

## Section 5-4 Hart Brook (City of Lewiston)

Refer to Chapter 4 of this document for information about sampling methods, sampling sites, and quality assurance.

### Overview

Hart Brook (aka Dill Brook) is listed on the MeDEP 2012 Integrated Water Quality Report as an impaired stream. Causes of impairment are macroinvertebrate assessment, habitat assessment, periphyton assessment, dissolved oxygen and E. coli. As such, a total maximum load (TMDL) report (“Maine Impervious Cover Total Maximum Daily Load Assessment (TMDL) for Impaired Streams” September 2012) has been completed for this brook. A Watershed Management Plan (WMP) has also been completed and approved.

The project area includes the entire Hart Brook watershed. Hart Brook is a small Class B urban stream located in Lewiston, Maine. The brook originates in the area of Pond Road, meanders through the Valley section neighborhoods, the Industrial Park, the Goff Brook neighborhoods, crosses under I-95, and then follows River Road to where it discharges to the Androscoggin River. The brook is approximately 3.7 miles long and its watershed encompasses approximately 2200 acres, including residential, commercial, industrial and undeveloped land.

The overall purpose of monitoring is to assess water quality data to determine whether the river is meeting water quality classification standards. Limited monitoring was done as part of the TMDL and Watershed Management Plan development. The Clean Water Act requires that a TMDL, which is an assessment of impairments and pollutant loading reductions needed to meet water quality standards be developed for impaired waters. Continued monitoring by the City will be used to assess current conditions and progress toward improvement.

### Methods

The volunteers monitored the Hart Brook in 2013 at four stations on the main stem and one tributary station (Table 5-4-1 and Figure 5-4-1). All of the Hart Brook sites are VRMP approved sites.

**Table 5-4-1:** City of Lewiston sampling sites on Hart Brook.

VRMP Site ID	Organization Site Code	Sample Location	Class
Hart Brook-ADL04-VRMP	HB-1	Pike Industries	B
Hart Brook-ADL14-VRMP	HB-2	Goddard Road	B
Hart Brook-ADL19-VRMP	HB-3	Olive Street	B
Hart Brook-ADL28-VRMP	HB-4	Westminster Street	B
Hart Brook-ADLUA04-VRMP	HB-5	Morningside Street	B

