

## Section 5-6

# Penjajawoc Stream (Penjajawoc Stream Team)

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

### Overview

---

In the fall of 2007, the City of Bangor and the Maine DEP VRMP Program organized a Volunteer Monitoring Team to monitor water quality in Penjajawoc Stream. Penjajawoc Stream is a small urban stream located partially in Bangor and partially in Veazie, Maine. The Penjajawoc has a watershed area of 8.57 square miles, with headwaters in a vast marsh system north of Bangor. The stream then flows through the Bangor Mall before passing under highway I-95, then past Eastern Maine Community College (a vocational college), the Dorothea Dix Mental Health Center complex, and past a number of auto dealerships before it passes through a residential area and drains into the Penobscot River. Two principal tributaries, Meadow Brook and Cemetery Brook, join the stream in the lower watershed. Penjajawoc Stream is 5.2 miles long, while the tributaries – Meadow and Cemetery Brooks – are 1.5 and 2.2 miles respectively. Penjajawoc Stream and Meadow Brook are listed as impaired due to urban non-point source pollution, hydraulic alterations due to development, and habitat degradation. Specific problems include seasonally low dissolved oxygen, seasonally warm water, and impaired aquatic macroinvertebrate communities. Bacterial contamination has been documented, but is probably from wildlife origins. The statutory water class of the Penjajawoc and Meadow Brook are Class B. As recently as 2009, a DEP biomonitoring assessment and a more inclusive assessment in 2008 showed that all biomonitoring sites failed to attain Class B standards.

The Volunteer Monitoring Team was established to assess water quality and to monitor progress as the City of Bangor makes stormwater retrofits in order to improve water quality. Eventually, the goal is for these streams to meet their water quality classification standards. The Penjajawoc Sampling and Analysis Plan states that the objectives of monitoring are to: (1) develop baseline data; (2) provide information on current watershed conditions; and (3) monitor progress during the restoration process.

### Methods

---

Since the first monitoring in the fall of 2007, the Penjajawoc Volunteer Monitoring Team have monitored up to seven historical stations on the main stem and one station each on the lower reaches of Meadow and Cemetery Brooks (Table 5-6-1 and Figure 5-6-1). In 2011, four main stem sites and two tributary sites were monitored, and the monitoring group became known as the Penjajawoc Stream Team. The same six sites were sampled in 2012. In the spring and fall, stream sampling was timed to coincide with stormwater episodes. Specific conductance (or total dissolved solids, TDS) and water temperature were measured in the field. Water samples for turbidity were collected and analyzed at the Bangor DEP office. In the summer, volunteers took baseflow measurements of water temperature, specific conductance, and dissolved oxygen (DO). Summer samples were taken mainly in the morning before 8:00 AM (the lowest DO in a 24 hour cycle occurs before sunrise, while the highest values occur in mid to late afternoon). Sampling began in February and April after strong storm events, and then sampling switched to twice a

