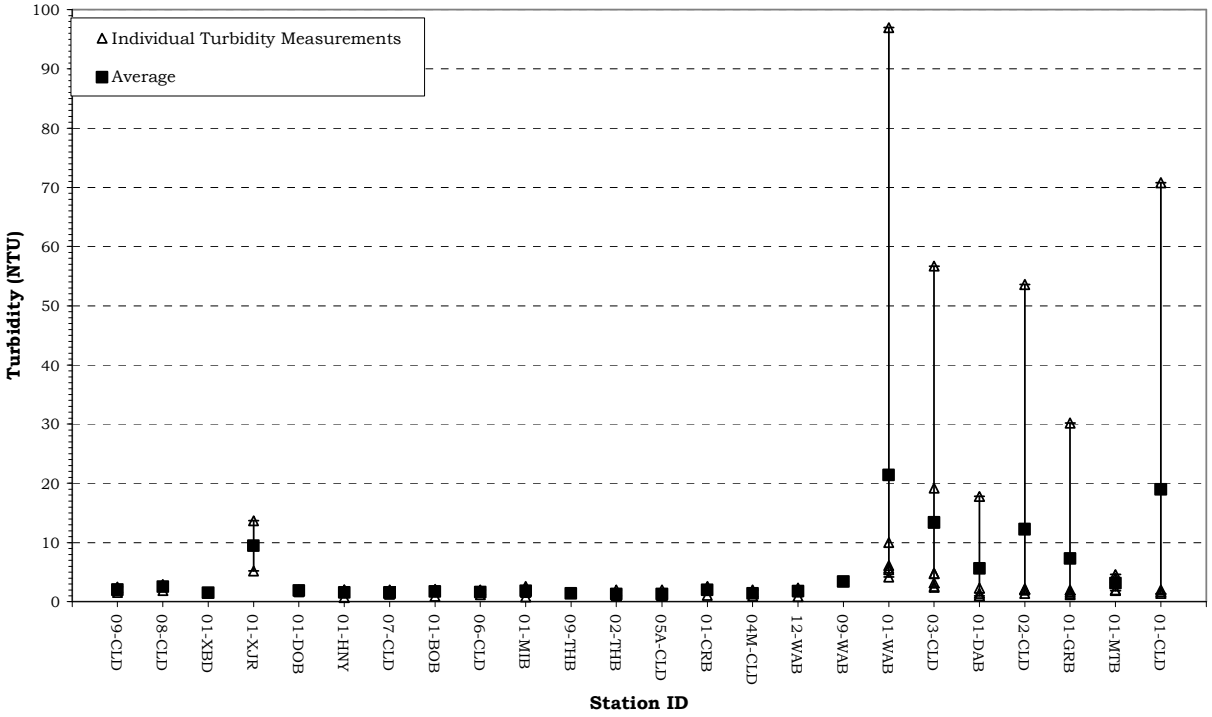
Station ID	Samples Collected	Data Range (NTU)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
09-CLD	3	1.6 - 2.5	0	3
08-CLD	3	1.9 - 2.9	0	3
01-XBD	1	1.5	0	1
01-XJR	2	5.2 - 13.7	0	2
01-DOB	3	1.7 - 2.0	0	3
01-HNY	3	0.7 - 2.0	0	3
07-CLD	3	1.3 - 2.0	0	3
01-BOB	4	0.9 - 2.1	0	4
06-CLD	3	1.2 - 2.0	0	3
01-MIB	3	0.8 - 2.6	0	3
09-THB	1	1.4	0	1
02-THB	3	1.0 - 2.0	0	3
05A-CLD	3	1.0 - 2.0	0	3
01-CRB	3	1.1 - 2.6	0	3
04M-CLD	3	0.9 - 2.0	0	3
12-WAB	4	0.9 - 2.3	0	4
09-WAB	1	3.4	0	1
01-WAB	6	4.2 - 97.0	1	6
03-CLD	7	2.4 - 56.7	2	7
01-DAB	4	1.0 - 17.8	1	4
02-CLD	5	1.4 - 53.6	1	5
01-GRB	5	1.2 - 30.2	1	5
01-MTB	4	1.9 - 4.6	0	4
01-CLD	4	1.4 - 70.8	1	4
Total	**81**	_____	**7**	**81**

Turbidity levels were low at all stations on the Cold River upstream of the confluence of Warren Brook with the average for these stations ranging from 1.3 NTU to 9.5 NTU (Figure 8). Stations 12-WAB and 09-WAB which are above Cooper Hill Road also had low turbidity measurements. In portions of the Cold River watershed below the confluence with Warren Brook and Warren Brook below Cooper Hill Road, all but one of the stations had at least one turbidity measurements that exceeded the Class B standard.

Preliminary National Weather service data indicates that on both dates when elevated turbidity measurements were recorded precipitation had either recently or was actively occurring in the Cold River watershed. The unstable streambanks in those portions of the watershed most damaged by the flood are very susceptible to further erosion during precipitation. Turbidity data collect by CRLAC in 2006 confirms that the damaged portions of the watershed still have problems with high turbidity levels when precipitation occurs.

Although clean waters are associated with low turbidity there is a high degree of natural variability involved. Precipitation often contributes to increased turbidity by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters. However, human activities such as removal of vegetation near surface waters and disruption of nearby soils can lead to dramatic increases in turbidity levels. In general it is typical to see a rise in turbidity in more developed areas due to increased runoff.

Figure 8. Turbidity Statistics for the Cold River Watershed
July 8 - October 27, 2006, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- Continue to collect samples during wet weather. This will help us to understand how the river responds to runoff and sedimentation. This should be a priority for those portions of the watershed most damaged by the 2005 flood.
- If a higher than normal turbidity measurement occurs, volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated turbidity levels. In addition, take good field notes and photographs. If human activity is suspected or verified as the source of elevated turbidity levels, volunteers should contact NHDES.

4.4 Specific Conductance

Between one and seven measurements were taken in the field for specific conductance at 24 stations in the Cold River watershed [Table 7]. Of the 83 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

New Hampshire surface water quality standards do not contain numeric limits for specific conductance.

Table 7. Specific Conductance Data Summary - Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (µS/cm)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
09-CLD	3	24.2 - 29.5	Not Applicable	3
08-CLD	4	33.2 - 38.4	N/A	4
01-XBD	1	79.4	N/A	1
01-XJR	2	27.8 - 30.4	N/A	2
01-DOB	3	68.5 - 74.2	N/A	3
01-HNY	3	53.5 - 58.9	N/A	3
07-CLD	3	46.9 - 51.8	N/A	3
01-BOB	4	31.6 - 33.2	N/A	4
06-CLD	3	46.8 - 51.5	N/A	3
01-MIB	3	42.8 - 48.8	N/A	3
NEWALSD	1 (profile)	23.7 - 58.8A	N/A	1
09-THB	1	24.4	N/A	1
02-THB	3	34.0 - 36.1	N/A	3
05A-CLD	3	48.6 - 55.5	N/A	3
01-CRB	5	59.2 - 86.1	N/A	5
04M-CLD	3	50.3 - 56.4	N/A	3
12-WAB	4	40.6 - 54.0	N/A	4
09-WAB	1	43.1	N/A	1
01-WAB	6	59.9 - 83.6	N/A	6
03-CLD	7	40.0 - 61.2	N/A	7
01-DAB	3	68.6 - 71.1	N/A	3
02-CLD	5	58.1 - 65.2	N/A	5
01-GRB	5	57.6 - 70.6	N/A	5
01-MTB	4	32.5 - 34.7	N/A	4
01-CLD	4	59.1 - 73.9	N/A	4
Total	**84**	_____	**N/A**	**84**

[A] Represents specific conductance levels for full profile of Newall Pond

Specific conductance levels were low throughout the entire watershed with the average ranging from 26.7 µS/cm to 71.6 µS/cm (Figure 9). Higher specific conductance levels can be indicative of pollution from sources such as urban/agricultural runoff, road salt, failed septic systems, or groundwater pollution. Thus, the low specific conductance levels generally indicate low pollutant levels.