# 2013 Hart Brook Sampling Sites City of Lewiston

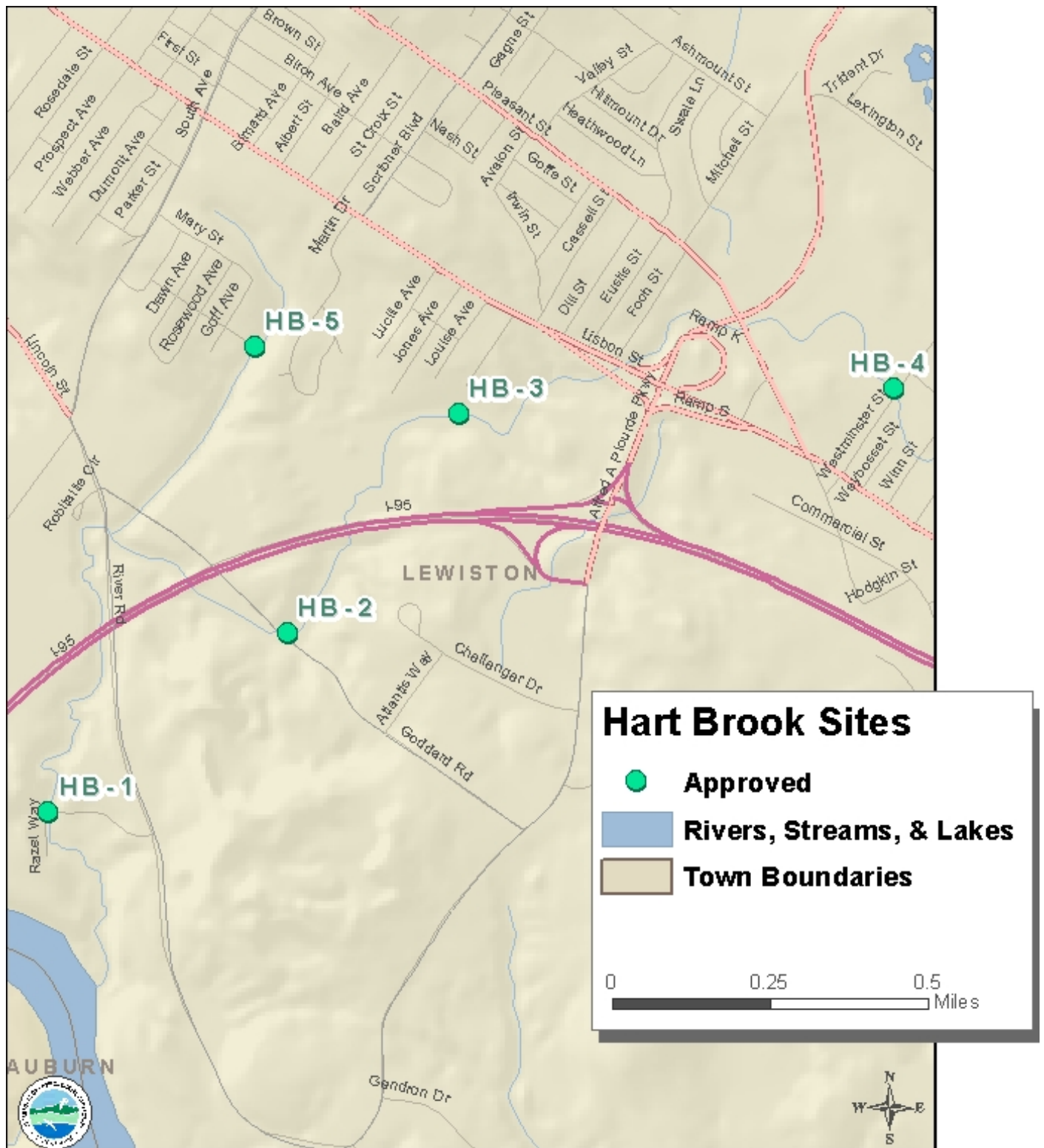


Figure 5-4-1: Map of Hart Brook sampling sites.

Monitoring was conducted biweekly in July-August. At each site, the monitors made direct measurements of water temperature and dissolved oxygen using a handheld YSI 550A meter. Conductivity was directly measured at the freshwater sites using an Oakton EC 11/11+ Testr conductivity pen.

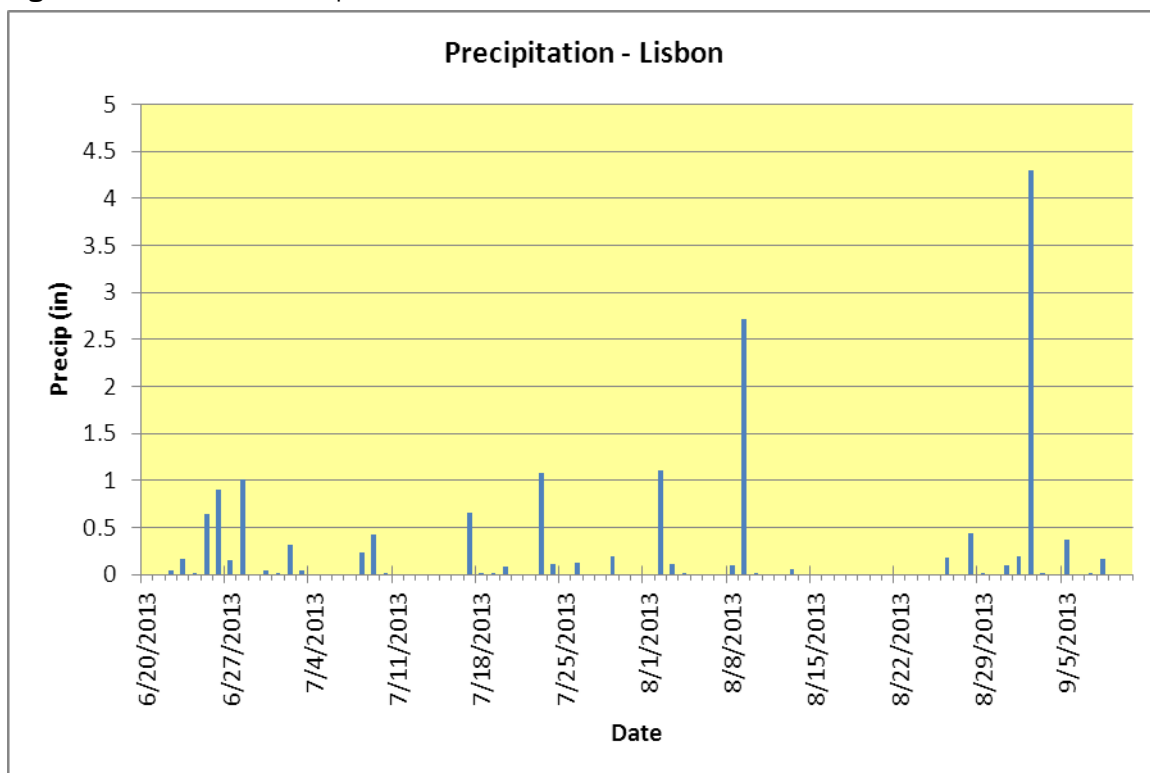
## Results

Refer to Appendices A-1 and A-2 in discussion of individual site data and trends at the end of this report.

