

## Section 5-3 Bagaduce River & Tributaries (Bagaduce Watershed Association)

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

### Overview

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The Bagaduce Watershed Association (BWA) was formed in 2002 because of interest and concern for the river. The association began sampling in 2003 and has been active since then. The volunteer group now includes over 100 members and 6 river monitors. Over the past ten years, the group has monitored several freshwater streams as well as sites in the Bagaduce River estuary. In addition to monitoring, the group has also done eelgrass transplants in cooperation with Maine Department of Transportation.

The Bagaduce River is located on the coast of Maine on the eastern shore of Penobscot Bay. The watershed includes seven major streams and ponds: Camp Stream, Winslow Stream, Mill Stream, Smelt Brook, Bagaduce Stream, Stony Brook, Mill Brook, Wight Pond, Snake Pond, Parker Pond, Walker Pond, Frost Pond, Black Pond, and Pierce Pond which have all been monitored at one time or another. These water bodies drain to the Bagaduce River – an estuary that flows into Penobscot Bay. The watershed includes parts of five towns: Brooksville, Blue Hill, Castine, Penobscot, and Sedgwick. The river has a total watershed area of 125 square miles. Land use in the watershed consists primarily of forest, wetlands, low intensity residential, roads, agriculture, shoreline development, and limited commercial development. Maine Maritime Academy (MMA) is located in Castine; it has an associated ship pier, the training ship *State of Maine*, and an undergraduate oceanography program. The headwaters of the Bagaduce, especially Walker Pond, support a unique dwarf alewife (a subspecies of *Alosa pseudoharengus*), and the estuary supports some of the best remaining eelgrass beds (*Zostera marina*) found in Hancock County.

The statutory water class of the freshwater tributaries to the Bagaduce River is Class B, and the Bagaduce River estuary is Class SA/SB.<sup>1</sup> All freshwater lakes and ponds are Class GPA – the only State classification for lakes.

The DEP “2012 Integrated Water Quality Monitoring and Assessment Report” lists segments of the river in 2 categories:

- “Category 2: “Rivers and Streams Attaining some Designated Uses-Insufficient Information for Other Uses”.”
  - Bagaduce River and its tributaries

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<sup>1</sup> See Water Classification webpage for further clarification of classification of these waters: [www.maine.gov/dep/water/monitoring/classification/index.html](http://www.maine.gov/dep/water/monitoring/classification/index.html)

- “Category 2: Estuarine and Marine Waters Attaining some Designated Uses-Insufficient Information for Other Uses”.
  - Penobscot and Bagaduce Rivers in Castine-Penobscot. It is listed here for the Department of Marine Resources’ closure of 2.55 square miles to shellfishing due to overboard discharges (on-site sewage treatment systems).

Past monitoring by BWA has indicated that some of the freshwater streams (Camp Stream, Mill Brook, Mill Stream, and Smelt Brook) experience warmer summer water temperature and low dissolved oxygen levels that may be of concern. Because of the rural nature of the watersheds, the problems are apparently due to natural causes (e.g. summer low flow and beaver activity). Macroinvertebrate community rapid assessments were also done on Mill Stream, Mill Brook, Winslow Stream, Stoney Brook, and Camp Stream. There was a good diversity of macroinvertebrates with many mayflies, stoneflies, and caddisflies, indicating good water quality.

The overall purpose of monitoring is to assess water quality data to determine whether the river and tributaries are meeting water quality classification standards. The Bagaduce River Watershed Sampling and Analysis Plan states that the overall objectives of monitoring are to: (1) assess overall health of the Bagaduce tributaries and river; and (2) assess habitat value for native coldwater fish species. After many years of assessing freshwater streams, the BWA retired the freshwater stations (measured only once in 2013) for the 2013 field season and concentrated on the estuary sites.

## Methods

During the 2013 field season, the volunteers monitored the Bagaduce River at four estuary sites (Bridges Point, Norden Dock, Lords Cove, and Youngs Island) and took only a single sample from two freshwater streams (Mill Brook and Winslow Stream) (Table 5-3-1 and Figure 5-3-1). All of the freshwater sites are VRMP approved sites and all of the estuary sites are VRMP non-approved sites.

**Table 5-3-1:** Bagaduce Watershed Association sampling sites.

VRMP Site ID	Organization Site Code	Sample Location	Class
Mill Brook-NBGMB07-VRMP	Site #3	Mill Brook	B
Winslow Stream-NBGWS32-VRMP	Site #2	Winslow Stream	B
Bagaduce River-NBGNB20-BWA	Bridges Point	Bridges Point	SA/SB
Bagaduce River-NBG-82-BWA	Norden Dock	Norden Dock	SA/SB
Bagaduce River-NBG-89-BWA	Youngs Island	Youngs Island	SA/SB
Bagaduce River-NBG-122-BWA	Lords Cove	Lords Cove	SA/SB

The two freshwater sites were monitored a single time in June before a decision was made to concentrate on the estuarine sites. The marine sites were monitored generally 1-2 times/month from June-September

(except that sampling at Youngs Island extended into October). Volunteers were encouraged to sample storm events any time there was more than one inch of rain measured at neighboring weather stations. Water temperature, dissolved oxygen (DO), specific conductance (or salinity for estuarine sites), and turbidity were monitored. Water temperature was measured with a handheld thermometer or YSI 550A meter (one marine site). Dissolved oxygen was measured with LaMotte all-liquid Titration kits (Model 5860). Specific conductance was measured at Mill Brook, and Winslow Stream with Oakton ECTestr 11+/11 conductivity pens. Salinity was measured with a refractometer. As a pilot project to look at factors that might be influencing the abundance of softshell clams, water pH and the mud pH just below the surface was measured with an Oakton pH Spear meter. Turbidity was measured using 120 cm transparency tubes. Transparency tubes are plexiglass tubes with a Secchi disk target at the bottom. Visibility is a measure of transparency (it is the distance at which the Secchi target becomes invisible at the bottom of the turbidity tube, and it ranges from 0-120 cm), and is just the opposite of turbidity. In other words, a transparency tube reading of 120 cm is clear water, while 120 NTU from a turbidity meter is cloudy and opaque.

