Section 5-3
Cold Brook and Whitten Brook (Skowhegan Conservation Commission)

Cold Brook and Whitten Brook

Cold Brook:
Cold Brook originates east of Russell Road, flows into an impounded section (Cold Brook Pond) bordered by three commercial shopping malls, flows under Route 201, meanders adjacent to the North Gate Industrial Park, the retired Town of Skowhegan Landfill, and a forested area before it discharges to the West Branch of Wesserunsett Stream. The brook is 5.89 miles long (mainstem) and its watershed encompasses approximately 4774 acres including residential, commercial, industrial and undeveloped land. The statutory class of Cold Brook is Class B.

Whitten Brook:
Whitten Brook originates in an undeveloped forest located northwest of Coburn Avenue in Skowhegan. It meanders for 0.6 miles parallel to Spring Street before it enters a small impounded area adjacent to an old shoe factory that is currently being used as a warehouse and storage facility. It then flows under Russell Street where it joins its northern branch that originates near Robinson Court. It continues to flow another 0.5 miles in a southerly direction, crossing underneath Spring Street, Summer Street, Bennett Avenue, Pleasant Street and finally Elm Street where it discharges into the Kennebec River upstream from Weston Dam. The brook is 1.11 miles long (mainstem) and its watershed encompasses approximately 304 acres including residential, commercial, industrial and undeveloped land. The statutory class of Whitten Brook is Class B.

Whitten Brook is listed by DEP as impaired due to non-attainment of aquatic life criterion and habitat, as well as nonattainment of bacteria criterion. The cause of impairment is stormwater runoff from impervious surfaces and roads within the watershed. The Town of Skowhegan and Maine DEP conducted a multi-year effort to assess the impacts to the brook's water quality that culminated in the placement of two bioretention cells designed to decrease the water quality impacts of high flow events. In March 2011, a watershed management plan that identifies the problems, priorities and actions needed to improve the water quality was completed.

Monitoring History

• The Maine DEP Biological Monitoring Program has been monitoring Cold Brook since 1997 and Whitten Brook since 2002. This data is available on DEP's website.

• The Maine DEP monitored Whitten Brook in 2006 for bacteria, dissolved oxygen and toxics.

• The Skowhegan Conservation Commission joined the Maine Volunteer River Monitoring Program (VRMP) in 2014.

Methods and Sampling Sites

Volunteers monitor Cold Brook at two sites on the mainstem. Volunteers monitor Whitten Brook at three sites on the mainstem and one site on the Northern tributary. All of the sites are VRMP approved sites.

Monitoring is conducted weekly from June to September. Monitors take measurements of water temperature, dissolved oxygen, and conductivity using a YSI meter.

Table 5-3-1: Cold Brook and Whitten Brook sampling sites.

VRMP Site ID	Organization Site Code	Sample Location	Class
Cold Brook-KWSCB27-VRMP	CB-2	Route 201	B
Cold Brook-KWSCB06-VRMP	CB-3	Steward Hill	B
Whitten Brook-KWB06-VRMP	WB-1	Russell Street-above	B
Whitten Brook-KWB05-VRMP	WB-2	Russell Street-below	B
Whitten Brook-North Branch-KWBNB02-VRMP	WB-3	North Branch	B
Whitten Brook-KWB01-VRMP	WB-4	Pleasant Street	B