### Precipitation

Figure 5-4-2 provides a graph of rainfall and sampling dates for the monitoring period. Rainfall data was obtained from Weather Underground (<http://www.wunderground.com>). Weather station (King Road Lisbon-KMELISBO7) choice was based on proximity and station with most complete records. If there was an airport station close by, this was chosen if there was a complete record. This information provides an overview of rainfall events and can be useful in interpreting monitoring results for some parameters. Summer of 2013 was wet with significant rain events in August and early September.

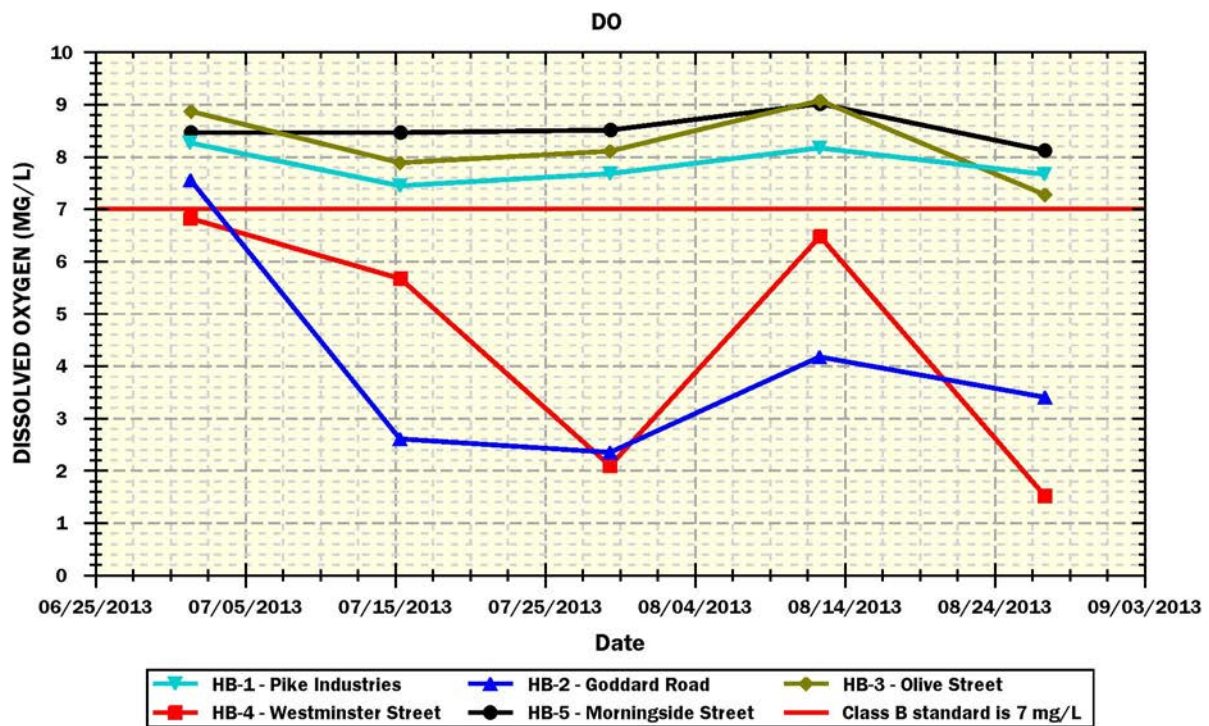
**Figure 5-4-2:** Seasonal Precipitation Measured at Lisbon



**Dissolved Oxygen**

Dissolved oxygen was measured 5 times at each of the five sampling sites (Figure 5-4-3 and Figure 5-4-4; Table 5-4-2 and Table 5-4-3). Monitoring occurred in July and August. 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 standards must be met.