Figure 9. Specific Conductance Statistics for the Cold River Watershed
July 8 - October 1, 2006, NHDES VRAP

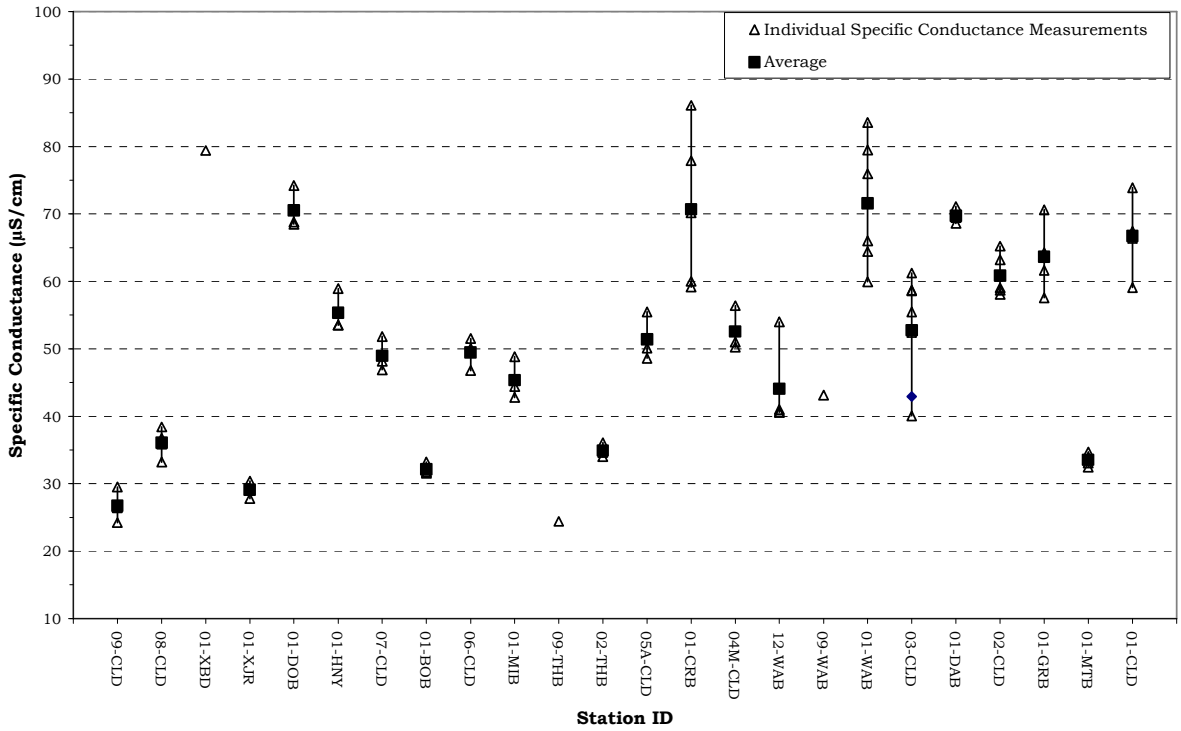
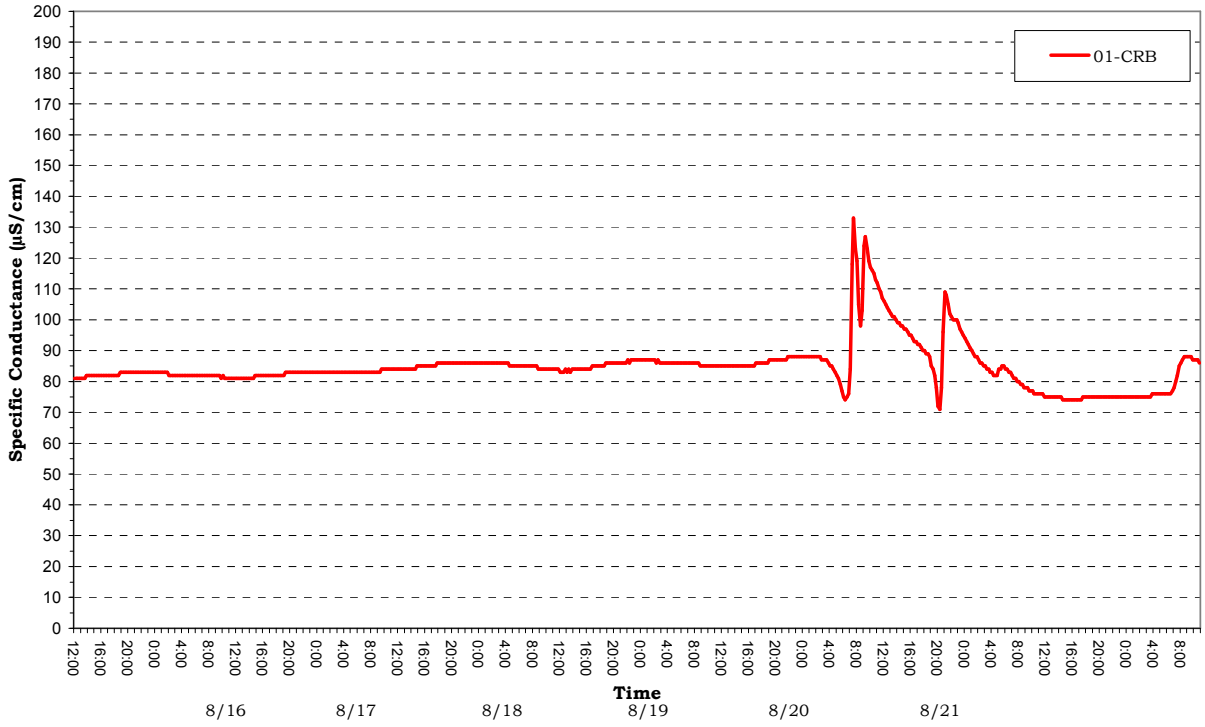


Figure 10 illustrates the results of specific conductance measurements obtained at station 01-CRB using a submersible datalogger that was deployed from August 15 through August 22. The meter was programmed to take specific conductance readings every 15 minutes. For a majority of the deployment specific conductance levels were low and consistent with instantaneous measurements previously recorded. On August 20 specific conductance levels rose quickly and sharply on multiple occasions. Although the peak specific conductance levels of these spikes were still relatively low, the data could indicate a discharge into the waterbody that increased the ionic content of the water.

Figure 10. Specific Conductance Statistics for the Crane Brook, New Hampshire August 15 - 22, 2006, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

4.5 Water Temperature

Between one and seven measurements were taken in the field for water temperature at 25 stations in the Cold River watershed [Table 8]. Of the 81 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

In addition to instantaneous measurements, VRAP staff deployed temperature loggers at two stations (06M-CLD and 01-CRB).

Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

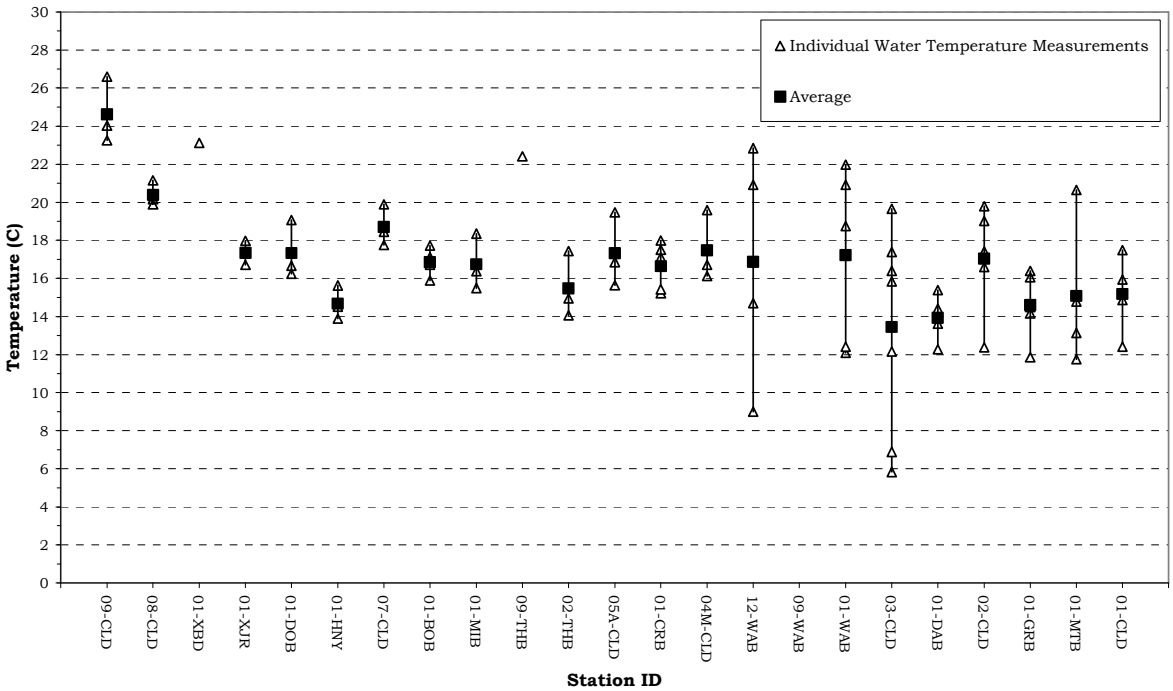
Table 8. Water Temperature Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (°C)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
09-CLD	3	23.25 - 26.60	Not Applicable	3
08-CLD	4	19.90 - 21.16	N/A	4
01-XBD	1	23.13	N/A	1
01-XJR	2	16.71 - 17.97	N/A	2
01-DOB	3	16.25 - 19.07	N/A	3
01-HNY	3	13.90 - 15.63	N/A	3
07-CLD	3	17.76 - 19.9	N/A	3
01-BOB	4	15.89 - 17.72	N/A	4
01-MIB	3	15.50 - 18.35	N/A	3
NEWALSD	1 (profile)	8.9 - 21.4 [A]	N/A	1
09-THB	1	22.41	N/A	1
02-THB	3	14.06 - 17.43	N/A	3
05A-CLD	3	15.64 - 19.47	N/A	3
01-CRB	5	15.22 - 17.99	N/A	5
04M-CLD	3	16.12 - 19.59	N/A	3
12-WAB	4	9.00 - 22.84	N/A	4
09-WAB	1	25.32	N/A	1
01-WAB	6	12.10 - 21.98	N/A	6
03-CLD	7	5.83 - 19.66	N/A	7
01-DAB	4	12.28 - 15.38	N/A	4
02-CLD	5	12.38 - 19.79	N/A	5
01-GRB	5	11.86 - 16.40	N/A	5
01-MTB	4	11.75 - 20.65	N/A	4
01-CLD	4	12.41 - 17.49	N/A	4
Total	**82**	_____	**0**	**82**

[A] Represents water temperature measurements for full profile of Newall Pond

Figure 11 shows the results of instantaneous water temperature measurements taken at 25 stations in the Cold River watershed. The average water temperature varied from 14.6 °C. to 24.6 °C.