Cold Brook and Whitten Brook Sampling Sites

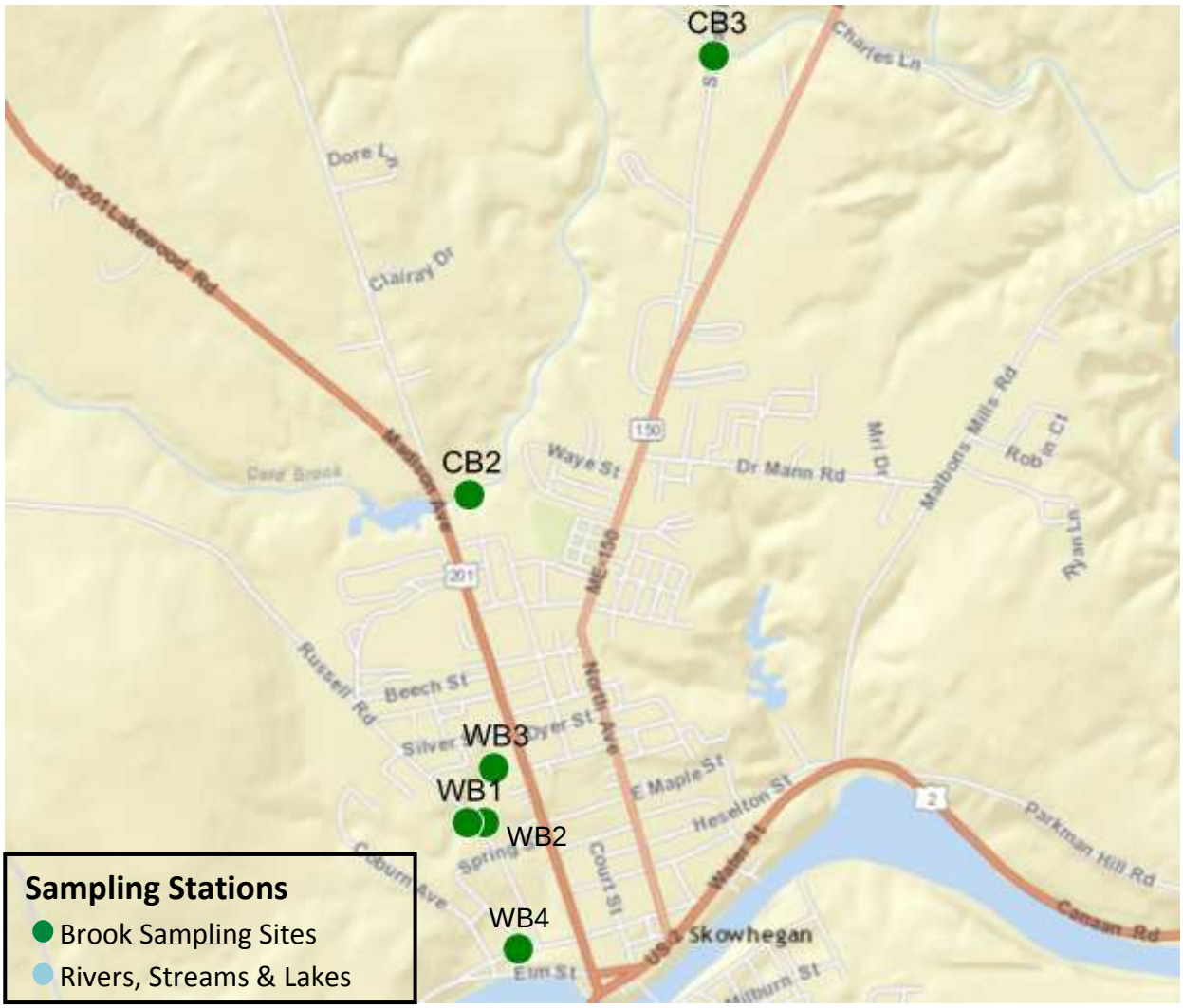


Figure 5-3-1: Map of Cold Brook and Whitten Brook sampling sites.

Results

Refer to Appendix for discussion of individual site data and trends.

Dissolved Oxygen

Dissolved oxygen levels are generally lowest early in the morning and then increase during the day, peaking mid to late afternoon. Monitors should try to collect some samples early in the morning. Dissolved oxygen is also affected by flow conditions and temperature. During high flow conditions, more oxygen is added to the river from the atmosphere as the water is more turbulent and there is more opportunity for mixing. If flow during the summer months is higher or lower that normal, this will affect the dissolved oxygen.

Class B criteria for dissolved oxygen are a minimum of 7 mg/l (milligrams/liter) or 75% saturation. To meet water quality criteria, both concentration and saturation criteria must be met.

2015 Results:

Both Cold Brook and Whitten Brook were sampled bi-weekly (9 times) through the sampling season. Site WB-4 was sampled 3 times due to construction activity. At sampling site CB-2, the dissolved oxygen (DO) concentration criterion of 7 mg/l was not met for 3 sampling dates (in July, August and September). This site also did not meet the DO percent saturation criterion on the same 4 dates. Site CB-3 did not meet criterion for DO concentration on 4 sampling dates (June, July and September) and did not meet criterion for DO percent saturation on the same dates. Dissolved oxygen at these sites may in part be natural since site CB-2 is below a large impounded area and there is a wetland above site CB-3. Dissolved oxygen at these two sites is fair-good.

All of the Whitten Brook sample sites met DO criterion for dissolved oxygen concentration of 7 mg/l. Whitten Brook sites also met criterion for DO percent saturation for all dates except 1 date at site WB-1. It is surprising that this small urban stream maintained good DO through the season. The monitors did an excellent job of obtaining early morning measurements. Overall dissolved oxygen was excellent at Whitten Brook.

Table 5-3-2: A summary of minimum, maximum, and average dissolved oxygen concentration (mg/l) values at Cold Brook and Whitten Brook monitoring sites.

Site	Class	# Sample Points	Mean	Minimum	Maximum	Criterion	# Not Meeting Criterion
CB-2	B	9	7.6	5.7	10.0	7	4
CB-3	B	9	7.2	5.3	8.7	7	4
WB-1	B	9	8.8	7.6	10.0	7	0
WB-2	B	9	9.0	8.2	9.8	7	0
WB-3	B	9	9.3	8.8	10.1	7	0

WB-4	B	3	10.0	9.5	10.5	7	0

Table 5-5-3: A summary of minimum, maximum, and average dissolved oxygen saturation (%) values at Cold Brook and Whitten Brook monitoring sites.

Site	Class	# Sample Points	Mean	Minimum	Maximum	Criterion	# Not Meeting Criterion
CB-2	B	9	79.3	60.2	94.3	75	4
CB-3	B	9	74.8	57.8	85.1	75	4
WB-1	B	9	84.8	72.3	92.2	75	1
WB-2	B	9	86.0	79.4	89.1	75	0
WB-3	B	9	86.6	81.4	95.1	75	0
WB-4	B	3	92.4	90.4	94.2	75	0

Figure 5-3-2: Graph of dissolved oxygen concentrations for Cold Brook sites.