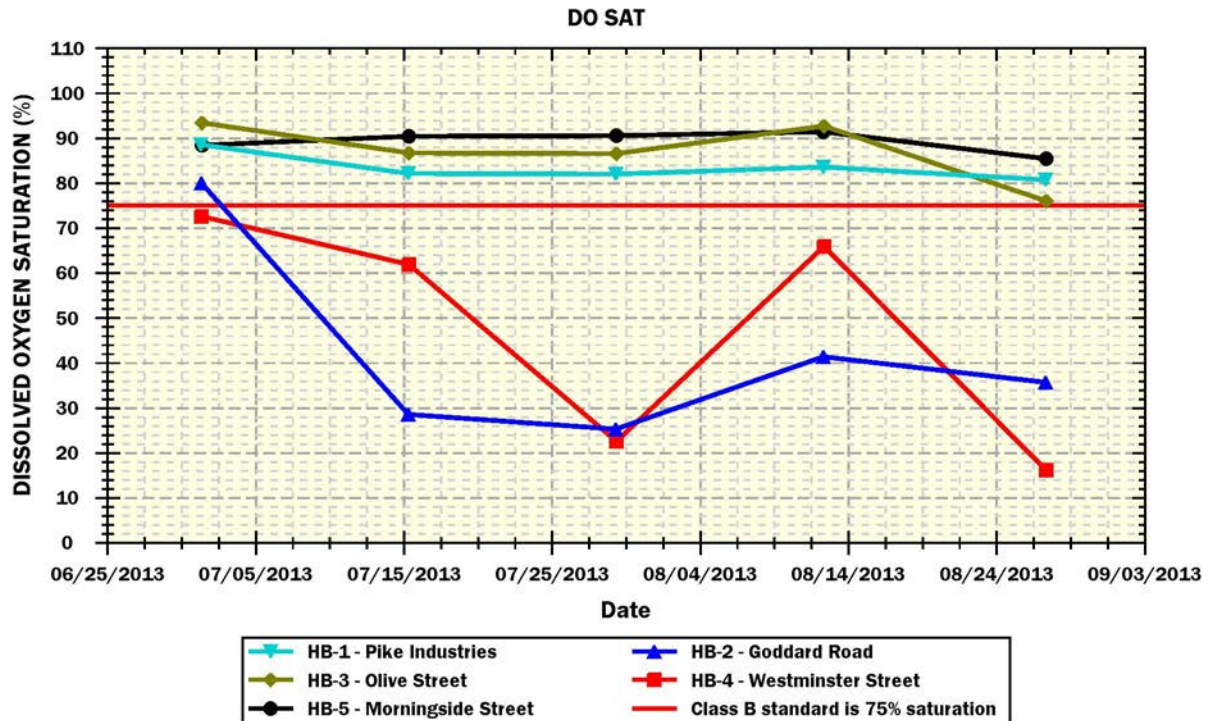
**Figure 5-4-3:** Graph of dissolved oxygen concentrations.



**Table 5-4-2:** A summary of minimum, maximum, and average dissolved oxygen concentration (mg/l) values at Hart Brook monitoring stations.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
HB-1	Y	5	7.5	8.3	7.8
HB-2	Y	5	2.4	7.6	4.0
HB-3	Y	5	7.3	9.1	8.2
HB-4	Y	5	1.5	6.8	4.5
HB-5	Y	5	8.1	9.0	8.5

**Figure 5-4-4:** Graph of dissolved oxygen saturation



**Table 5-4-3:** A summary of minimum, maximum, and average dissolved oxygen saturation (%) values at Hart Brook monitoring sites.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
HB-1	Y	5	80.7	88.6	83.4
HB-2	Y	5	25.2	80.0	42.2
HB-3	Y	5	76.0	93.4	87.1
HB-4	Y	5	16.2	72.6	47.8
HB-5	Y	5	85.4	91.4	89.2

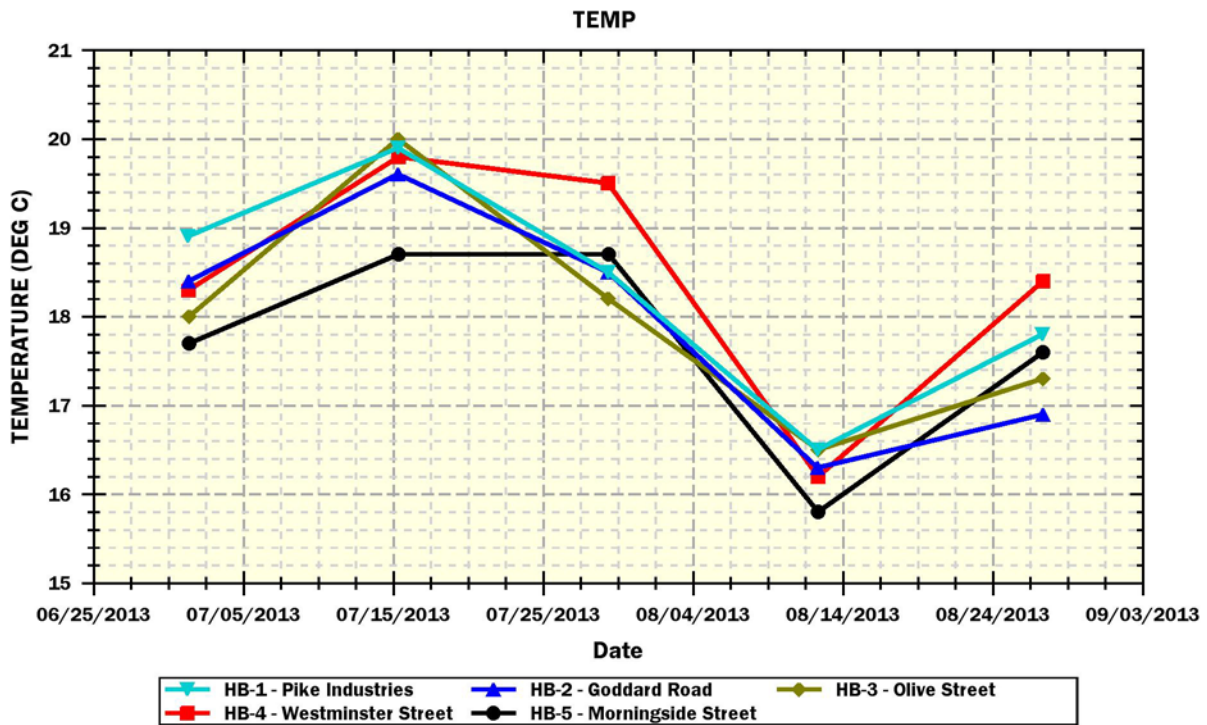
Dissolved oxygen at Sites HB-1, HB-3 and HB-5 were similar. Site HB-5 was the best overall with values ranging from 8.1 mg/l and 9.0 mg/l. Site HB-3 was a bit lower with values between 7.3 mg/l and 9.1 mg/l. Site HB-1 was lower than these two sites for most dates with values ranging from 7.5 mg/l to 8.3 mg/l. Percent saturation for these three sites followed a similar pattern with values ranging from 76.0% to 91.4%. The values for both concentration and percent saturation were above the Class B standard of 7.0 mg/l and 75% saturation. Site HB-2 had the lowest measurements with values ranging from 2.4 mg/l to 4.1 mg/l and percent saturation ranging from 25.2% to 41.4% for 4 out of 5 dates. Site HB-4 was somewhat better, but all measurements were below the Class B standards for both