## 2013 Bagaduce River Sampling Sites Bagaduce Watershed Association

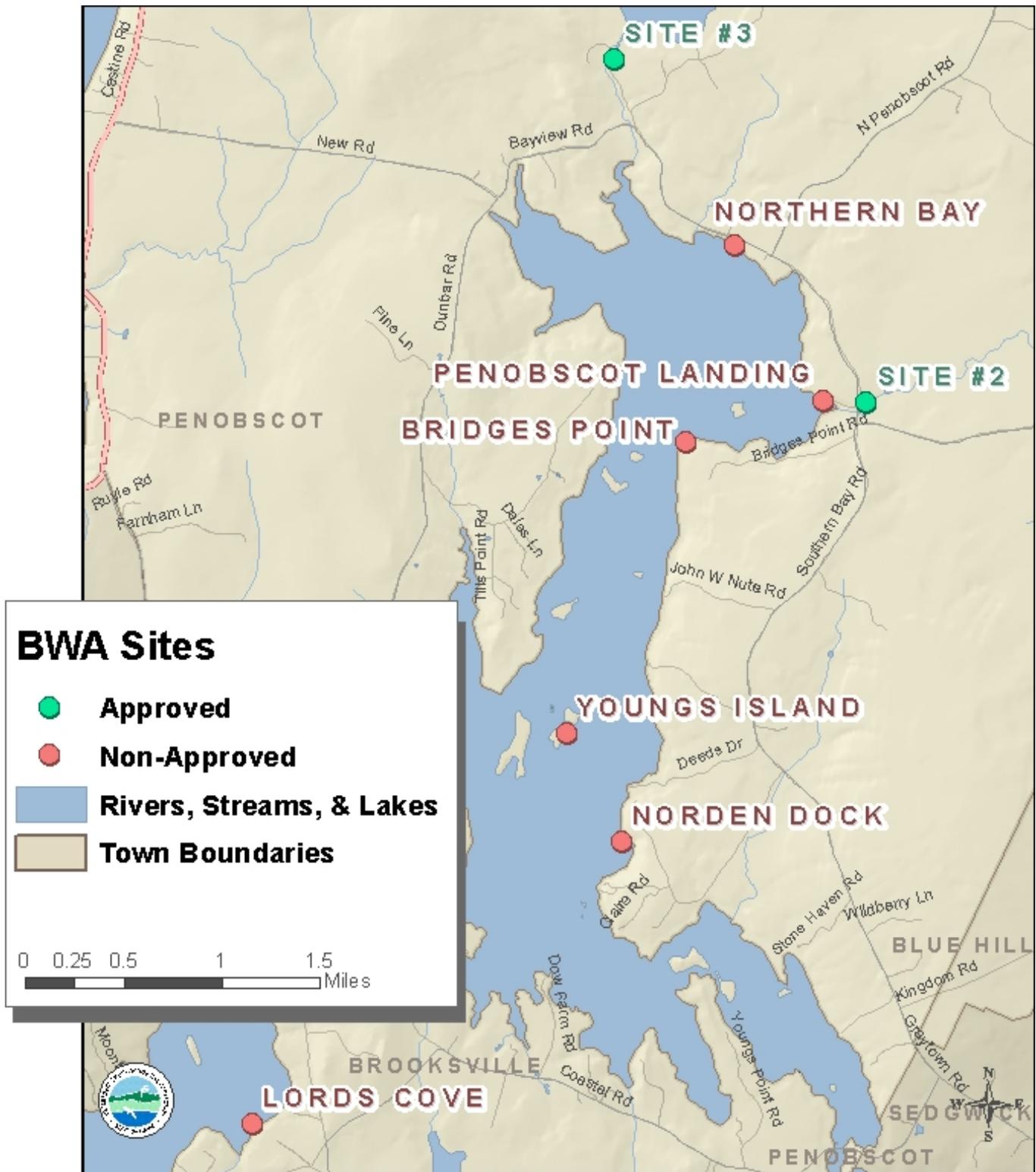


Figure 5-3-1: Map of Bagaduce Watershed Association sampling sites on the Bagaduce River and tributaries.