Figure 11. Water Temperature Statistics for the Cold River Watershed
July 8 - October 1, 2006, NHDES VRAP



From June 29 to September 19 VRAP staff deployed submersible water temperature dataloggers at stations 06M-CLD and 01-CRB. The dataloggers were programmed to record water temperature once an hour during the deployment time. Figures 12 and 13 show the results of water temperature during the deployment time in terms of the daily maximum temperature, the daily average temperature and the swing between the daily maximum and daily minimum. Due to a high water event, the temperature logger at station 01-CRB was out of the water for a brief period and thus the gap in the dataset.

For station 06M-CLD the monthly average water temperatures for the months of July and August were 19.4 °C. and 17.7 °C respectively. More detailed temperature data was collected at station 06M-CLD due to its selection as a location for fish and macroinvertabrate biomonitoring by NHDES during the summer of 2006. Station 01-CRB was selected due to its selection as a location for a nutrient/periphyton study conducted by NHDES during the summer of 2006. The monthly average water temperatures for the months of July and August at 01-CRB were 18.0 °C. and 16.9 °C respectively.

Figure 12. Water Temperature Statistics for the Cold River (06M-CLD)
June 29 - September 19, 2006, NHDES VRAP

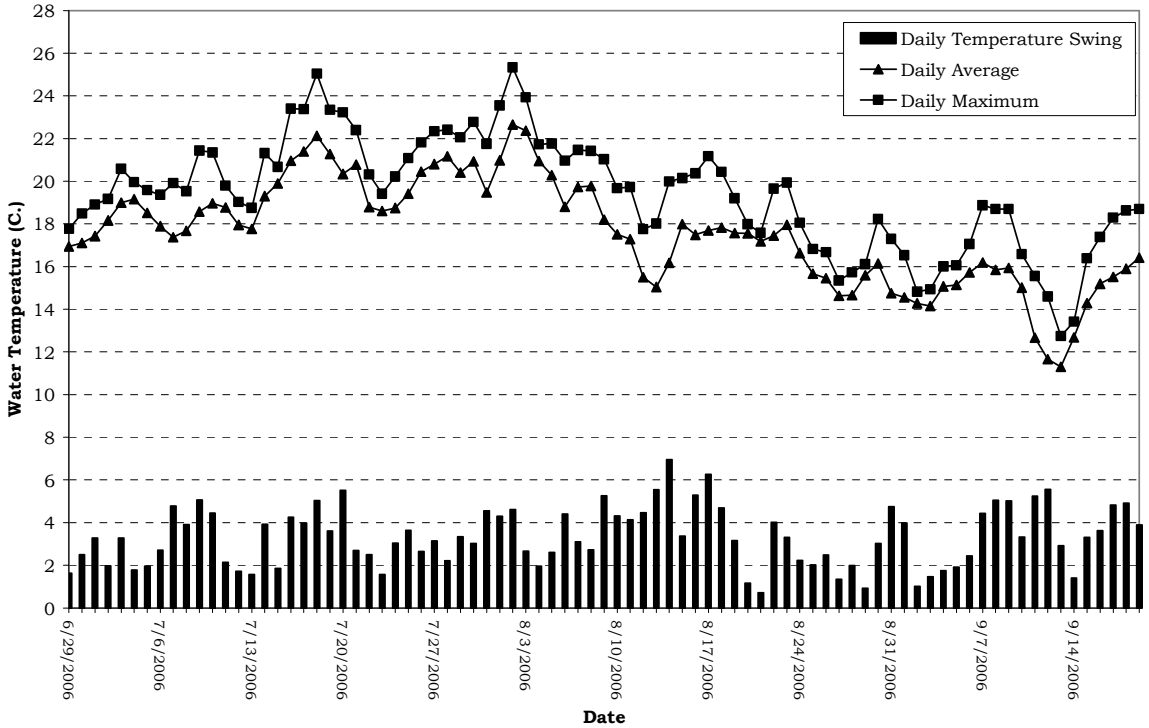
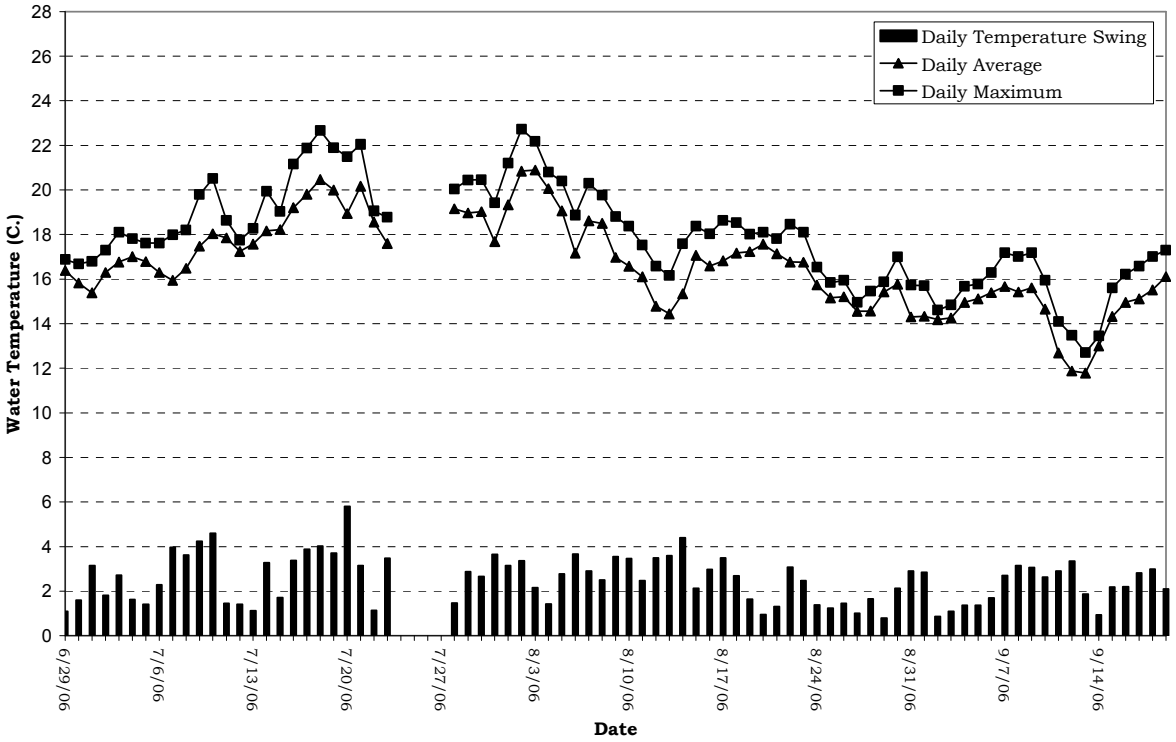


Figure 13. Water Temperature Statistics for Crane Brook (01-CRB)
June 29 - September 19, 2006, NHDES VRAP



Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and the activity of bacteria in the water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertabrate species can survive in a given river or stream.

A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation along the shoreline, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and the influence of groundwater.

Recommendations

- Continue collecting water temperature data via both instantaneous reading and long-term deployment of dataloggers.

4.6 *Escherichia coli*/Bacteria

Either one or three samples were taken for *Escherichia coli* (*E. coli*) at 17 stations in the Cold River watershed (Table 9). Of the 31 samples taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

Class B New Hampshire surface water quality standards for *E.coli* are as follows:

<406 cts/100 ml, based on any single sample, or
<126 cts/100 ml, based on a geometric mean calculated from three samples collected within a 60-day period.

Table 9. *E.coli* Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (cts/100ml)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
08-CLD	3	10 - 1490	1	3
01-XBD	3	5 - 10	0	3
01-DOB	1	5	0	1
01-HNY	1	40	0	1
01-BOB	1	5	0	1
06D-CLD	3	5 - 1360	1	3
01-MIB	1	5	0	1
09-THB	3	5 - 40	0	3
02-THB	1	5	0	1
01-CRB	1	5	0	1
12-WAB	1	10	0	1
01-WAB	3	5 - 700	1	3
03T-CLD	3	10 - 610	1	3
03-CLD	1	5	0	1
01T-CLD	3	50 - 560	1	3
01-GRB	1	10	0	1
01-MTB	1	5	0	1
Total	**31**	_____	**5**	**31**

Five out of 17 stations sampled had one measurement that exceeded the New Hampshire Class B single sample water quality standard for *E.coli* (Figure 14). In order to fully determine whether a waterbody is meeting surface water standards for *E.coli* a geometric mean must be calculated. A geometric mean is calculated using three samples collected within a 60-day period. At seven stations a geometric mean was calculated. All of these stations had geometric means that were below the Class B standard of 126 cts/100ml (Table 10).

Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife, and the presence of septic systems along the river.

Figure 14. *Escherichia coli* Statistics for the Cold River Watershed July 11 - Septmeber 12, 2006, NHDES VRAP

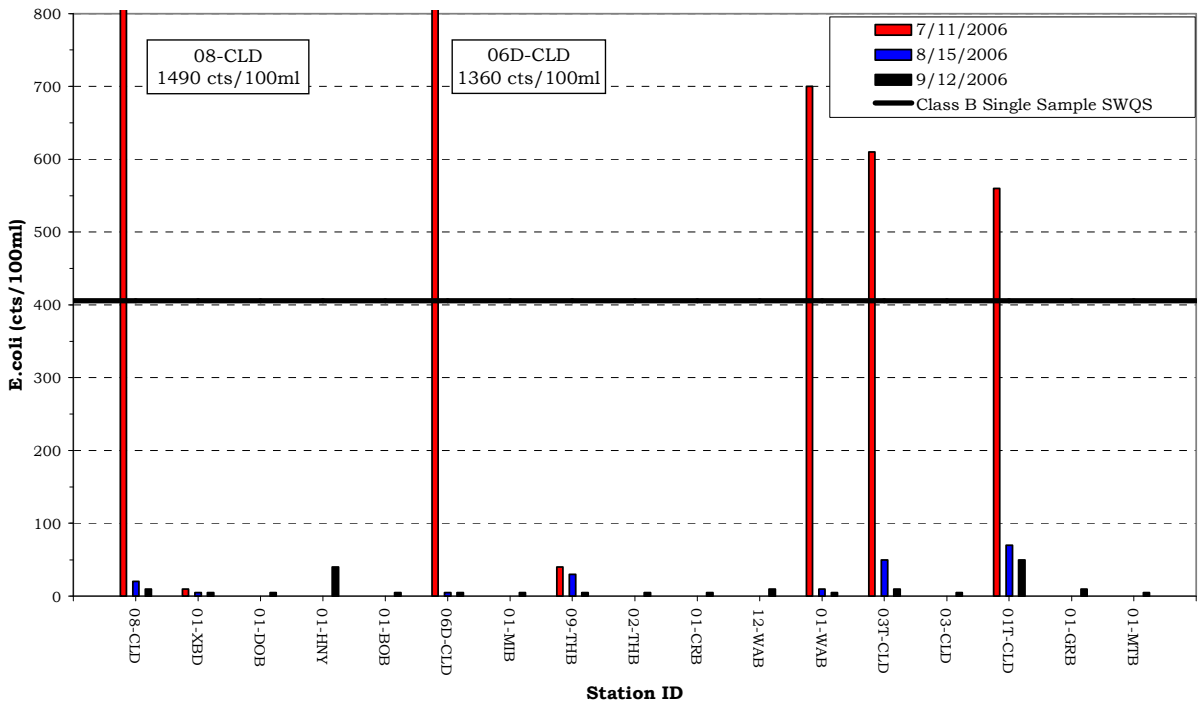


Table 10. *E. coli* Geometric Mean Data Summary – Cold River Watershed, 2006

Station ID	Geometric Means Calculated	Geometric Mean July 11, 2006 - September 12, 2006	Geometric Means Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
08-CLD	1	66	0	1
06D-CLD	1	32	0	1
03C-CLD	1	67	0	1
01T-CLD	1	125	0	1
01-XDB	1	5	0	1
09-THB	1	13	0	1
01-WAB	1	33	0	1
Total	**7**	_____	**0**	**7**

Recommendations

- Continue collecting three samples within any 60-day period during the summer to allow for determination of geometric means.
- Continue to document river conditions and station characteristics (including the presence of wildlife in the area during sampling).
- At stations with particularly high bacteria levels volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated bacteria levels. Those sampling should also look for any potential sources of bacteria such as emission pipes and failed septic systems.

4.7 Total Phosphorus

Either one or three samples were taken for total phosphorus at 12 stations in the Cold River watershed (Table 11). Of the 30 samples taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

There is no numeric standard for total phosphorus for Class B waters. The narrative standard states that "unless naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses." The NHDES "level of concern" for total phosphorous is 0.05 mg/L.

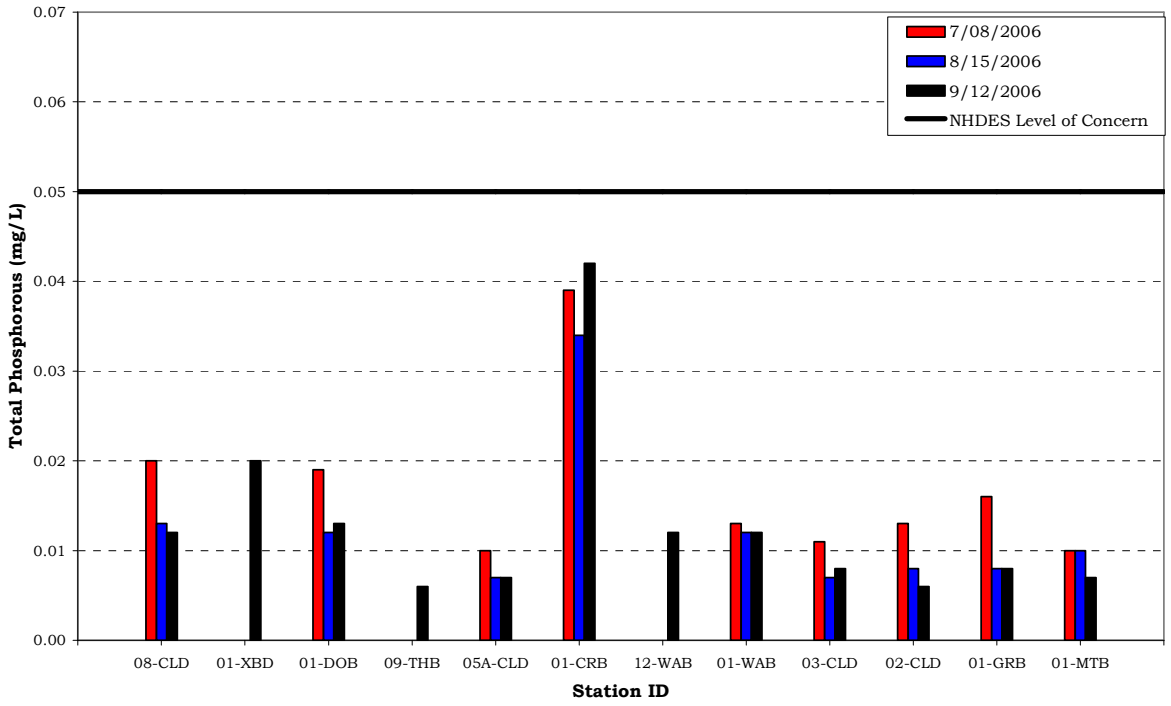
Table 11. Total Phosphorus Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
08-CLD	3	0.012 - 0.020	0	3
01-XBD	1	0.020	0	1
01-DOB	3	0.012 - 0.019	0	3
09-THB	1	0.006 - 0.006	0	1
05A-CLD	3	0.007 - 0.010	0	3
01-CRB	3	0.034 - 0.042	0	3
12-WAB	1	0.012	0	1
01-WAB	3	0.012 - 0.013	0	3
03-CLD	3	0.007 - 0.011	0	3
02-CLD	3	0.006 - 0.013	0	3
01-GRB	3	0.008 - 0.016	0	3
01-MTB	3	0.007 - 0.010	0	3
Total	**30**	_____	**0**	**30**

At all stations and on all occasions, total phosphorus levels at each station were below the NHDES "level of concern" (Figure 15). Station 01-CRB on Crane Brook did have higher total phosphorous levels than the other stations in the watershed. Under undisturbed natural conditions phosphorous is at very low levels in aquatic ecosystems. Of the three nutrients critical for aquatic plant growth; potassium, nitrogen, and phosphorous, it is usually phosphorous that is the limiting factor to plant growth. When the supply of phosphorous is increased due to human activity, algae respond with significant growth.

A major source of excessive phosphorous concentrations in aquatic ecosystems can be wastewater treatment facilities, as sewage typically contains relatively high levels of phosphorus detergents. However, fertilizers used on lawns and agricultural areas can also contribute significant amounts of phosphorus.

Figure 15. Total Phosphorous Statistics for the Cold River Watershed
July 8 - September 12, 2006, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- Additional investigation of Crane Brook should be conducted given that it had significantly higher total phosphorous levels than other stations in the watershed. This is similar to results from 2005.

4.8 Nitrogen – Nitrate (NO_3)

Either one or two samples were taken for total nitrate at 12 stations in the Cold River watershed (Table 12). Of the 18 samples taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

There is no numeric standard for nitrate for Class B waters. The narrative standard states that "unless naturally occurring, shall contain no nitrogen in such concentrations that would impair any existing or designated uses."