concentration and percent saturation and two dates had the lowest values recorded compared to all the sites. Values here ranged from 1.5 mg/l to 6.8 mg/l and 16.2 % to 72.6 % saturation. Overall, dissolved oxygen was better at least on Sites HB-1, HB-3 and HB-5 compared to previous years, which may in part be due to 2013 being a wet summer with higher flows.

### Water Temperature

Temperature was measured 5 times at each of the five sampling sites (Figure 5-4-5 and Table 5-4-4). Monitoring occurred from July-August. 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.

**Figure 5-4-5:** Graph of temperature



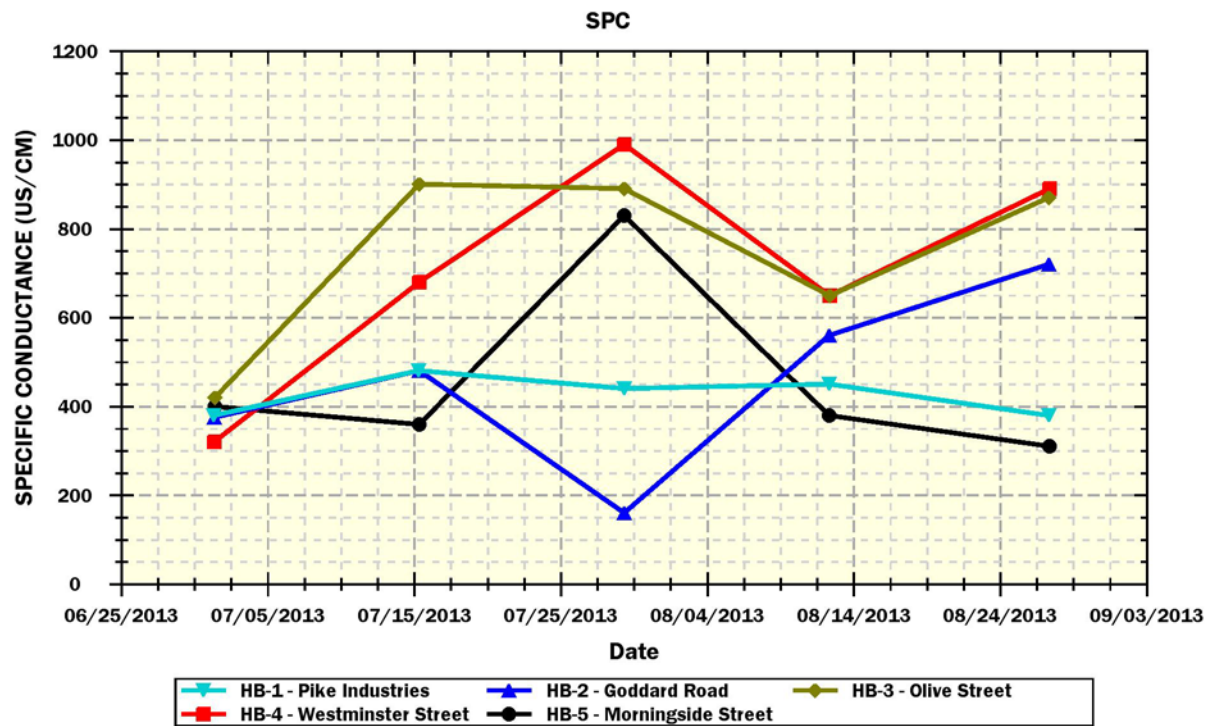
**Table 5-4-4:** A summary of minimum, maximum, and water temperature (°C) values at Hart Brook monitoring sites.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
HB-1	Y	5	16.5	19.9	18.3
HB-2	Y	5	16.3	19.6	17.9
HB-3	Y	5	16.5	20.0	18.0
HB-4	Y	5	16.2	19.8	18.4
HB-5	Y	5	15.8	18.7	17.7