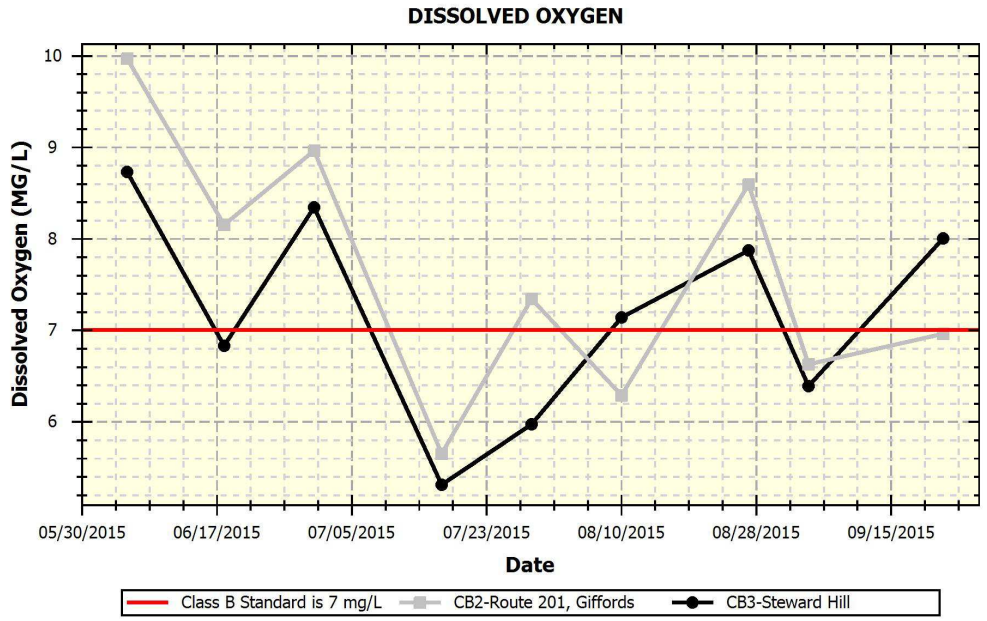


Figure 5-3-3: Graph of dissolved oxygen concentrations for Whitten Brook sites.

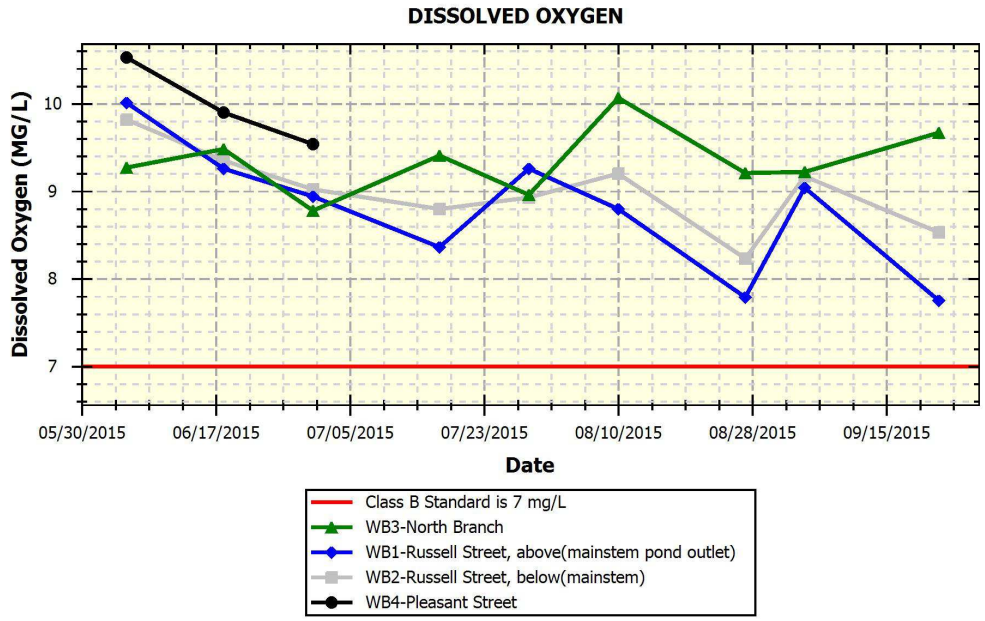


Figure 5-3-4: Graph of dissolved oxygen saturation for Cold Brook sites.