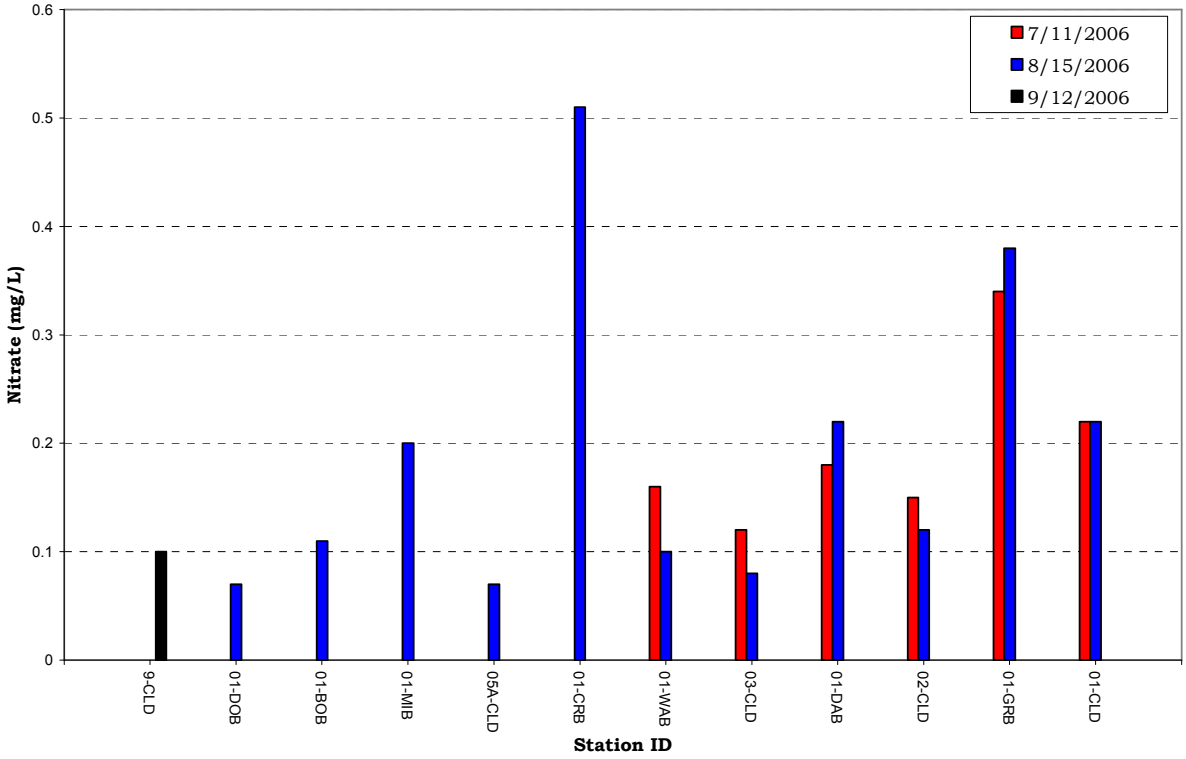
Table 12. Nitrate Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
09-CLD	1	0.10	0	1
01-DOB	1	0.07	0	1
01-BOB	1	0.01	0	1
01-MIB	1	0.20	0	1
05A-CLD	1	0.07	0	1
01-CRB	1	0.51	0	1
01-WAB	2	0.10 - 0.16	0	2
03-CLD	2	0.08 - 0.12	0	2
01-DAB	2	0.18 - 0.22	0	2
02-CLD	2	0.12 - 0.15	0	2
01-GRB	2	0.34 - 0.38	0	2
01-CLD	2	0.22	0	2
Total	**18**	_____	**0**	**18**

Nitrate levels at almost all the station were relatively low and not indicative of nitrogen problems. Stations on Crane Brook and Great Brook had nitrate levels higher than elsewhere in the watershed and this could indicate potential nuisance levels of nitrogen.

Nitrogen is naturally occurring in soil in organic forms from decomposing plant and animal matter. Bacteria in the soil then convert nitrogen to nitrate, a nitrogen-oxygen chemical unit. Primary sources which can cause increased nitrate levels are human sewage, livestock manure, and agricultural fertilizers. Sources of nitrogen include fertilizer, failing septic systems, and animal wastes.

Figure 16. Nitrate (NO_3) Statistics for the Cold River Watershed
July 11 - September 12, 2006, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to build a long-term data set to better understand trends as time goes on.
- Additional investigation of Crane Brook and Great Brook should be conducted given that it had significantly higher nitrate levels than other stations in the watershed.

4.9 Nitrogen – Nitrate (NO_3) + Nitrite (NO_2)

Between one and three samples were taken for NO_2 + NO_3 at 18 stations in the Cold River watershed [Table 13]. Of the 27 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

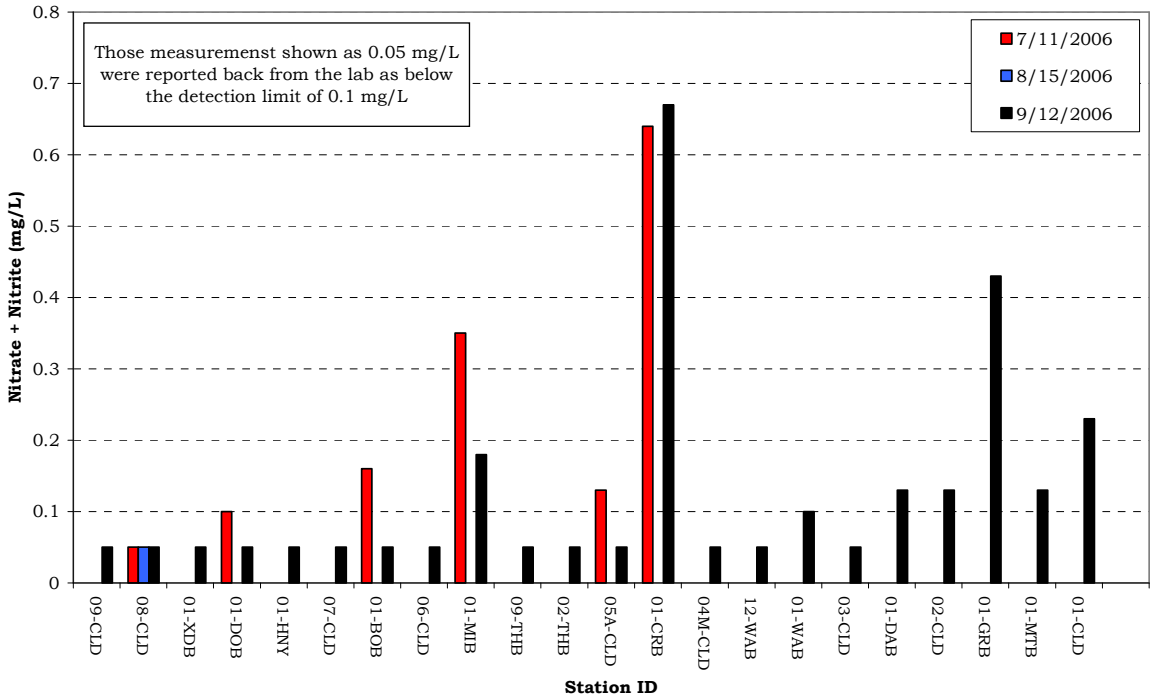
There is no numeric standard for nitrate for Class B waters. The narrative standard states that "unless naturally occurring, shall contain no nitrogen in such concentrations that would impair any existing or designated uses."

Table 13. Nitrate + Nitrite Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
09-CLD	1	<.10	0	1
08-CLD	3	<.10	0	3
01-XDB	1	<.10	0	1
01-DOB	2	<.10-.10	0	2
01-HNY	1	<.10	0	1
07-CLD	1	<.10	0	1
01-BOB	2	<.10-.16	0	2
01-MIB	2	0.18-0.35	0	2
09-THB	1	<.10	0	1
02-THB	1	<0.10	0	1
05A-CLD	2	<0.10-0.13	0	2
01-CRB	2	0.64-0.67	0	2
04M-CLD	1	<0.10	0	1
12-WAB	1	<0.10	0	1
01-WAB	1	0.10	0	1
03-CLD	1	0.13	0	1
02-CLD	1	0.13	0	1
01-GRB	1	0.13	0	1
01-CLD	2	0.22-0.22	0	2
Total	**27**	_____	**0**	**27**

Nitrate/Nitrite levels at almost all the stations were either below or just above the detection limit of 0.10 mg/L. Stations on Crane Brook and Great Brook had nitrate/nitrite levels higher than elsewhere in the watershed and this could indicate potential nuisance levels of nitrogen.

Figure 17. Nitrate (NO_3)/Nitrite (NO_2) Statistics for the Cold River Watershed July 11 - September 12, 2006, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to build a long-term data set to better understand trends as time goes on.
- Additional investigation of Crane Brook and Great Brook should be conducted given that it had significantly higher nitrate levels than other stations in the watershed

4.10 Chloride

Three samples were taken for chloride at three stations in the Cold River watershed [Table 14]. Of the nine measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for chloride is as follows:

Freshwater chronic criterion	230 mg/l
Freshwater acute criterion	860 mg/l

Table 14. Chloride Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
08-CLD	3	4 - 5	0	3
05A-CLD	3	7 - 11	0	3
02-CLD	3	9 - 11	0	3
Total	**9**	_____	**0**	**9**

Chloride concentrations were extremely low and therefore well below the New Hampshire Class B freshwater chronic and acute surface water quality standards.