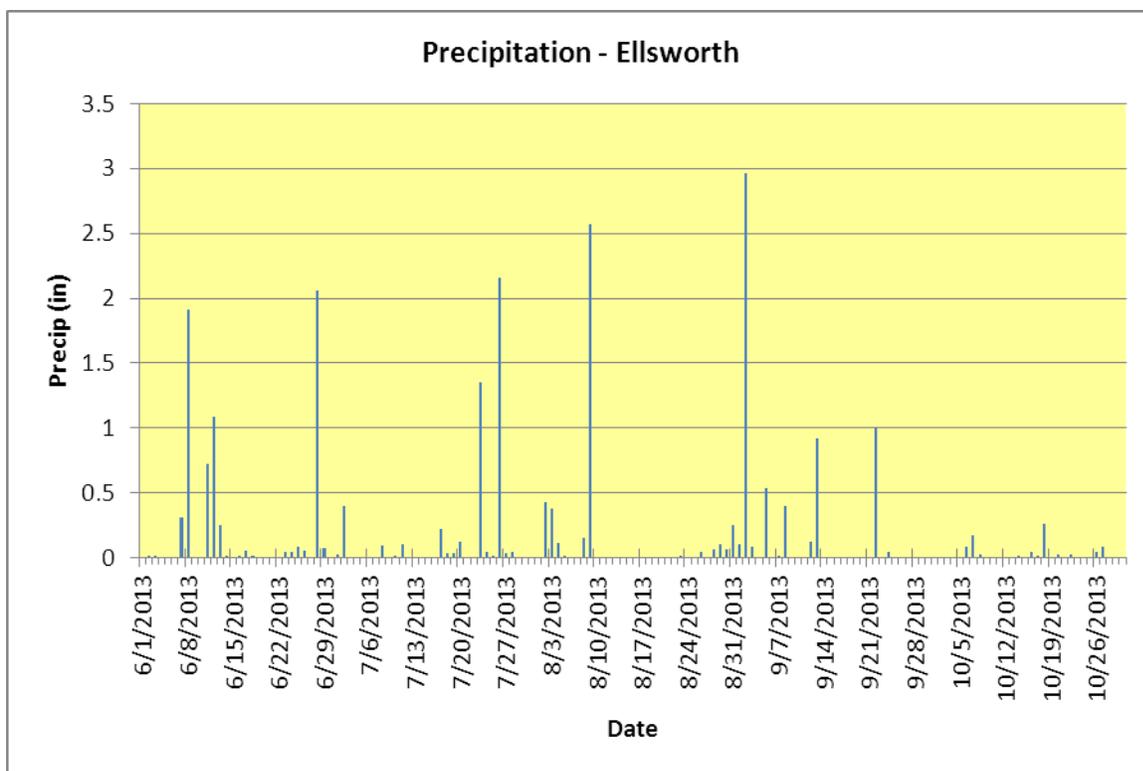
After an initial sampling in June, the freshwater sites (in green) were discontinued in favor of concentrating the monitoring effort on the estuary. Three tidal falls act to mix the Bagaduce estuary. These are located at The Narrows (just east of the Castine – Penobscot town line), at Johnson Point, and at the Bagaduce Falls (at the Route 176 bridge into Brooksville).

## Results

Refer to Appendices A-1 and A-2 for raw data and field observations, and on discussion of individual site data and trends.

### Precipitation

Figure 5-3-2 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 choice (Ellsworth Treatment Plant-KMEELLSW6) was based on proximity and station with most complete records. If there was an airport station close by, this was chosen. This information provides an overview of rainfall events and can be useful in interpreting monitoring results for some parameters. Summer and early fall 2013 was wet with significant rain events throughout the season.

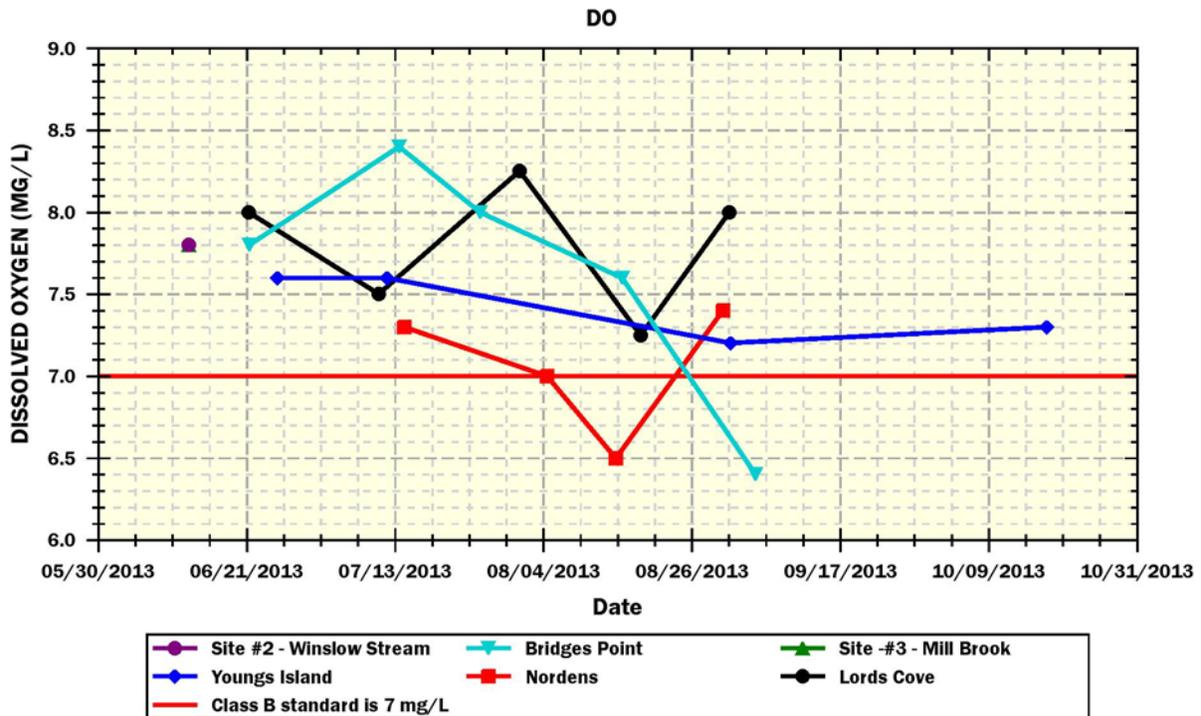


**Figure 5-3-2:** Seasonal Precipitation Measured at the Ellsworth – Bar Harbor Airport.

**Dissolved Oxygen**

Dissolved oxygen was measured once at each freshwater tributary, and 3-5 times at each of the four estuary sites (Figure 5-3-3 and Figure 5-3-4; Table 5-3-2 and Table 5-3-3). The LaMotte Kits do not give an oxygen saturation value. Dissolved oxygen saturation was calculated for sample dates when both dissolved oxygen in mg/l and water temperature were available. Monitoring occurred from June to October. For freshwater, Class B criteria for DO are a minimum of 7.0 mg/l (milligrams/liter) or 75% saturation. To meet water quality criteria, both concentration and saturation standards must be met. For the Bagaduce River estuary, Class SA standards are “as naturally occurs” and Class SB standards are 85% saturation.