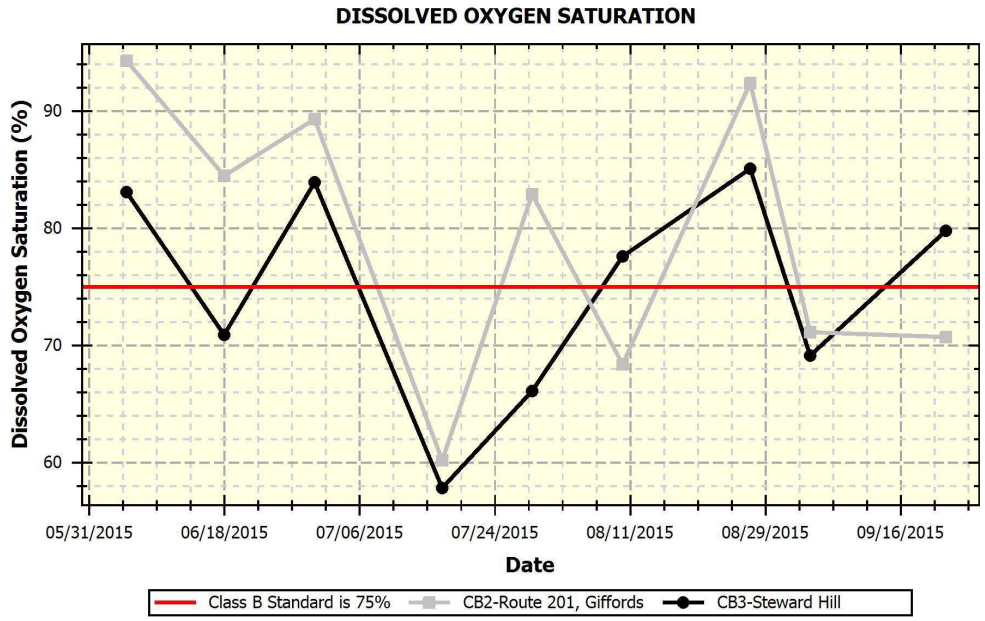
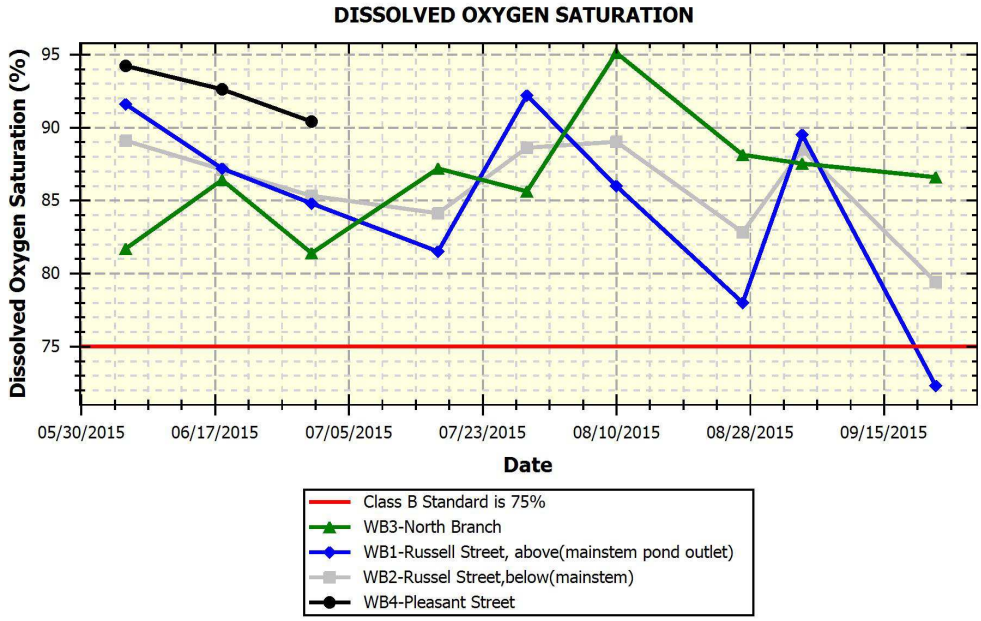


Figure 5-3-5: Graph of dissolved oxygen saturation for Whitten Brook sites.



Water Temperature

Maine's Regulations Relating to Temperature (06-096 CMR Chapter 582) require that discharge of pollutants not raise the temperature of any river and stream above the EPA criteria for indigenous species (23°C maximum and 19°C weekly average) or 0.3°C (0.5°F) above the temperature that would naturally occur outside a mixing zone established by the Board of Environmental Protection. Pollutant is defined in statute as many things including dirt and heat. For tidal waters, discharge of pollutants may not raise the temperature more than 4°F (2.2°C) or more than 1.5°F (0.8°C) from June 1 to September 1, and may not cause the temperature of any tidal waters to exceed 85°F (29°C) at any point outside a mixing zone established by the Board of Environmental Protection.

2015 Results:

Temperature at the Cold Brook sampling sites was overall fairly good. Temperatures rose somewhat in July and August to the 18˚-21˚ C range. Overall temperature at Cold Brook is good. Temperature at Whitten Brook was cold at all the sites throughout the season with maximum temperatures 15˚C (Celsius). Overall temperature at Whitten Brook is excellent.

Table 5-3-4: A summary of minimum, maximum, and water temperature (°C) values at Cold Brook and Whitten Brook monitoring sites.

Site	Class	# Sample Points	Mean	Minimum	Maximum	Criterion	# Exceeding Criterion
CB-2	B	9	17.4	12.6	21.4	n/a	n/a
CB-3	B	9	17.4	12.8	20.6	n/a	n/a
WB-1	B	9	13.6	10.7	15.5	n/a	n/a
WB-2	B	9	13.2	10.4	15.3	n/a	n/a
WB-3	B	9	12.0	9.6	13.3	n/a	n/a
WB-4	B	3	11.8	10.1	13.0	n/a	n/a

Figure 5-3-6: Graph of water temperature for Cold Brook sites.