Although chloride can originate from natural sources, most of the chloride that enters the environment is associated with the storage and application of road salt. Road salt readily dissolves and enters aquatic environments in ionic forms. As such, chloride-containing compounds commonly enter surface water, soil, and groundwater during late-spring snowmelt (since the ground is frozen during much of the late winter and early spring). Chloride ions are conservative, which means they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans.

Additional human sources of chloride can come from fertilizers, septic systems, and underground water softening systems.

Recommendations

- Chloride and specific conductance levels are very closely related to one another. In 2005, CRLAC collected chloride at the same time specific conductance was measured and confirmed this close relationship. Data collected by CRLAC in 2005 and additional studies by NHDES indicate that the chronic chloride standard is correlated with a specific conductance level of approximately 850 µS/cm. Given the low specific conductance levels throughout the Cold River watershed it is recommended that CRLAC use specific conductance as a surrogate for chloride in lieu of additional laboratory expenses.

4.11 Aluminum

One sample was taken for aluminum at five stations in the Cold River watershed [Table 15]. Of the five measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for Aluminum is as follows:

Freshwater chronic criterion	0.087 mg/l
Freshwater acute criterion	0.750 mg/l

Table 15. Aluminum Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
08-CLD	1	0.080	0	1
05A-CLD	1	0.047	0	1
04M-CLD	1	0.043	0	1
01-WAB	1	0.144	1	1
02-CLD	1	0.044	0	1
Total	**5**	_____	**1**	**5**

With the exception of station 01-WAB, all samples at all stations were below the New Hampshire Class B chronic surface water quality standard.

Aluminum is the most common metal in the earth's crust and occurs in many rocks and ores. Due to its high chemical reactivity, aluminum does not occur in nature as its pure metal state but is instead combined with other elements. Aluminum will exist in higher concentrations in those surface waters with lower pH levels. The more acidic waters allow higher amounts of aluminum to precipitate out from surrounding soils and substrate.

Station 01-WAB on Warren Brook had a median pH of 6.94 which meets the Class B water quality standard and thus is likely not the largest factor impacting aluminum levels at this station. This location on Warren Brook was one of the more heavily damaged in the watershed. It is likely that the elevated aluminum levels are due to the alteration of the terrain that occurred and the instability of the streambed. As the stream stabilizes, aluminum levels will likely decline.

Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on. Station 01-WAB should be a priority.

4.12 Hardness

One sample was taken for hardness at four stations in the Cold River watershed [Table 16]. Of the four measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

New Hampshire surface water quality standards do not contain numeric limits for Hardness. However, hardness levels are used to determine the specific standard levels where measurements are taken for metals such as copper, lead, and zinc.

Table 16. Hardness Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
08-CLD	1	10.40	Not Applicable	1
05A-CLD	1	13.33	N/A	1
01-WAB	1	22.81	N/A	1
02-CLD	1	18.32	N/A	1
Total	**4**	_____	**N/A**	**4**

Hardness is primarily a measure of the calcium and magnesium ion concentrations in water, expressed as calcium carbonate. The hardness concentration affects the toxicity of certain metals.

Recommendations

- Continue sampling hardness when hardness dependent metal samples are collected.

4.13 Copper

One sample was collected for copper at four stations in the Cold River watershed (Table 17). All samples met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2006 surface water quality report to the US Environmental Protection Agency.

Class B New Hampshire surface water quality standards for copper are dependant on hardness. As hardness samples were collected simultaneously with copper the calculated standards are as follows:

Freshwater chronic criterion:	08-CLD	0.0014 mg/l
	05A-CLD	0.0017 mg/L
	01-WAB	0.0026 mg/L
	02-CLD	0.0022 mg/l
Freshwater acute criterion:	08-CLD	0.0017 mg/l
	05A-CLD	0.0021 mg/L
	01-WAB	0.0035 mg/L
	02-CLD	0.0028 mg/l

Table 17. Copper Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
08-CLD	1	<0.0050	1	1
05A-CLD	1	<0.0050	1	1
01-WAB	1	<0.0050	1	1
02-CLD	1	<0.0050	1	1
Total	**4**	_____	**4**	**4**

Copper concentrations were below the laboratory detection limit at all stations. In this case where the laboratory detection limit for copper is <0.0050 mg/L, half of that value or 0.0025 mg/L is used as a surrogate value to determine if the sample is below water quality standards. In the case of stations 08-CLD, 05A-CLD, and 02-CLD, the surrogate value of 0.0025 mg/L is above the chronic water quality criteria for those stations (08-CLD and 05A-CLD were also above the acute level). However, given that the surrogate value is based on a laboratory detection limit and the true value is unknown, the sample is not considered to be violating water quality standards and is listed as "insufficient information".

Potential sources of elevated copper levels are the corrosion of plumbing, erosion of natural deposits, some mining activities, industrial pollution, and some domestic wastewaters.

Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on. Continue sampling hardness simultaneously with copper samples.

4.14 Lead

One sample was collected for lead at four stations in the Cold River watershed (Table 18). All samples met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2006 surface water quality report to the US Environmental Protection Agency.

Class B New Hampshire surface water quality standards for lead are dependant on hardness. As hardness samples were collected simultaneously with lead the calculated standards are as follows:

Freshwater chronic criterion:	08-CLD	0.00018 mg/l
	05A-CLD	0.00024 mg/L
	01-WAB	0.00048 mg/L
	02-CLD	0.00037 mg/l
Freshwater acute criterion:	08-CLD	0.0045 mg/l
	05A-CLD	0.0063 mg/L
	01-WAB	0.0120 mg/L
	02-CLD	0.0094 mg/l

Table 18. Lead Data Summary – Cold River, 2006

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
08-CLD	1	<0.0010	0	1
05A-CLD	1	<0.0010	0	1
01-WAB	1	<0.0010	0	1
02-CLD	1	<0.0010	0	1
Total	**4**	_____	**0**	**4**

Lead concentrations were below the laboratory detection limit at all stations. In this case where the laboratory detection limit for lead is <0.0010 mg/L, half of that value or 0.00050 mg/L is used as a surrogate value to determine if the sample is below water quality standards. In the case of the chronic standard for all four stations, the surrogate value of 0.00050 mg/L is above the chronic water quality criteria. However, given that the surrogate value is based on a laboratory detection limit and the true value is unknown, the sample is not considered to be violating water quality standards and is listed as "insufficient information".

Potential sources of elevated lead levels are the erosion of natural deposits, industrial discharges, and presence of lead in the streambed from sources such as fishing lures or lead ammunition.

Recommendations

- Continue sampling at all stations, in order to develop a long-term data set to better understand trends as time goes on. Continue sampling hardness simultaneously with lead samples.

4.15 Zinc

One sample was collected for zinc at four stations in the Cold River watershed (Table 19). All samples met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2006 surface water quality report to the US Environmental Protection Agency.

Class B NH surface water quality standards for zinc are dependant on hardness. As hardness samples were collected simultaneously with zinc the calculated standards are as follows:

Freshwater chronic criterion:	08-CLD	0.018 mg/l
	05A-CLD	0.021 mg/L
	01-WAB	0.034 mg/L
	02-CLD	0.028 mg/l
Freshwater acute criterion:	08-CLD	0.017 mg/l
	05A-CLD	0.021 mg/L
	01-WAB	0.034 mg/L
	02-CLD	0.028 mg/l

Table 19. Zinc Data Summary – Cold River Watershed, 2006

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
08-CLD	1	<0.025	0	1
05A-CLD	1	<0.025	0	1
01-WAB	1	<0.025	0	1
02-CLD	1	<0.025	0	1
Total	**4**	_____	**0**	**4**

Zinc concentrations were below the laboratory detection limit at all stations. In this case where the laboratory detection limit for lead is <0.025 mg/L, half of that value or 0.0125 mg/L is used as a surrogate value to determine if the sample is below water quality standards. At all three stations the surrogate value is below the chronic standard.

Potential sources of zinc are runoff from smelting and refining operations, industrial discharges, and weathering of bedrock. Zinc can also enter surface water via airborne sources such as atmospheric deposition as automobiles and fuel combustion.

Recommendations

- Continue sampling at all stations in order to develop a long-term dataset to better understand trends as time going on. Continue sampling hardness simultaneously with zinc samples.