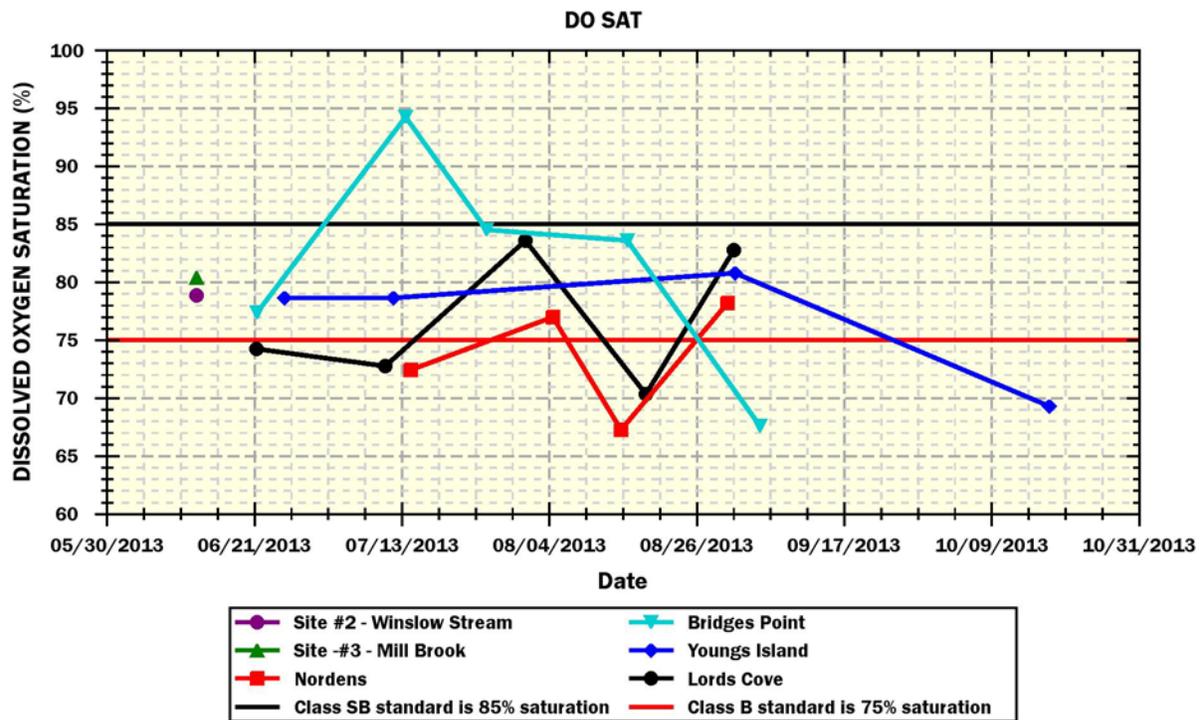
**Figure 5-3-3:** Dissolved oxygen in mg/L at all sites. The freshwater sites Mill Brook and Winslow Stream were measured only once and were both 7.5 mg/L and are superimposed on each other on the graph.



**Table 5-3-2:** A summary of minimum, maximum, and average DO concentration values (mg/l) at Bagaduce Watershed Association monitoring sites on the Bagaduce River & two tributaries.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
Site #2	Y	1	7.8	7.8	7.8
SITE #3	Y	1	7.8	7.8	7.8
BRIDGES POINT	N	5	6.4	8.4	7.6
NORDEN DOCK	N	4	6.5	7.4	7.1
YOUNGS ISLAND	N	4	7.2	7.6	7.4
LORDS COVE	N	5	7.3	8.3	7.8

**Figure 5-3-4:** Dissolved oxygen saturation in percent. The two freshwater sites are slightly different since the water temperature affects the saturation level.



**Table 5-3-3:** A summary of minimum, maximum, and average DO saturation values (%) at Bagaduce Watershed Association monitoring sites on the Bagaduce River & two tributaries.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
SITE #2	Y	1	78.9	78.9	78.9
SITE #3	Y	1	80.4	80.4	80.4
BRIDGES POINT	N	5	67.6	94.2	81.5
NORDEN DOCK	N	4	67.3	78.2	73.7
YOUNGS ISLAND	N	4	69.3	80.8	76.8
LORDS COVE	N	5	70.4	83.6	76.7

Dissolved oxygen concentrations measured at the freshwater sites was 7.5 mg/l on June 12, 2013, well above the Class B standard of 7.0 mg/l. Percent saturation was also above the Class B standard of 75%. In previous years, in spite of good overall water quality, some low dissolved oxygen levels were observed in the heat of the summer. These are likely influenced by natural conditions (e.g. pond outlet flow, wetlands). Ponds, wetland and beaver dams are often very good solar heat collectors. In deeper water, the warm water is on top and often cold water can be found below. The cold deep water or cold springs are summer refuges for fish and other organisms that like cold water.