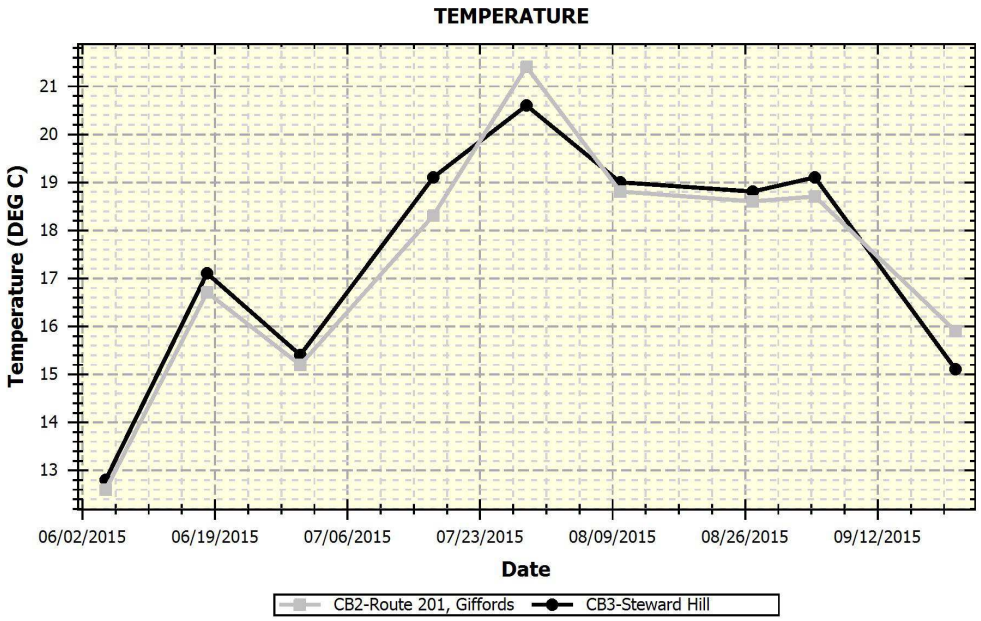
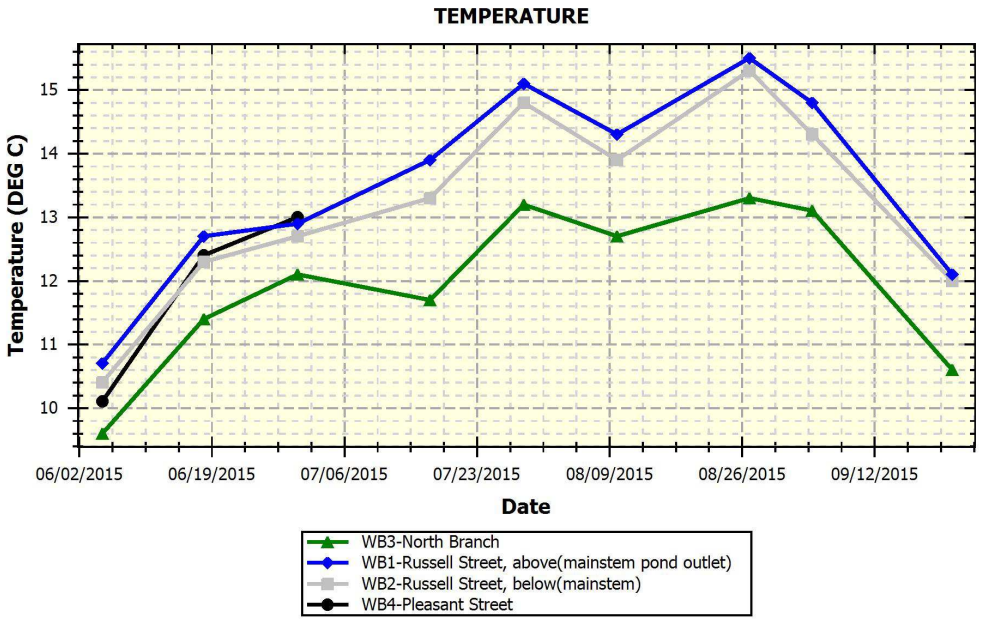


Figure 5-3-7: Graph of water temperature for Whitten Brook sites.



Specific Conductance

Specific conductance is related to the amount of dissolved materials in the water. While there are no numerical standards, a relationship exists between conductivity and chloride which has numerical criteria. In general, streams located in urban areas tend to have high specific conductance due to polluted urban stormwater runoff. This may also in large part be due to salt buildup in surface and groundwater from road maintenance practices.

2015 Results:

Specific conductance at the two Cold Brook sites followed similar patterns with conductivity being in the 300-600 µS/cm range for July through September. The exception was the one date in late August which coincided with heavy rain, thus diluting the stream. The above site was generally higher which makes sense given its location below Route 201 development. Conductivty is poor to fair.