APPENDIX A

2006 Cold River Watershed Water Quality Data

2006 COLD RIVER VRAP DATA

Measurements not meeting New Hampshire surface water quality standards
Insufficient information to determine if sample is above or below standard
Total Phosphorous measurements exceeding NHDES level of concern
Measurements not meeting NHDES quality assurance/quality control standards

[A] Hardness dependent metal. The water quality standard is caluculated based on the site specific hardness value.
[B] Chronic water quality standard

09-CLD, Crescent Lake Road Bridge, Lempster

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**Narrative**	**Narrative**
7/8/06	17:00	7.25	94.1	26.6	24.1	6.38	2.0	29.5		
8/12/06	15:31	7.43	92.4	24.0	18.6	6.25	2.5	24.2		
9/9/06	15:21	7.98	97.9	23.3	25.0	5.89	1.6	26.4		
9/12/06	12:55								0.1	<0.10

08-CLD, Allen Road Bridge, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphours (mg/L)	Chloride (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**<126**	**Narrative**	**<230 mg/L[a]**	**Narrative**
7/8/06	16:35	8.76	102.0	21.2	22.6	5.99		36.7			0.02		
7/11/06	12:15								1490			4	<0.10
8/12/06	15:10	8.46	97.1	20.2	19.7	6.27	2.9	35.9					
8/15/06	11:40	8.52	97.7	19.9	23.0	5.80	2.8	33.2	20		0.013	5	<0.10
9/9/06	14:57	8.46	97.6	20.3	23.6	5.66	1.9	38.4					
9/12/06	12:40								10	67	0.012	5	<0.10

08-CLD, Allen Road Bridge, Acworth (Cont.)

Date	Time of Sample	Hardness (mg/L)	Alumnium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)
Standard	**NA**	**NA**	**<0.087 mg/L[B]**	**<0.0014[A,B] mg/L**	**<0.00018[A,B] mg/L**	**<0.018[A,B] mg/L**
9/12/06	12:40	10.4	0.080	<0.005	<0.001	<0.025

01-XDB, Unamed Tributary Upstream of Dodge Pond, Lempster

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphours (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**<126**	**Narrative**	**Narrative**
7/11/06	11:50								10			
8/15/06	11:25								5			
9/9/06	15:54	8.82	108.0	23.1	24.3	5.87	1.5	79.4				
9/12/06	13:05								5	5	0.02	<0.10

01-XJR, Unamed Tributary to Dodge Brook, Lempster

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**
8/12/06		8.80	94.5	16.7	20.4	6.09	13.7	27.8
9/9/06	16:14	9.72	107.4	18.0	22.8	5.55	5.2	30.4

01-DOB, Dodge Brook, East Acworth Road Bridge, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	Total Phosphours (mg/L)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**	**Narrative**	**Narrative**
7/8/06	16:20	9.35	104.1	19.1	23.7	6.37	2.0	68.8		0.019		
7/11/06	12:20											0.10
8/12/06	14:53	9.68	102.2	16.3	20.4	6.54	1.7	68.5				
8/15/06	11:55									0.012	0.07	
9/9/06	14:28	9.80	104.6	16.7	25.0	6.27	1.9	74.2				
9/12/06	12:35								<5	0.013		<0.10

01-HNY, Honey Brook, Route 123A Bridge, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**
7/8/06	16:05	10.06	104.1	15.6	21.0	5.92	2.0	53.5		
8/12/06	14:42	10.56	105.9	13.9	20.7	6.25	2.0	53.5		
9/9/06	14:05	10.34	105.1	14.5	25.0	5.80	0.7	58.9		
9/12/06	12:30								40	<0.10

07-CLD, Grout Hill Road Bridge, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**Narrative**
7/8/06	15:45	9.40	106.2	19.9	23.2	6.76	2.0	48.2	
8/12/06	14:20	9.65	104.9	17.8	19.6	6.74	1.3	46.9	
9/9/06	13:38	10.11	111.6	18.5	25.7	6.16	1.3	51.8	
9/12/06	12:20								<0.10

01-BOB, Bowers Brook, Route 123A Bridge, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**	**Narrative**
7/8/06	15:12	9.44	101.7	17.7	27.3	6.09	2.0	33.2			
7/11/06	12:33										0.16
8/12/06	13:49	10.27	107.0	15.9	21.0	6.42	2.1	31.6			
8/15/06	12:05	10.42	112.0	17.1	21.6	6.17	1.9	32.0		0.11	
9/9/06	13:01	9.91	105.3	16.7	23.9	6.11	0.9	31.7			
9/12/06	12:15								<10		<0.10

06D-CLD, Deep Hole, Acworth

Date	Time of Sample	*E. coli* (CTS/100 mL)	*E.coli* Geometric Mean
Standard	**NA**	**<406**	**<126**
7/11/06	12:40	1360	
8/15/06	12:15	5	
9/12/06	12:10	5	32

06-CLD, Route 123A Pulloff, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**Narrative**
7/8/06	14:38	9.43	106.3	20.1	22.1	6.20	2.0	50.1	
8/12/06	13:18	9.46	100.4	16.9	19.0	6.47	1.2	46.8	
9/9/06	12:44	10.02	105.8	16.5	23.1	6.03	1.7	51.5	
9/12/06	12:05								<0.10

01-MIB, Milliken Brook, Route 123A Bridge, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**	**Narrative**
7/8/06	14:04	9.83	106.8	18.4	24.8	6.46	2.6	44.4			
7/11/06	12:55										0.35
8/12/06	13:00	9.95	102.6	15.5	19.1	6.68	2.1	42.8			
8/15/06	12:20									0.2	
9/9/06	12:31	10.35	108.9	16.4	23.1	6.04	0.8	48.8			
9/12/06	11:50								<10		0.18

09-THB, Thayer Brook, Newell Pond Road Bridge, Alstead

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphours (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**<126**	**Narrative**	**Narrative**
7/11/06	11:20								40			
8/15/06	11:00								30			
9/9/06	17:14	8.44	102.6	22.4	19.7	6.23	1.4	24.4				
9/12/06	09:20								2	13	0.006	<0.10

NEWALSD, Newall Pond - Deep Spot, Alstead (Depth Profile)

Date	Time of Sample	Depth	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	Total Phosphours (mg/L)	Nitrate (mg/L)	Chloride (mg/L)
Standard	**NA**	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**	**Narrative**	**<230 mg/L[a]**
9/9/06	16:59	1.5	8.24	98.1	21.4	19.7	6.51	0.5	24.7				
	16:59	3.1	8.55	100.4	20.7	19.7	6.32	0.8	25.0				
	16:59	4.6	8.69	101.3	20.3	19.7	6.22	0.7	24.5				
	17:00	6.2	8.54	99.1	20.0	19.7	6.10	0.7	24.3				
	17:00	7.9	8.65	99.8	19.8	19.7	6.05	0.8	24.6				
	17:00	9.4	8.66	99.2	19.5	19.7	5.99	0.7	23.9				
	17:01	11.0	8.74	99.9	19.3	19.7	5.93	0.6	23.8				
	17:01	12.8	8.5	96.6	19.0	19.7	5.89	0.7	23.8				
	17:01	14.6	8.23	93.0	18.8	19.7	5.80	0.7	23.7				
	17:02	16.7	6.59	73.1	17.8	19.7	5.52	1.2	24.5				
	17:02	18.8	3.08	32.5	15.5	19.7	5.01	1.1	25.6				
	17:03	20.9	1.15	11.4	12.6	19.7	4.83	1.0	26.3				
	17:03	22.5	0.68	6.6	11.3	19.7	4.81	2.5	26.9				
	17:03	24.0	0.53	5.0	10.5	19.7	4.85	4.0	28.3				
	17:04	26.5	0.43	3.9	9.2	19.7	4.89	18.3	32.2				
	17:04	28.2	0.37	3.3	8.9	19.7	5.21	17.0	58.8				
	~~17:05~~	~~29.2~~	~~0.31~~	~~2.8~~	~~8.9~~	~~19.7~~	~~5.53~~	~~681.2~~	~~81.2~~				
9/12/06										<10	0.005	<0.05	<3

02-THB, Thayer Brook, Forrest Road Bridge, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**
7/8/06	13:37	9.94	106.3	17.4	23.0	6.31	2.0	34.6		
8/12/06	12:41	10.27	102.8	14.1	19.0	6.57	1.0	34.0		
9/9/06	12:09	10.42	106.5	14.9	22.6	5.69	1.0	36.1		
9/12/06	11:45								<10	<0.10

05A-CLD, Forrest Road Bridge, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	Total Phosphours (mg/L)	Nitrate (mg/L)	N02+N03	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**Narrative**	**Narrative**	**Narrative**	**<230 mg/L[a]**
7/8/06	13:05	9.76	108.2	19.5	25.5	6.78	2.0	50.1	0.010			
7/11/06	13:15										0.13	7
8/12/06	11:50	10.08	104.0	15.6	18.1	6.72	1.0	48.6				
8/15/06	12:22				21.8				0.007	0.07		10
9/9/06	11:50	9.93	105.3	16.9	24.8	6.06	1.0	55.5				
9/12/06	11:40								0.007		<0.10	11

05A-CLD, Forrest Road Bridge, Acworth (Cont.)