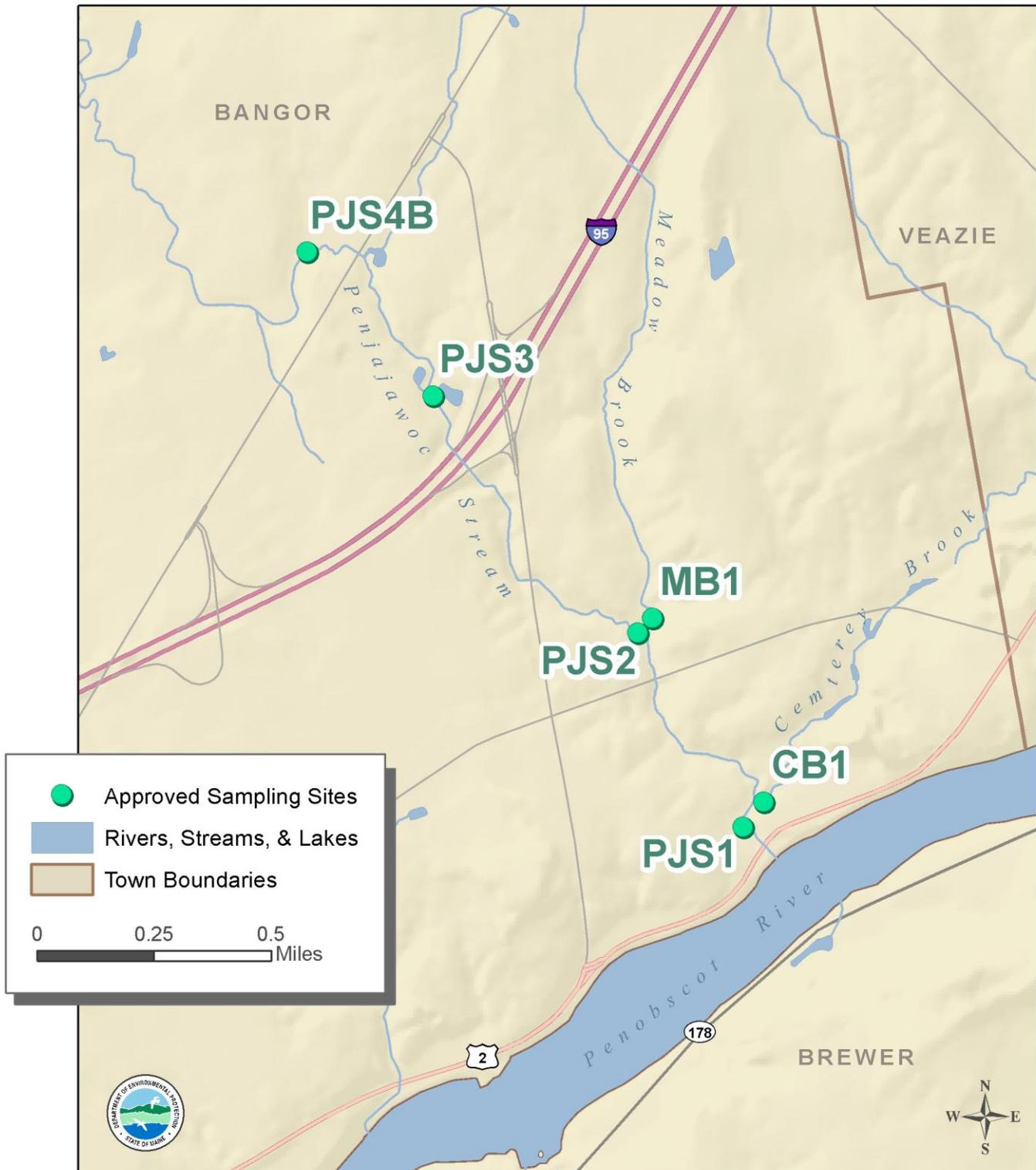
month at two week intervals in June, July, and August. There was a single end-of-season sample date in mid-September. All of the Penjajawoc Stream Team sites are VRMP approved sites.

**Table 5-6-1:** Penjajawoc Stream Team monitoring sites.

VRMP Site ID	Organization Site Code	Sample Location	Class
Cemetery Brook-PPJCB02-VRMP	CB1	Cemetery Brook	B
Penjajawoc Stream-PPJ01-VRMP	PJS1	Young Street	B
Penjajawoc Stream-PPJ08-VRMP	PJS2	Evergreen Woods	B
Penjajawoc Stream-PPJ16-VRMP	PJS3	Staples	B
Penjajawoc Stream-PPJ21-VRMP	PJS4B	Penn Plaza	B
Meadow Brook (Bangor)-PPJME01	MB1	Meadow Brook	B

Monitoring was conducted from February 17 through September 13. Spring samples were timed to catch stormwater events. Summer samples were essentially twice a month from June to August and a single mid-month sample in September. At each site, the monitors made direct measurements of water temperature and dissolved oxygen using a LaMotte all-liquid Winkler titration kit. Conductivity was directly measured at the freshwater sites using an Oakton EC 11+ Testr conductivity pen (or some volunteers had Oakton TDS Testr 11 pens, TDS was converted to specific conductance for reporting). Grab samples were collected for turbidity analysis at the Bangor DEP office. DEP used a Hach 2100 P meter for assessing turbidity.