Specific conductance at Whitten Brook sampling sites WB-1, WB-2, and WB-4 were similar. Values here were overall moderate with values ranging from 118-287 µS/cm range. Specific conductance was generally always high at site WB-3 (north branch) with values ranging from 460-708 µS/cm. Conductivity at sites WB-1, WB-2 and WB-4 is fair to good and poor at Site WB-3.

Table 5-3-5: A summary of minimum, maximum, and specific conductance (µS/cm) values at Cold Brook and Whitten Brook monitoring sites.

Site	Class	# Sample Points	Mean	Minimum	Maximum	Criterion	# Exceeding Criterion
CB-2	B	9	331	102	626	n/a	n/a
CB-3	B	9	260	114	447	n/a	n/a
WB-1	B	9	180	118	218	n/a	n/a
WB-2	B	9	238	187	287	n/a	n/a
WB-3	B	9	623	460	708	n/a	n/a
WB-4	B	3	251	219	279	n/a	n/a

Figure 5-3-8: Graph of specific conductance for Cold Brook sites.

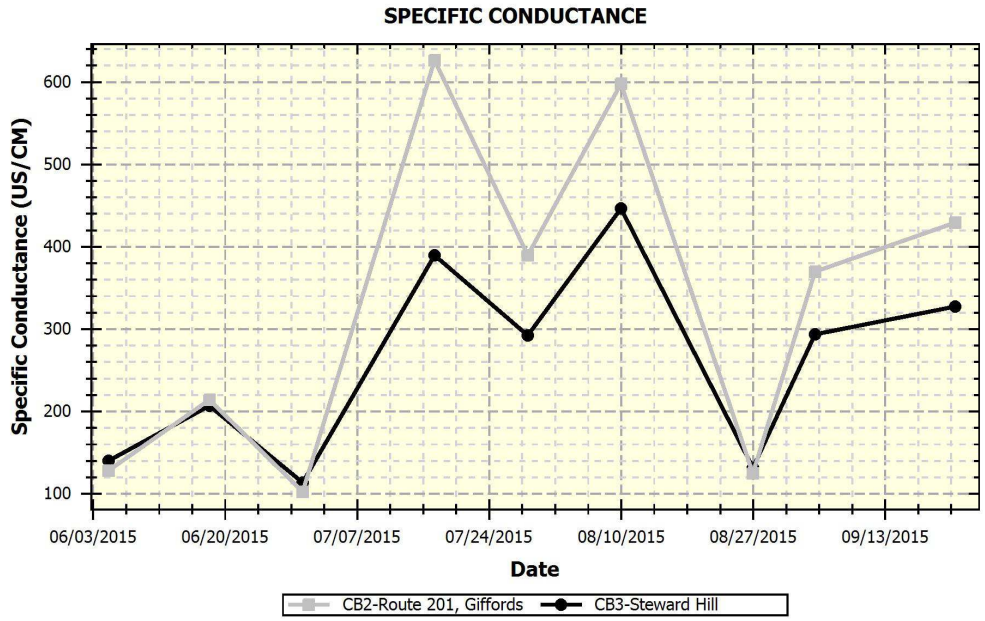
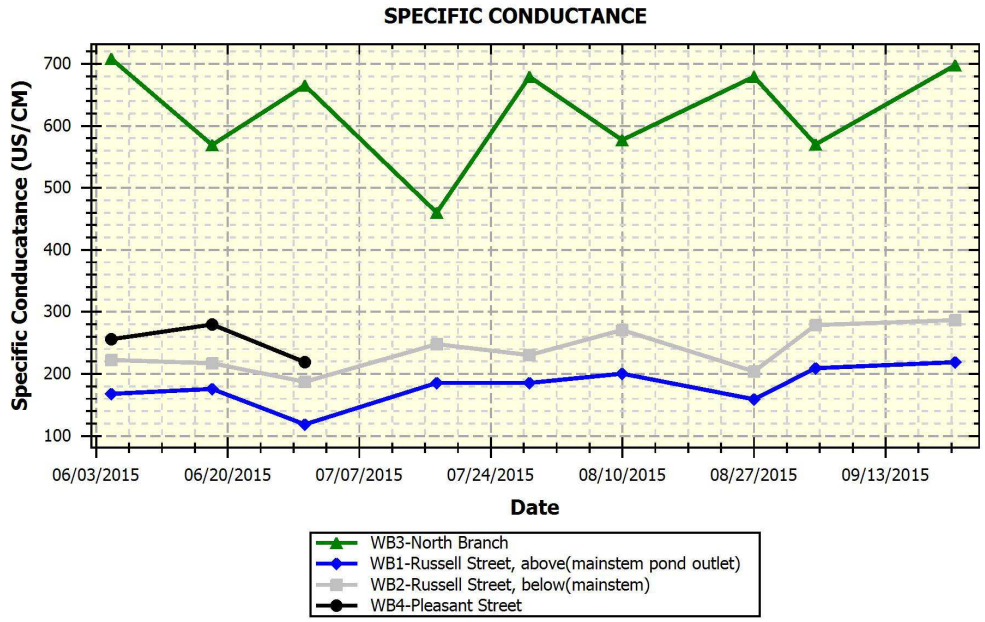


Figure 5-3-9: Graph of specific conductance for Whitten Brook sites.