Date	Time of Sample	Hardness (mg/L)	Alumnium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)
Standard	**NA**	**NA**	**<0.087 mg/L[B]**	**<0.0017[A,B] mg/L**	**<0.00024[A,B] mg/L**	**<0.021[A,B] mg/L**
7/8/06	13:05					
7/11/06	13:15					
8/12/06	11:50					
8/15/06	12:22					
9/9/06	11:50					
9/12/06	11:40	13.33	0.047	<0.005	<0.001	<0.025

01-CRB, Crane Brook, Upstream of Confluence with Cold River, Acworth

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	Total Phosphours (mg/L)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**	**Narrative**	**Narrative**
7/8/06	12:30	9.54	102.5	18.0	20.1	7.04	2.3	59.2		0.039		
7/11/06	13:00											0.64
8/12/06	11:18	9.77	99.6	15.2	19.3	6.80	2.6	60.0				
8/15/06	11:55	8.96	92.8	17.1	18.2	6.87		77.9		0.034	0.51	
8/22/06	10:55	9.23	96.0	17.5	19.6	7.19		86.1				
9/9/06	10:26	9.79	100.4	15.4	17.8	6.65	1.1	70.2				
9/12/06	11:35								<10	0.042		0.67

04M-CLD, McDermott Bridge, Langdon

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	N02+N03	Alumnium (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**Narrative**	**<0.087 mg/L[B]**
7/8/06	12:06	9.69	107.3	19.6	26.1	6.45	2.0	50.3		
8/12/06	10:38	9.68	100.4	16.1	17.6	6.85	1.4	51.0		
9/9/06	10:51	10.10	106.3	16.7	23.1	6.59	0.9	56.4		
9/12/06	11:20								<0.10	0.043

12-WAB, Warren Brook, Prentice Hill Road Bridge, Alstead

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	Total Phosphours (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**	**Narrative**
4/12/06	11:00	11.57	100.2	9.0		6.62	0.9	54.0			
8/12/06	16:23	6.98	84.8	22.8	19.6	6.29	2.0	41.0			
9/9/06	19:11	8.57	100.4	20.9	19.2	6.19	1.9	40.6			
9/12/06	11:05								10	0.012	<0.10
10/1/06	18:57	9.91	102.5	14.7	13.1	5.92	2.3	40.7			

09-WAB, Warren Brook, Route 123 Bridge, Second Crossing, Alstead

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**
7/8/06	18:40	8.01	101.5	25.3	23.4	6.42	3.4	43.1

01-WAB, Warren Brook, Route 123A Bridge, Alstead

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphours (mg/L)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**<126**	**Narrative**	**Narrative**	**Narrative**
4/12/06	13:30	11.09	103.0	12.1		6.95	5.4	66.0					
7/8/06	11:30	8.92	103.1	22.0	23.1	7.01	4.2	64.4			0.013		
7/11/06	11:05								700			0.16	
8/12/06	10:21	8.81	96.2	18.8	18.1	6.97	6.1	79.5					
8/15/06	10:30	8.84	101.6	20.9	25.1	6.72	10.0	83.6	10		0.012	0.10	
9/9/06	09:40	9.71	102.8	17.2	17.5	6.59	5.7	75.9					
9/12/06	10:55								5	33	0.012		0.10
10/1/06	19:14	10.50	100.2	12.4	13.1	6.30	97.0	59.9					

01-WAB, Warren Brook, Route 123A Bridge, Alstead (Cont.)

Date	Time of Sample	Hardness (mg/L)	Alumnium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)
Standard	**NA**	**NA**	**<0.087 mg/L[B]**	**<0.0026[A,B] mg/L**	**<0.00048[A,B] mg/L**	**<0.034[A,B] mg/L**
4/12/06	13:30					
7/8/06	11:30					
7/11/06	11:05					
8/12/06	10:21					
8/15/06	10:30					
9/9/06	09:40					
9/12/06	10:55	22.81	0.144	<0.005	<0.001	<0.025
10/1/06	19:14					

03T-CLD, Wooden Dam - Downstream of Warren Brook, Alstead

Date	Time of Sample	*E. coli* (CTS/100 mL)	*E.coli* Geometric Mean
Standard	**NA**	**<406**	**<126**
7/11/06	10:57	610	
8/15/06	10:20	50	
9/12/06	10:50	10	67

03-CLD, Route 123 Bridge - Center Alstead, Alstead

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	Total Phosphours (mg/L)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**Narrative**	**Narrative**	
7/8/06	07:30	9.34	98.2	17.4	17.5	6.78	2.4	55.5	0.011		
7/11/06	10:50									0.12	
8/12/06	07:14	9.62	98.7	15.8	12.0	6.45	3.2	52.4			
8/15/06	10:05	9.23	103.4	19.7	23.0	6.73	19.2	58.7	0.007	0.08	
9/9/06	07:05	9.59	99.7	16.4	16.3	6.16	2.6	61.2			
9/12/06	10:45								0.008		<0.10
10/1/06	19:37	10.40	98.5	12.2	12.5	7.24	56.7	58.6			
10/25/06	10:22	11.31	95.3	6.9	7.2	6.01	4.8	40.1			
10/27/06	10:14	11.96	96.8	5.8	8.9	5.91	4.8	42.9			

01-DAB, Darby Brook, Comstock Road Bridge, Alstead

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**	
7/8/06	10:20	10.37	104.8	15.4	23.0	6.81	2.3	71.1			
7/11/06	10:44									0.18	
8/12/06	09:54	9.87	96.7	13.6	15.3	6.89	1.4	69.5			
8/15/06	10:00									0.22	
9/9/06	09:18	9.99	99.8	14.4	16.7	6.48	1.0	68.6			
9/12/06	10:40								<10		0.13
10/1/06	20:00	10.25	97.5	12.3	12.2	7.12	17.8				

02-CLD, Route 123 Bridge - Drewsville, Walpole

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	Total Phosphours (mg/L)	Nitrate (mg/L)	N02+N03	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**Narrative**	**Narrative**	**Narrative**	**<230 mg/L[a]**
7/8/06	09:45	9.40	102.0	19.0	21.9	6.71	2.0	59.1	0.013			
7/11/06	10:35									0.15		9
8/12/06	09:33	9.15	96.7	17.4	16.0	6.60	2.0	58.7				
8/15/06	09:45	9.12	102.1	19.8	22.5	6.64	1.4	63.2	0.008	0.12		10
9/9/06	08:56	9.38	97.1	16.6	16.5	6.22	2.2	65.2				
9/12/06	10:25								0.006		0.13	11
10/1/06	20:18	10.09	95.7	12.4	12.3	7.05	53.6	58.1				

02-CLD, Route 123 Bridge - Drewsville, Walpole (Cont.)

Date	Time of Sample	Hardness (mg/L)	Alumnium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)
Standard	**NA**	**NA**	**<0.087 mg/L[B]**	**<0.0022[A,B] mg/L**	**<0.000037[A,B] mg/L**	**<0.028[A,B] mg/L**
7/8/06	09:45					
7/11/06	10:35					
8/12/06	09:33					
8/15/06	09:45					
9/9/06	08:56					
9/12/06	10:25	18.32	0.044	<0.005	<0.001	<0.025
10/1/06	20:18					

01T-CLD, Tinkers Bridge, Upstream of Confluence with Great Brook, Langdon

Date	Time of Sample	*E. coli* (CTS/100 mL)	*E.coli* Geometric Mean
Standard	**NA**	**<406**	**<126**
7/11/06	10:30	560	
8/15/06	09:15	70	
9/12/06	10:15	50	125

01-GRB, Great Brook, Cold River Road Bridge, Langdon

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	Total Phosphours (mg/L)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**	**Narrative**	**Narrative**
7/8/06	09:20	9.54	97.1	16.1	18.0	7.05	2.0	64.3		0.016		
7/11/06	10:20										0.34	
8/12/06	09:09	9.60	94.4	14.2	13.8	6.81	1.4	61.7				
8/15/06	09:30	10.59	110.2	16.4	21.5	6.35	1.2	64.1		0.008	0.38	
9/9/06	08:27	9.81	97.3	14.5	16.6	6.31	1.7	70.6				
9/12/06	10:15								10	0.008		0.43
10/1/06	20:29	10.80	101.0	11.9	12.3	7.13	30.2	57.6				

01-MTB, Mountain Brook, Cold River Road Bridge, Walpole

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	*E. coli* (CTS/100mL)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**<406**	**Narrative**
7/8/06	08:55	9.37	95.7	20.7	16.4	6.96	2.0	33.9		
8/12/06	08:44	9.93	95.3	13.1	12.7	6.35	4.0	34.7		
9/9/06	08:11	9.84	98.0	14.8	15.5	6.07	1.9	32.5		
9/12/06	10:00								<10	0.13
10/1/06	20:45	10.34	96.3	11.8	12.4	7.12	4.6	33.1		

01-CLD, Route 123 Bridge at Brewery Road, Walpole

Date	Time of Sample	DO (mg/L)	DO (% sat.)	Water Temp. (°C)	Air Temp. (°C)	pH	Turbidity (NTUs)	Specific Conductance (µS/cm)	Total Phosphours (mg/L)	Nitrate (mg/L)	N02+N03
Standard	**NA**	**>5.0**	**>75% Daily Average**	**Narrative**	**NA**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**Narrative**	**Narrative**	**Narrative**
7/8/06	08:15	9.59	100.2	17.5	18.1	7.00	2.0	67.4	0.010		
7/11/06	10:12									0.22	
8/12/06	07:56	9.52	94.9	14.9	13.2	6.45	1.7	66.4			
8/15/06	09:00								0.010	0.22	
9/9/06	07:48	9.75	99.5	15.9	15.9	6.45	1.4	73.9			
9/12/06	09:45								0.007		0.23
10/1/06	21:02	10.33	97.6	12.4	12.2	7.29	70.8	59.1			