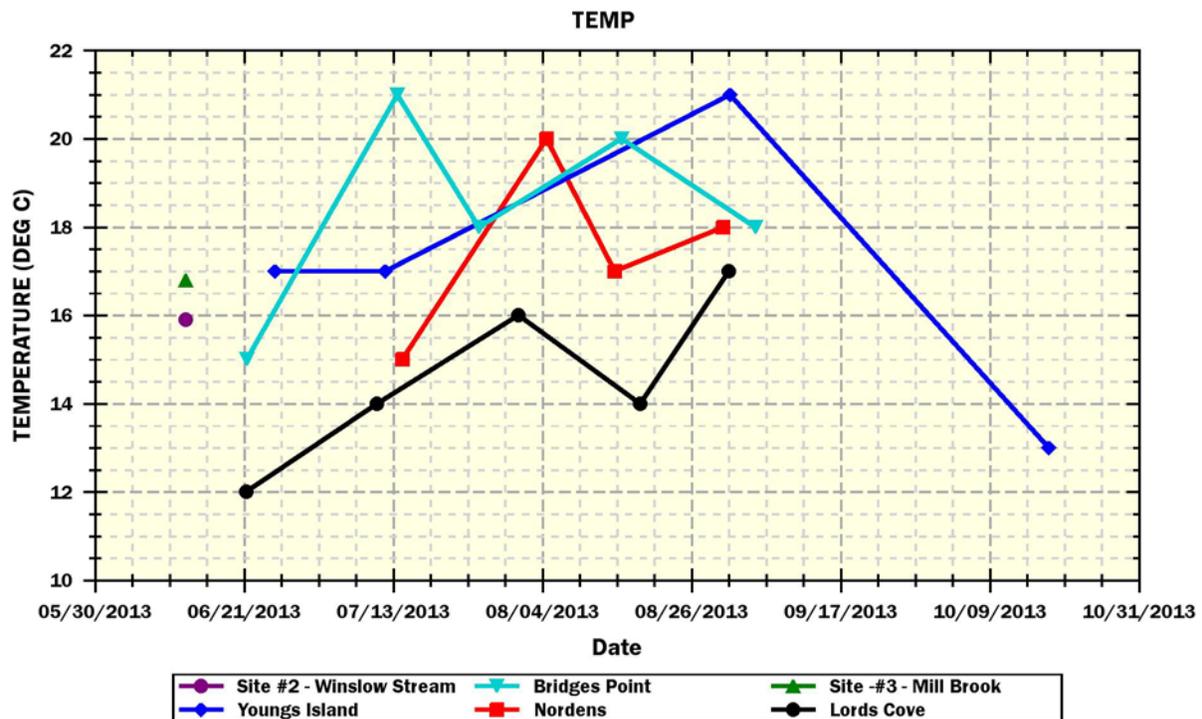
Dissolved oxygen concentrations measured in the Bagaduce estuary sites ranged from 6.4 mg/l to 8.4 mg/l and percent saturation ranged from 67.3% to 94.2%. Every estuary site had at least one value below the Class SB standard of 85% saturation, usually in August or September (but in one case in mid-October). Like last year, Lords Cove had the poorest oxygen levels (with three of five samples below the saturation threshold in 2013) in spite of being the coldest and the most marine site (see temperature graph and salinity summary, and Appendix A-1). While the air temperature peaked in July, the summer water temperatures appeared to peak in August at most sites (see next section). August was also the month with the most oxygen values below thresholds.

It is surprising that the estuary sites had low values for all sites. The estuary has a strong marine influence with three tidal falls (The Narrows, at Johnson Point, and at the Bagaduce Falls). Freshwater inputs are small and diffuse (so there should be little stratification based on salinity). On the other hand, there are large tidal flats, some coastal development, and some aquaculture. Thermal stratification could develop due to heating in the tidal flats (and might persist until it went through one of the tidal falls). Our sampling approach may also not be the best for the circumstances. All of the sampling in 2013 in the estuary was done using LaMotte titration kits. Samples are collected by reaching down into the water from a boat or from the shore or from a dock. One concern was whether the monitors were able to obtain a representative sample by only sampling the surface. DEP staff thinks that the estuarine monitoring program would be improved by using electronic meters with probes that can be lowered on a cable. This provides a DO and temperature profile from top to bottom.

### 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. A “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 5-3-5:** Graph of water temperature



**Table 5-3-4:** A summary of minimum, maximum, and average temperature values (°C) at Bagaduce Watershed Association monitoring sites on the Bagaduce River & tributaries.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
SITE #2	Y	1	15.9	15.9	15.9
SITE #3	Y	1	16.8	16.8	16.8
BRIDGES POINT	N	5	15.0	21.0	18.4
NORDEN DOCK	N	4	15.0	20.0	17.5
YOUNGS ISLAND	N	4	13.0	21.0	17.0
LORDS COVE	N	5	12.0	17.0	14.6