Discussion and Recommendations

There are numerous sources of pollution and other stresses to the Kennebunk River sites monitored by the Mousam and Kennebunk Rivers Alliance that could potentially have an impact on water quality. Some of those sources of pollution and stress may include:

- Non-point source pollution (e.g., septic systems, eroded soil, fertilizers, pesticides, heavy metals, petroleum residues, road salt, wildlife and pet feces) and polluted stormwater originating from urban impervious surfaces (e.g., streets, parking lots, driveways, roofs), agriculture, and forestry.
- Ponds and impoundments (which often create more pond-like aquatic habitat conditions that may have higher water temperatures and lower dissolved oxygen concentrations than free-flowing waters)
- Natural effects of wetlands (such as contributing waters to a stream/river that have low dissolved oxygen levels due to the decomposition of large amounts of organic matter, respiration of abundant plant matter, and low re-aeration rates that is characteristic of many wetlands).

The following are recommendations for future monitoring:

- **The monitors should continue to include early morning measurements for dissolved oxygen. It is important to get some values early in the morning (before 8:00 am), particularly during the warmer summer months. Over a 24 hour period, the lowest readings occur in the early morning and highest readings in mid to late afternoon. This occurs because oxygen is used up during the night due to plant respiration and during the day, plant life is photosynthesizing.**

- **Further assessment of possible pollution sources contributing to high conductivity in Cold Brook may be investigated. Further investigation of potential sources in Whitten Brook-north branch may also be warranted.**
- **Good dissolved oxygen and temperature in Whitten Brook is encouraging. It would be worthwhile to do an assessment of aquatic life and habitat to determine if these are the primary stressors for Whitten Brook. DEP will be monitoring aquatic life in the Kennebec Basin in 2017 and we should make sure that Whitten Brook is included.**
- **Continue monitoring at all stations to develop a long term trend database.**

Appendix A-1. 2011 water quality data for "Approved" and "Non-Approved" sites. Non-Approved sites do not yet meet official VRMP sample location criteria and/or require further inspection and review.
* Sampling depths are only reported for Tier 1 VRMP sites.
** "N/A" = normal environmental sample ; "D" = field duplicate; "D.O." = dissolved oxygen; "Spec. Cond" = specific conductance; "Turb" = turbidity; "TSS" = total suspended solids"
Refer to Appendix A-2 for observational data and quality assurance/quality control (QA/QC) notes.