Temperatures at the five sampling sites ranged from 15.8 °C to 20.0 °C. Sites HB-1, HB-2, HB-3 and HB-4 were similar with values ranging from 16.2 °C to 20.0 °C. Site HB-4 had the highest values on two dates. The highest values overall occurred in July. Site HB-5 was overall lower than the other sites with temperatures ranging from 15.8 °C to 18.7 °C. Differences in temperatures are likely in part due to differences in shading between sites. Overall, temperatures were moderate which is surprising for an urban stream. Again this may be partly weather and flow related. In previous years, Site HB-4 had very high values.

### *Specific Conductance*

Specific conductance was measured 5 times at each of the five sampling sites (Figure 5-4-6 and Table 5-4-5). Monitoring occurred from July-August. 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. If enough samples of chloride and conductivity are taken, a regression may be developed. 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 in surface and groundwater from road maintenance practices.

**Figure 5-4-6:** Graph of specific conductivity**Table 5-4-5:** A summary of minimum, maximum, and specific conductance ( $\mu\text{S}/\text{cm}$ ) values at Hart Brook monitoring sites.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
HB-1	Y	5	380	480	426
HB-2	Y	5	160	720	459
HB-3	Y	5	420	900	746
HB-4	Y	5	320	990	706
HB-5	Y	5	310	830	456

Overall, specific conductance is high to very high at all the sampling sites. Site HB-1 is lowest overall with values ranging from 380  $\mu\text{S}/\text{cm}$  to 480  $\mu\text{S}/\text{cm}$  and was fairly consistent. Site HB-5 was similar to HB-1 with the exception of one date (830  $\mu\text{S}/\text{cm}$ -7/29/13). Site HB-2 values ranged from 160  $\mu\text{S}/\text{cm}$  to 720  $\mu\text{S}/\text{cm}$ . Sites HB-3 and HB-4 were mostly consistently the highest sites.



## Discussion and Recommendations

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There are numerous sources of pollution and other stresses to Hart Brook sites monitored by the City of Lewiston 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, rooftops), 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 interns did a good job of getting out early in the morning. 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. It would be worthwhile to monitor 2x/day (early morning and mid-afternoon) at least a couple of times during July-August to determine if there are significant differences. Significant differences (at least 2 mg/l) may indicate nutrient loading issues.
- It would be worthwhile to take water samples for chloride to determine if winter salt is a problem. Potential sources of the high conductivity may also be tracked by walking the stream and periodically measuring conductivity.
- Continue monitoring at all stations to develop a long term trend database.