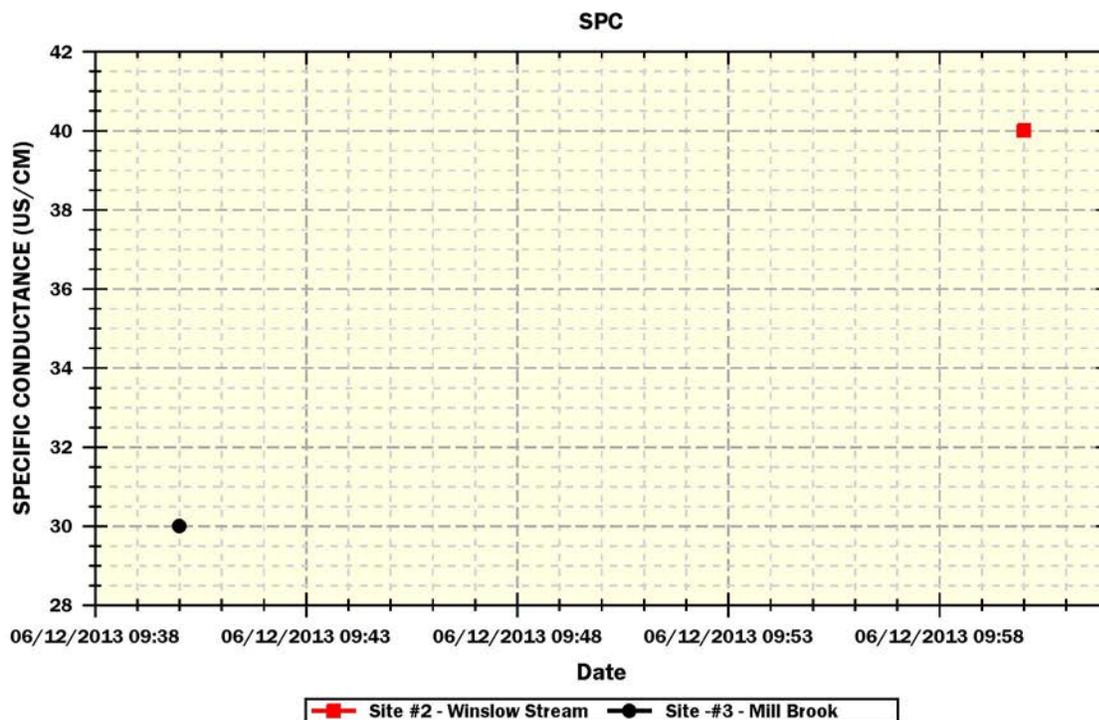
Temperature measured at the freshwater sites ranged from 15.9°C to 16.8°C (60.8-62.4°F). Mill Brook and Winslow Stream both originate in small ponds. As mentioned above in the discussion of oxygen, streams with headwater lakes or ponds can be strongly influenced by solar heating. This is a natural process and does not reflect the influence of human activities. None of the observed values exceeded any thresholds for cold water fishes.

Temperature measured at the estuary sites ranged from 12.0°C to 21.0 (53.6-70.7°F). The highest temperatures were recorded at Bridges Point and Youngs Island (21.0°C). The vast mudflats of Northern Bay influence summer water quality (high temperatures) at Bridges Point. At Lords Cove, the water temperature was generally the coldest, reflecting the marine influence in the lower estuary.

### Specific Conductance and Salinity

Specific conductance was measured only once at the freshwater sampling sites (Table 5-3-5). Monitoring occurred in June. 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.

**Figure 5-3-6:** Specific conductance was measured only from the freshwater sites and only in June.



**Table 5-3-5:** A summary of minimum, maximum, and average specific conductance ( $\mu\text{S}/\text{cm}$ ) at Bagaduce Watershed Association monitoring sites on the Bagaduce River tributaries.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
SITE #2	Y	1	40	40	40
SITE #3	Y	1	30	30	30

**Table 5-3-6:** A summary of minimum, maximum, and average salinity values (ppt) at Bagaduce Watershed Association monitoring sites on the Bagaduce River.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
BRIDGES POINT	N	5	12	30	25
NORDEN DOCK	N	4	27	29	28
YOUNGS ISLAND	N	4	27	28	27
LORDS COVE	N	5	30	32	31

Salinity was measured at the estuary sites (Table 5-3-6). Normal seawater salinity is 32 ppt (parts per thousand). The range was 12-32 ppt, reflecting the strong marine influence and the seasonally strong freshwater dilution.

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*pH*

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Freshwater pH was not measured in 2013. As a pilot project, some pH measurements were taken in the estuary. The measurement of pH is a measure of the acid – base balance of the water. A pH below 7.0 is acidic while a value greater than 7.0 is basic (or alkaline). The ocean is typically alkaline with a pH around 8.2.

**Table 5-3-7:** A summary of minimum, maximum, and average pH values at Bagaduce Watershed Association at monitoring sites in Northern Bay on the Bagaduce River.

Site	Approved Site	# of Sampling Events	Minimum Value	Maximum Value	Average Value
BRIDGES POINT, WATER	N	2	8.01	8.10	8.05
BRIDGES POINT, MUD	N	2	7.14	7.18	7.16
PENOBSCOT LANDING, WATER	N	2	7.20	7.50	7.35
PENOBSCOT LANDING, MUD	N	2	7.20	7.40	7.30
NORTHERN BAY, WATER	N	2	7.30	7.50	7.40
NORTHERN BAY, MUD	N	2	7.00	7.10	7.05

Measurements of surface water pH in Northern Bay ranged from 7.2 to 8.1 and measurements in the mudflat (just a few mm below the surface) were somewhat lower, ranging 7.0 to 7.4. Normal seawater pH should be about 8.2. Bridges Point is closest to Penobscot Bay (for these sample sites) and has the most marine influence and highest water pH. Other sites are located farther into Northern Bay and have lower water pH. Most of the reduction in water pH in the estuary is due to dilution with freshwater. However, ocean acidification is also a concern in Maine. In fact, the Gulf of Maine is more vulnerable to ocean acidification than any other part of the US coastline. This is due to the northern latitude (getting some freshwater input from melt water from Greenland and sea ice melting), and increased ability to hold dissolved carbon dioxide due to cold water, and the shallow enclosed nature of the Gulf of Maine (again concentrating the freshwater influence from surrounding land masses). The lower pH values in the mudflats are from carbon dioxide from bacteria and protozoans in the sediment. Carbon dioxide mixes with water to form carbonic acid which drives pH down. The survival threshold for juvenile softshell clams (*Mya arenaria*) is approximately pH 7.5. Much of Northern Bay is apparently generally below that in the summer. Local fishermen are concerned that the once-productive clam flats in Northern Bay have been lost to a combination of climate change and invasive green crabs. Clams are Maine's second most important fishery (after lobster).