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	* Sample Depth	Depth Unit	Water Temp (DEG C)	** D.O. Sat. (%)	** D.O. (MG/L)	** Spec. Cond. (US/CM)	Salinity (PPTH)	Turb-idity (NTU)	Total Diss. Solids (MG/L)	** TSS (MG/L)	E Coli Bacteria (MPN/ 100ML)	Entero-cocci (MPN/ 100ML)
Cold Brook, Whitten Brook - Skowhegan Conservation Commission: Approved Sites																
CB3	COLD BROOK - KWSCB06 - VRMP	6/5/2015	5:31 AM	NA			12.8	83.1	8.7	139.8						
CB3	COLD BROOK - KWSCB06 - VRMP	6/18/2015	6:47 AM	NA			17.1	70.9	6.8	206.7						
CB3	COLD BROOK - KWSCB06 - VRMP	6/30/2015	5:22 AM	NA			15.4	83.9	8.3	113.6						
CB3	COLD BROOK - KWSCB06 - VRMP	7/17/2015	7:40 AM	NA			19.1	57.8	5.3	389						
CB3	COLD BROOK - KWSCB06 - VRMP	7/29/2015	5:48 AM	NA			20.6	66.1	6.0	291.8						
CB3	COLD BROOK - KWSCB06 - VRMP	7/29/2015	5:48 AM	D			20.6	66.4	5.9	292.9						
CB3	COLD BROOK - KWSCB06 - VRMP	8/10/2015	7:15 AM	NA			19.0	77.6	7.1	446.5						
CB3	COLD BROOK - KWSCB06 - VRMP	8/27/2015	6:36 AM	NA			18.8	85.1	7.9	131.2						
CB3	COLD BROOK - KWSCB06 - VRMP	9/4/2015	7:40 AM	NA			19.1	69.1	6.4	293.5						
CB3	COLD BROOK - KWSCB06 - VRMP	9/22/2015	6:31 AM	NA			15.1	79.8	8.0	327.3						
CB3	COLD BROOK - KWSCB27 - VRMP	6/5/2015	5:43 AM	NA			12.6	94.3	10.0	128.1						
CB3	COLD BROOK - KWSCB27 - VRMP	6/18/2015	6:56 AM	NA			16.7	84.5	8.2	213.6						
CB3	COLD BROOK - KWSCB27 - VRMP	6/30/2015	5:34 AM	NA			15.2	89.3	9.0	101.8						
CB3	COLD BROOK - KWSCB27 - VRMP	7/17/2015	7:50 AM	NA			18.3	60.2	5.7	626						
CB3	COLD BROOK - KWSCB27 - VRMP	7/29/2015	6:08 AM	NA			21.4	82.9	7.3	389.4						
CB3	COLD BROOK - KWSCB27 - VRMP	8/10/2015	7:25 AM	NA			18.8	68.4	6.3	598						
CB3	COLD BROOK - KWSCB27 - VRMP	8/10/2015	7:25 AM	D			18.9	68.8	6.4	598						
CB3	COLD BROOK - KWSCB27 - VRMP	8/27/2015	6:47 AM	NA			18.6	92.4	8.6	124.8						
CB3	COLD BROOK - KWSCB27 - VRMP	9/4/2015	7:32 AM	NA			18.7	71.1	6.6	369.3						
CB3	COLD BROOK - KWSCB27 - VRMP	9/22/2015	6:44 AM	NA			15.9	70.7	7.0	429						
WB4	WHITTEN BROOK - KWB01 - VRMP	6/5/2015	6:23 AM	NA			10.1	94.2	10.5	255.6						
WB4	WHITTEN BROOK - KWB01 - VRMP	6/18/2015	7:20 AM	NA			12.4	92.6	9.9	278.8						
WB4	WHITTEN BROOK - KWB01 - VRMP	6/30/2015	6:13 AM	NA			13.0	90.4	9.5	218.5						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	6/5/2015	6:11 AM	NA			9.6	81.7	9.3	708						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	6/18/2015	7:10 AM	NA			11.4	86.4	9.5	569						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	6/30/2015	6:00 AM	NA			12.1	81.4	8.8	665						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	7/17/2015	7:25 AM	NA			11.7	87.2	9.4	460						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	7/29/2015	6:31 AM	NA			13.2	85.6	9.0	679						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	8/10/2015	7:00 AM	NA			12.7	95.1	10.1	577						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	8/27/2015	7:13 AM	NA			13.3	88.1	9.2	679						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	9/4/2015	7:16 AM	NA			13.1	87.5	9.2	570						
WB3	WHITTEN BROOK - NORTH BRANCH - KWBNB02 - VRMP	9/22/2015	7:11 AM	NA			10.6	86.6	9.7	697						
WB2	WHITTEN BROOK - KWB05 - VRMP	6/5/2015	6:03 AM	NA			10.4	89.1	9.8	222.1						
WB2	WHITTEN BROOK - KWB05 - VRMP	6/18/2015	7:14 AM	NA			12.3	87.1	9.4	216.6						
WB2	WHITTEN BROOK - KWB05 - VRMP	6/30/2015	5:52 AM	NA			12.7	85.3	9.0	186.5						
WB2	WHITTEN BROOK - KWB05 - VRMP	7/17/2015	7:30 AM	NA			13.3	84.1	8.8	247.1						

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	* Sample Depth	Depth Unit	Water Temp (DEG C)	** D.O. Sat. (%)	** D.O. (MG/L)	** Spec. Cond. (US/CM)	Salinity (PPTH)	Turb-idity (NTU)	Total Diss. Solids (MG/L)	** TSS (MG/L)	E Coli Bacteria (MPN/ 100ML)	Entero-cocci (MPN/ 100ML)
WB2	WHITTEN BROOK - KWB05 - VRMP	7/29/2015	6:22 AM	NA			14.8	88.6	8.9	229.7						
WB2	WHITTEN BROOK - KWB05 - VRMP	8/10/2015	7:05 AM	NA			13.9	89.0	9.2	270.4						
WB2	WHITTEN BROOK - KWB05 - VRMP	8/27/2015	7:04 AM	NA			15.3	82.8	8.2	203.1						
WB2	WHITTEN BROOK - KWB05 - VRMP	9/4/2015	7:20 AM	NA			14.3	88.5	9.2	278						
WB2	WHITTEN BROOK - KWB05 - VRMP	9/22/2015	7:02 AM	NA			12.0	79.4	8.5	286.5						
W1	WHITTEN BROOK - KWB06 - VRMP	6/5/2015	5:55 AM	NA			10.7	91.6	10.0	167.6						
W1	WHITTEN BROOK - KWB06 - VRMP	6/18/2015	7:06 AM	NA			12.7	87.2	9.3	175.5						
W1	WHITTEN BROOK - KWB06 - VRMP	6/30/2015	5:45 AM	NA			12.9	84.8	8.9	117.7						
W1	WHITTEN BROOK - KWB06 - VRMP	7/17/2015	7:20 AM	NA			13.9	81.5	8.4	185						
W1	WHITTEN BROOK - KWB06 - VRMP	7/29/2015	6:17 AM	NA			15.1	92.2	9.3	185.4						
W1	WHITTEN BROOK - KWB06 - VRMP	8/10/2015	6:55 AM	NA			14.3	86.0	8.8	200.1						
W1	WHITTEN BROOK - KWB06 - VRMP	8/27/2015	6:59 AM	NA			15.5	78.0	7.8	158.3						
W1	WHITTEN BROOK - KWB06 - VRMP	9/4/2015	7:12 AM	NA			14.8	89.5	9.0	208.8						
W1	WHITTEN BROOK - KWB06 - VRMP	9/22/2015	6:56 AM	NA			12.1	72.3	7.8	218.1						