Appendix A-1. 2013 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" = normal environmental sample ; "D" = field duplicate; "D.O." = dissolved oxygen; "Spec. Cond" = specific conductance; "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)	Turbidity (NTU)	Total Diss. Solids (MG/L)	** TSS (MG/L)	E Coli Bacteria (MPN/100ML)	Enterococci (MPN/100ML)
<b>Hart Brook, City of Lewiston - Approved Sites:</b>																
HB-1	HART BROOK-ADL04-VRMP	7/1/2013	7:34 AM	N			18.9	88.6	8.26	380						
HB-1	HART BROOK-ADL04-VRMP	7/15/2013	7:30 AM	N			19.9	82.1	7.45	480						
HB-1	HART BROOK-ADL04-VRMP	7/29/2013	7:35 AM	N			18.5	82	7.68	440						
HB-1	HART BROOK-ADL04-VRMP	8/12/2013	7:30 AM	N			16.5	83.5	8.17	450						
HB-1	HART BROOK-ADL04-VRMP	8/27/2013	7:42 AM	N			17.8	80.7	7.67	380						
HB-2	HART BROOK-ADL14-VRMP	7/1/2013	7:56 AM	N			18.4	80	7.56	375						
HB-2	HART BROOK-ADL14-VRMP	7/15/2013	7:45 AM	N			19.6	28.6	2.6	480						
HB-2	HART BROOK-ADL14-VRMP	7/29/2013	7:46 AM	N			18.5	25.2	2.35	160						
HB-2	HART BROOK-ADL14-VRMP	8/12/2013	7:42 AM	N			16.3	41.4	4.17	560						
HB-2	HART BROOK-ADL14-VRMP	8/27/2013	7:55 AM	N			16.9	35.7	3.4	720						
HB-3	HART BROOK-ADL19-VRMP	7/1/2013	8:50 AM	N			18	93.4	8.86	420						
HB-3	HART BROOK-ADL19-VRMP	7/15/2013	8:00 AM	N			20	86.7	7.88	900						
HB-3	HART BROOK-ADL19-VRMP	7/29/2013	8:02 AM	N			18.2	86.5	8.11	890						
HB-3	HART BROOK-ADL19-VRMP	8/12/2013	8:25 AM	N			16.5	92.7	9.07	650						
HB-3	HART BROOK-ADL19-VRMP	8/27/2013	8:10 AM	N			17.3	76	7.27	870						
HB-4	HART BROOK-ADL28-VRMP	7/1/2013	8:23 AM	N			18.3	72.6	6.82	320						
HB-4	HART BROOK-ADL28-VRMP	7/15/2013	8:10 AM	N			19.8	61.9	5.67	680						
HB-4	HART BROOK-ADL28-VRMP	7/15/2013	8:10 AM	D			19.8	62.3	5.67	780						
HB-4	HART BROOK-ADL28-VRMP	7/29/2013	8:14 AM	N			19.5	22.5	2.09	990						
HB-4	HART BROOK-ADL28-VRMP	8/12/2013	8:33 AM	N			16.2	65.9	6.48	650						
HB-4	HART BROOK-ADL28-VRMP	8/12/2013	8:33 AM	D			16.2	66	6.47	900						
HB-4	HART BROOK-ADL28-VRMP	8/27/2013	8:25 AM	N			18.4	16.2	1.52	890						
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	7/1/2013	9:04 AM	N			17.7	88.4	8.46	400						
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	7/15/2013	8:30 AM	N			18.7	90.4	8.46	360						
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	7/29/2013	8:30 AM	N			18.7	90.5	8.51	830						
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	8/12/2013	7:56 AM	N			15.8	91.4	9.01	380						
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	8/27/2013	8:37 AM	N			17.6	85.4	8.12	310						

Appendix A-2. 2013 observational data and quality assurance/quality control (QA/QC) notes for "approved" and "non-approved" sites.  
 \*\* "N" = normal environmental sample; "D" = field duplicate; "L" = lab duplicate  
 Refer to Appendix A-1 for water quality data

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	Flow	Stage	Air Temp (°C)	Sample Location	Current Weather	Air Condition	Past 24HR Weather	Habitat	Tide Stage	Water Appearance	Comments
<b>Hart Brook, City of Lewiston - Approved Sites:</b>															
HB-1	HART BROOK-ADL04-VRMP	7/1/2013	7:34 AM	N	BASE FLOW	MED	21.11	WADING	CLEAR	CALM	CLEAR, CLOUDY, HEAVY RAIN, SHOWERS	RIFFLE		TURBID	WADEABLE/MID-DEPTH
HB-1	HART BROOK-ADL04-VRMP	7/15/2013	7:30 AM	N	BASE FLOW	LOW	21.11	WADING	CLEAR	CALM	CLEAR	RUN		TURBID	WADEABLE/MID-DEPTH
HB-1	HART BROOK-ADL04-VRMP	7/29/2013	7:35 AM	N	BASE FLOW	LOW	18.33	WADING	MOSTLY CLOUDY	CALM	MOSTLY CLOUDY, SHOWERS	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-1	HART BROOK-ADL04-VRMP	8/12/2013	7:30 AM	N	BASE FLOW	LOW	15.56	WADING	CLEAR	CALM	CLEAR, PARTLY CLOUDY	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-1	HART BROOK-ADL04-VRMP	8/27/2013	7:42 AM	N	BASE FLOW	LOW	18.33	WADING	CLEAR	CALM	CLEAR, LIGHT RAIN, PARTLY CLOUDY, SHOWERS	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-2	HART BROOK-ADL14-VRMP	7/1/2013	7:56 AM	N	BASE FLOW	MED	21.11	CULVERT	CLEAR	CALM	CLEAR, CLOUDY, HEAVY RAIN, SHOWERS	RUN		TURBID	WADEABLE/MID-DEPTH
HB-2	HART BROOK-ADL14-VRMP	7/15/2013	7:45 AM	N	BASE FLOW	LOW	21.11	WADING	CLEAR	CALM	CLEAR	RUN		TURBID	WADEABLE/MID-DEPTH
HB-2	HART BROOK-ADL14-VRMP	7/29/2013	7:46 AM	N	BASE FLOW	LOW	18.33	WADING	MOSTLY CLOUDY	CALM	MOSTLY CLOUDY, SHOWERS	RUN		TURBID	WADEABLE/MID-DEPTH
HB-2	HART BROOK-ADL14-VRMP	8/12/2013	7:42 AM	N	BASE FLOW	MED	15.56	WADING	CLEAR	CALM	CLEAR, PARTLY CLOUDY	RUN		TURBID	WADEABLE/MID-DEPTH
HB-2	HART BROOK-ADL14-VRMP	8/27/2013	7:55 AM	N	BASE FLOW	MED	18.33	WADING	CLEAR	CALM	CLEAR, LIGHT RAIN, PARTLY CLOUDY, SHOWERS	RUN		TURBID	WADEABLE/MID-DEPTH
HB-3	HART BROOK-ADL19-VRMP	7/1/2013	8:50 AM	N	BASE FLOW	MED	21.11	WADING	CLEAR	CALM	CLEAR, CLOUDY, HEAVY RAIN, SHOWERS	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-3	HART BROOK-ADL19-VRMP	7/15/2013	8:00 AM	N	BASE FLOW	LOW	21.11	WADING	CLEAR	CALM	CLEAR	RIFFLE		CLEAR	WADEABLE/MID-DEPTH
HB-3	HART BROOK-ADL19-VRMP	7/29/2013	8:02 AM	N	BASE FLOW	MED	18.33	WADING	MOSTLY CLOUDY	CALM	MOSTLY CLOUDY, SHOWERS	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-3	HART BROOK-ADL19-VRMP	8/12/2013	8:25 AM	N	BASE FLOW	MED	15.56	WADING	CLEAR	CALM	CLEAR, PARTLY CLOUDY	RIFFLE		CLEAR	WADEABLE/MID-DEPTH