## 2012 Penjajawoc Stream Sampling Sites Penjajawoc Stream Team



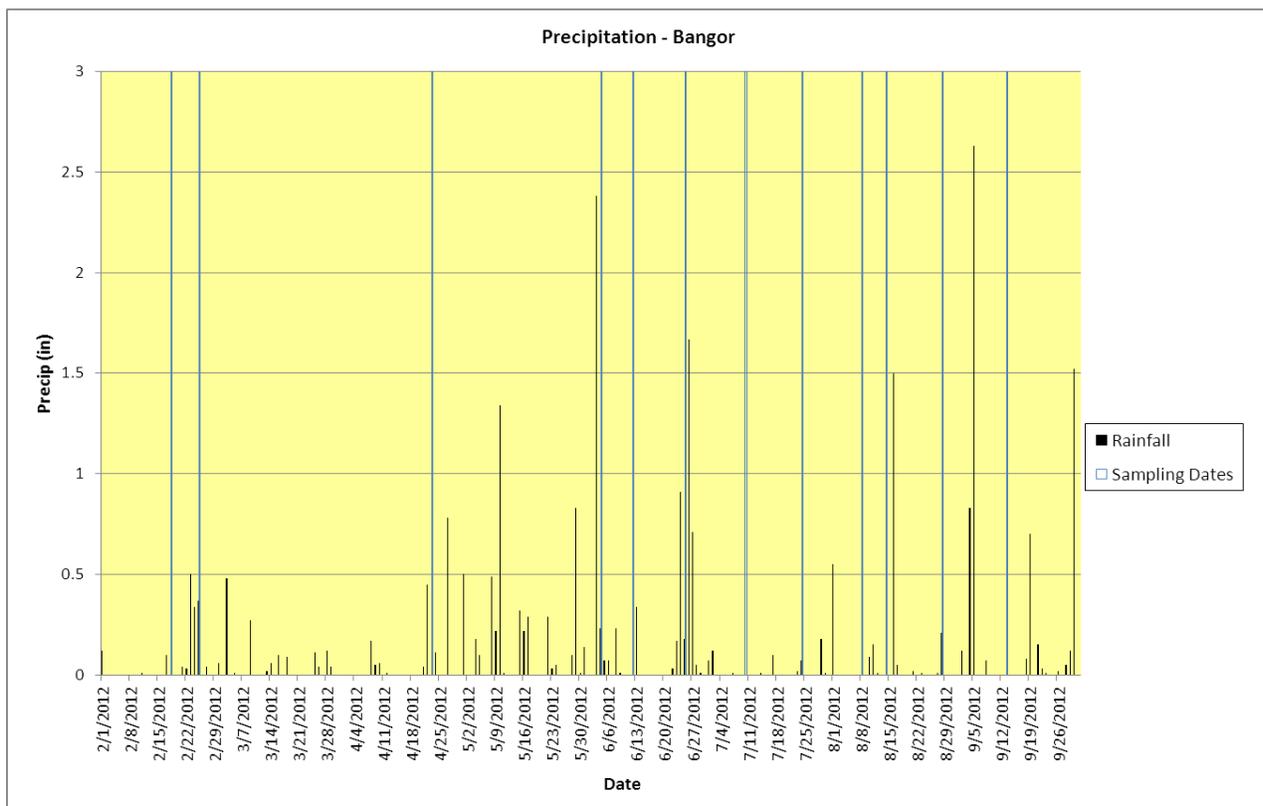
**Figure 5-6-1:** Map of Penjajawoc Stream Team sampling sites on the Penjajawoc Stream.

## Results

Refer to Appendices A-1 and A-2 in discussion of individual site data and trends, as well as graphed data (5-6-3 through 5-6-6), at the end of this section of the report.

### Precipitation

The 2012 field season was a year full of climatic anomalies, mainly extremely high temperatures and extreme rain. For instance, Bangor experienced large rain storms on April 23 (2.32 inches at the Bangor International Airport) and on June 4 (2.38 inches at BIA) (Figure 5-6-2). This was considerably less than the huge storms experienced in southern Maine (see section for Presumpscot, rain was recorded at the Portland Jetport, a total of 6.97 inches for June 2-4). Hurricane Sandy landed on the Maine coast on November 6, with high winds and strong rain. However no sampling occurred on the Penjajawoc that late in the season. Overall it was a good water year, but with dry spells in March, April and July.