### ***Turbidity / Transparency***

Transparency is a measure of the clarity of the water and is related to turbidity—the amount of suspended materials in the water; including soil particles, algae, plankton and decaying vegetation. During precipitation events that are great enough to cause runoff, land use activities (e.g. construction, agriculture, logging) may contribute to increased turbidity. In order to evaluate the effects of turbidity on aquatic life, you need both intensity data (a transparency or turbidity measure) and some knowledge of the duration (in hours, days, and weeks).

**Table 5-3-8:** A summary of minimum, maximum, and average transparency values (cm) at Bagaduce Watershed Association monitoring sites on the Bagaduce River.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average Value
SITE #2	Y	0			
SITE #3	Y	0			
BRIDGES POINT	N	5	40	65	54
NORDEN DOCK	N	4	98	116	105
YOUNGS ISLAND	N	2	75	105	90
LORDS COVE	N	3	120	120	120

\*Values >120 cm not included in mean calculation

At the estuarine sites, 2 out of 4 of the sites had low transparency values. The worse site was Bridges Point which was sampled 5 times and had values ranging from 40-65 cm. This site is at a mud flat area. Some long-time residents have mentioned that Northern Bay used to have abundant eelgrass and clear water. It is not known why the eelgrass disappeared. More recent reports of green crabs have also caused some alarm. These invasive crabs are predators on soft shell clams. The Youngs Island site also reported some turbidity and is located at the lower end of Northern Bay.

## Discussion and Recommendations

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There are numerous sources of pollution and other stresses to the Bagaduce River and tributary sites monitored by the Bagaduce Watershed Association 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., eroded soil, fertilizers, pesticides, sewage systems, heavy metals, petroleum residues, road salt, wildlife and pet feces) and polluted stormwater originating from impervious surfaces such as streets, parking lots, driveways, rooftops (even though development and roads are fairly sparse in the watershed), and from 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 has 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).
- Invasive green crabs.
- Ocean water that is increasingly warmer and less alkaline due to climate change. Air temperatures are also changing, and summer heat waves are likely to become more common.

The following are recommendations for future monitoring:

- Upper and lower estuary pH during high and low tide.
- Continued oxygen and turbidity monitoring at high and low tide and relative to large storms.

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)
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**Bagaduce River, Bagaduce Watershed Association - Approved Sites:**

SITE #3	MILL BROOK - NBGMB07 - VRMP	6/12/2013	9:40 AM	N			16.8	80.37	7.8	30		>120				
SITE #2	WINSLOW STREAM - NBGWS32 - VRMP	6/12/2013	10:00 AM	N			15.9	78.86	7.8	40		>120				

**Bagaduce River, Bagaduce Watershed Association - Non-Approved Sites:**

LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	6/21/2013	8:30 AM	N			12	74.23	8	30		>120				
LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	7/10/2013	1:00 PM	N			14	72.77	7.5	31		120				
LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	7/31/2013	11:15 AM	N			16	83.58	8.25	31		120				
LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	8/18/2013	11:00 AM	N			14	70.35	7.25	31		>120				
LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	8/31/2013	12:30 PM	N			17	82.77	8	32		120				
NORDEN DOCK	BAGADUCE RIVER-NBG-82-BWA	7/14/2013	8:00 AM	N			15	72.39	7.3	28		116				
NORDEN DOCK	BAGADUCE RIVER-NBG-82-BWA	8/4/2013	1:55 PM	N			20	76.99	7	27		105				
NORDEN DOCK	BAGADUCE RIVER-NBG-82-BWA	8/14/2013	4:45 PM	N			17	67.25	6.5	28		101				
NORDEN DOCK	BAGADUCE RIVER-NBG-82-BWA	8/30/2013	3:30 PM	N			18	78.17	7.4	29		98				
YOUNGS ISLAND	BAGADUCE RIVER-NBG-89-BWA	6/25/2013	12:30 PM	N			17	78.64	7.6	27		105				
YOUNGS ISLAND	BAGADUCE RIVER-NBG-89-BWA	7/11/2013	7:30 PM	N			17	78.64	7.6	27		>120				
YOUNGS ISLAND	BAGADUCE RIVER-NBG-89-BWA	8/31/2013	5:00 PM	N			21	80.76	7.2	27		75				
YOUNGS ISLAND	BAGADUCE RIVER-NBG-89-BWA	10/17/2013	3:30 PM	N			13	69.28	7.3	28		>120				

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)
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	6/21/2013	9:15 AM	N			15	77.35	7.8		28	65				
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	7/13/2013	2:30 PM	N			21	94.22	8.4		30	51				
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	7/25/2013	2:35 PM	N			18	84.5	8		29	65				
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	8/15/2013	4:20 PM	N			20	83.59	7.6		27	40				
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	9/4/2013	10:20 AM	N			18	67.6	6.4		12	50				

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>Bagaduce River, Bagaduce Watershed Association - Approved Sites:</b>															
SITE #3	MILL BROOK - NBGM07 - VRMP	6/12/2013	9:40 AM	N	STORM FLOW	HIGH	13.89	WADING	HEAVY RAIN, LIGHT RAIN	CALM	CLOUDY, LIGHT RAIN, SHOWERS	RIFFLE		CLEAR	1" PLUS RAIN IN LAST 48 HOURS. LOTS OF SILT RUNNING FROM NORTH BANK INTO STREAM. WADEABLE/MID-DEPTH
SITE #2	WINSLOW STREAM - NBGWS32 - VRMP	6/12/2013	10:00 AM	N	STORM FLOW	HIGH	13.89	WADING	LIGHT RAIN, SHOWERS		CLOUDY, HEAVY RAIN, SHOWERS	RIFFLE		CLEAR	1" PLUS RAIN IN LAST 48 HOURS. SILT FROM NORTH BANK LEACHING INTO STREAM. NON-WADEABLE/MID-DEPTH