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	Flow	Stage	Air Temp (°C)	Sample Location	Current Weather	Air Condition	Past 24HR Weather	Habitat	Tide Stage	Water Appearance	Comments
HB-3	HART BROOK-ADL19-VRMP	8/27/2013	8:10 AM	N	BASE FLOW	MED	18.33	WADING	CLEAR	CALM	CLEAR, LIGHT RAIN, PARTLY CLOUDY, SHOWERS	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-4	HART BROOK-ADL28-VRMP	7/1/2013	8:23 AM	N	BASE FLOW	MED	21.11	CULVERT	CLEAR	CALM	CLEAR, CLOUDY, HEAVY RAIN, SHOWERS	RUN		TURBID	WADEABLE/MID-DEPTH
HB-4	HART BROOK-ADL28-VRMP	7/15/2013	8:10 AM	N	BASE FLOW	LOW	21.11	CULVERT	CLEAR	CALM	CLEAR	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-4	HART BROOK-ADL28-VRMP	7/15/2013	8:10 AM	D				CULVERT							WADEABLE/MID-DEPTH
HB-4	HART BROOK-ADL28-VRMP	7/29/2013	8:14 AM	N	BASE FLOW	MED	18.33	CULVERT	MOSTLY CLOUDY	CALM	MOSTLY CLOUDY, SHOWERS	RUN		TURBID	WADEABLE/MID-DEPTH
HB-4	HART BROOK-ADL28-VRMP	8/12/2013	8:33 AM	N	BASE FLOW	MED	15.56	CULVERT	CLEAR	CALM	CLEAR, PARTLY CLOUDY	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-4	HART BROOK-ADL28-VRMP	8/12/2013	8:33 AM	D				CULVERT							WADEABLE/MID-DEPTH
HB-4	HART BROOK-ADL28-VRMP	8/27/2013	8:25 AM	N	BASE FLOW	MED	18.33	WADING	CLEAR	CALM	CLEAR, LIGHT RAIN, PARTLY CLOUDY, SHOWERS	RUN		TURBID	WADEABLE/MID-DEPTH
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	7/1/2013	9:04 AM	N	BASE FLOW	LOW	21.11	WADING	CLEAR	CALM	CLEAR, CLOUDY, HEAVY RAIN, SHOWERS	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	7/15/2013	8:30 AM	N	BASE FLOW	MED	21.11	WADING	CLEAR	CALM	CLEAR	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	7/29/2013	8:30 AM	N	BASE FLOW	MED	18.33	WADING	MOSTLY CLOUDY	CALM	MOSTLY CLOUDY, SHOWERS	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	8/12/2013	7:56 AM	N	BASE FLOW	MED	15.56	WADING	CLEAR	CALM	CLEAR, PARTLY CLOUDY	RUN		CLEAR	WADEABLE/MID-DEPTH
HB-5	UNNAMED TRIBUTARY TO HART BROOK-ADLUA04-VRMP	8/27/2013	8:37 AM	N	BASE FLOW	MED	18.33	WADING	CLEAR	CALM	CLEAR, LIGHT RAIN, PARTLY CLOUDY, SHOWERS	RUN		CLEAR	WADEABLE/MID-DEPTH