**Bagaduce River, Bagaduce Watershed Association - Non-Approved Sites:**

LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	6/21/2013	8:30 AM	N	BASE FLOW	HIGH	15		CLOUDY	CALM	CLEAR		HIGH EBB	OPAQUE	LOTS OF POLLEN ON SURFACE NON-WADEABLE/3 FT BELOW SURFACE SAMPLE LOCATION FROM DOCK
LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	7/10/2013	1:00 PM	N	BASE FLOW	HIGH	20		CLOUDY	CALM	CLOUDY		HIGH	OPAQUE	WATER WAS UNUSUALLY CLOUDY, BUT TURBIDITY WAS NORMAL. NON-WADEABLE/3 FT BELOW SURFACE SAMPLE LOCATION FROM DOCK
LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	7/31/2013	11:15 AM	N	BASE FLOW	LOW	23.33		CLEAR	BREEZE	CLEAR		LOW EBB	CLEAR	NON-WADEABLE/3 FT BELOW SURFACE SAMPLE LOCATION FROM DOCK
LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	8/18/2013	11:00 AM	N	BASE FLOW	LOW	23.33		PARTLY CLOUDY	BREEZE	PARTLY CLOUDY		LOW EBB	MILKY	NON-WADEABLE/3 FT BELOW SURFACE SAMPLE LOCATION FROM DOCK
LORDS COVE	BAGADUCE RIVER-NBG-122-BWA	8/31/2013	12:30 PM	N	BASE FLOW	MED	24.44		CLEAR	BREEZE	HEAVY RAIN		LOW EBB	OPAQUE	NON-WADEABLE/3 FT BELOW SURFACE SAMPLE LOCATION FROM DOCK
NORDEN DOCK	BAGADUCE RIVER-NBG-82-BWA	7/14/2013	8:00 AM	N			18		CLEAR	CALM	CLEAR		LOW EBB		WADEABLE/1.5 FT BELOW SURFACE SAMPLE LOCATION-NORDENS' DOCK
NORDEN DOCK	BAGADUCE RIVER-NBG-82-BWA	8/4/2013	1:55 PM	N			22		CLEAR	CALM	CLEAR		LOW EBB		WADEABLE/1.5 FT BELOW SURFACE SAMPLE LOCATION-NORDENS' DOCK
NORDEN DOCK	BAGADUCE RIVER-NBG-82-BWA	8/14/2013	4:45 PM	N			21		CLEAR	CALM	CLEAR		HIGH EBB		WADEABLE/1.5 FT BELOW SURFACE SAMPLE LOCATION-NORDENS' DOCK
NORDEN DOCK	BAGADUCE RIVER-NBG-82-BWA	8/30/2013	3:30 PM	N			20			BREEZE	PARTLY CLOUDY		LOW FLOOD		WADEABLE/1.5 FT BELOW SURFACE SAMPLE LOCATION-NORDENS' DOCK
YOUNGS ISLAND	BAGADUCE RIVER-NBG-89-BWA	6/25/2013	12:30 PM	N			34	BOAT	CLEAR	BREEZE	PARTLY CLOUDY		HIGH FLOOD		NON-WADEABLE/MID-DEPTH
YOUNGS ISLAND	BAGADUCE RIVER-NBG-89-BWA	7/11/2013	7:30 PM	N			24	BOAT	CLEAR	CALM	FOGGY, LIGHT RAIN		LOW		NON-WADEABLE/MID-DEPTH
YOUNGS ISLAND	BAGADUCE RIVER-NBG-89-BWA	8/31/2013	5:00 PM	N			30	BOAT	CLEAR		SHOWERS		LOW FLOOD	OPAQUE	NO VERTICAL DEPTH RECORDED.
YOUNGS ISLAND	BAGADUCE RIVER-NBG-89-BWA	10/17/2013	3:30 PM	N			17	BOAT	CLEAR	CALM	LIGHT RAIN		LOW EBB	CLEAR	NON-WADEABLE/MID-DEPTH
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	6/21/2013	9:15 AM	N	BASE FLOW	HIGH	16.11	WADING	PARTLY CLOUDY	CALM	CLEAR	RUN	HIGH FLOOD	TURBID	CANNOT SEEM TO DETERMINE CAUSE OF TURBIDITY-COLOR SEEMS TO BE LIGHT GRAYISH-SILT? WADEABLE/MID-DEPTH
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	7/13/2013	2:30 PM	N	BASE FLOW	HIGH	27.78	WADING	CLEAR	BREEZE	CLEAR	RUN	HIGH	MILKY	WATER CLARITY POOR WADEABLE/MID-DEPTH
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	7/25/2013	2:35 PM	N	BASE FLOW	HIGH	22.78	WADING	MOSTLY CLOUDY	BREEZE	CLEAR, CLOUDY, MOSTLY CLOUDY	RUN	HIGH EBB	MILKY	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
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	8/15/2013	4:20 PM	N	BASE FLOW	HIGH	23.33	WADING	CLEAR	BREEZE	CLEAR, CLOUDY, HEAVY RAIN, LIGHT RAIN	RUN	LOW FLOOD	MILKY	BREEZE WSW TOWARDS TEST SITE. WATER MILKIER THAN USUAL-LOWER CLARITY WADEABLE/MID-DEPTH
BRIDGES POINT	BAGADUCE RIVER-NBGNB20-BWA	9/4/2013	10:20 AM	N	BASE FLOW	HIGH	20	WADING	CLEAR	BREEZE	CLOUDY, HEAVY RAIN, SHOWERS	RUN	HIGH FLOOD	OPAQUE	NOTE SALINITY-LOWEST I HAVE SEEN IT ON THIS PART OF BAGADUCE. 2" RAIN LAST 48 HOURS; 1.5 " RAIN LAST 24 HOURS WADEABLE/MID-DEPTH