**Figure 5-6-2:** Precipitation measured at Bangor, Maine

Figure 5-6-2 provides a graph of rainfall and sampling dates for the monitoring period. Blue bars indicate sample dates while black bars indicate rain events and amount in inches. Rainfall data was obtained from Weather Underground (<http://www.wunderground.com>). Weather station choice 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.

### *Dissolved Oxygen*

Dissolved oxygen (DO) was measured once in mid- to late-May and then twice a month from June 15 through August 23 (Table 5-6-2 and Table 5-6-3). Class B standards for dissolved oxygen are a minimum of 7 mg/l (milligrams/liter) or 75% saturation, whichever is higher.

**Table 5-6-2:** A summary of minimum, maximum, and average dissolved oxygen concentration values (mg/l) at Penjajawoc Stream Team sites on the Penjajawoc Stream.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average
PJS1	Y	1	8.0	8.0	8.0
PJS2	Y	6	6.3	8.0	7.1
PJS3	Y	7	5.9	6.8	6.3
PJS4b	Y	7	4.0	7.0	5.3
MB1	Y	6	3.1	9.4	5.6
CB1	Y	1	7.6	7.6	7.6

**Table 5-6-3:** A summary of minimum, maximum, and average dissolved oxygen saturation values (%) at Penjajawoc Stream Team sites on the Penjajawoc Stream.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average
PJS1	Y	1	83.6	83.6	83.6
PJS2	Y	6	68.6	84.4	76.8
PJS3	Y	7	63.6	76.3	69.2
PJS4b	Y	7	43.1	69.4	54.7
MB1	Y	6	31.4	93.2	54.7
CB1	Y	1	77.8	77.8	77.8

Dissolved oxygen concentrations measured at main stem and tributary sites ranged from 3.1 mg/l on Meadow Brook (MB1) on August 28<sup>th</sup> to 9.4 mg/l also at MB1 on June 25<sup>th</sup>. Like last year, all DO samples from the lower watershed (PJS1 and CB1) met the state Class B standard (although there was only one sample from each site this year). All the other sites had some DO concentrations that were below the Class B standard of 7.0 mg/l. Dissolved oxygen percent saturation ranged from 31.4% to 93.2%. Again, PJS1 and MB1 met the Class B standard of 75% saturation for both samples, while other sites all had some values below that threshold. All of the measurements below 75% saturation occurred on summer days when water temperature was equal to or exceeded 18°C (64.4°F), except for MB1 which

had some low values down to 15°C (59°F). A DO concentration of 4.0 mg/l of oxygen is mentioned in fisheries literature as a threshold for survival for many fish and invertebrates. In 2012 there were many values in the 4's and 5's at the upper watershed site, PJS4b in June and July, and in the 3's and 4.0 at MB1 in August. Dissolved oxygen is strongly influenced by temperature and flow conditions. Warm water has less capacity to carry dissolved gasses (i.e., gasses are less soluble). Also, during high flow conditions, oxygen is renewed in streams by turbulent mixing of water and air. If summer flows are rainy and cooler than normal, then this will affect the dissolved oxygen. The summer of 2012 was dry in July with some moderation in August, and was especially wet in September.

Penn Plaza (PJS4b) had poor DO throughout the summer (Figure 5-6-2), with all measurements below either the concentration or percent saturation standards. This may be due to the proximity of this site to Penjajawoc Marsh, which is only 0.25 miles away. Most of the stream habitat from the Marsh to PJS4b is rocky riffles and is expected to be a good aerator for the stream water. However, the aeration may not be very efficient at low flows and during high summer temperatures. The decomposition of peat in the marsh can reduce oxygen levels in the stream to very low levels.

The Penjajawoc below Staples at the Bangor Mall (PJS3) had low DO all summer. No measurements were above the concentration threshold. In the fall of 2012, a box culvert above the Sylvan Road was removed from a discontinued road. This culvert formed a low-head dam that backed water up into the Staples area and may have contributed to poor oxygen concentrations. Improvements in flow at this site should result in improved oxygen during the summer of 2013.

Meadow Brook (MB1) also often has low DO values even though it has the coldest water. This may indicate an organic load in this sub-watershed. The nature of the organic load (if any) in Meadow Brook is not apparent. A septic sewer line runs parallel to the stream in the Hogan Road and Evergreen Woods area. However, *E. coli* testing results are no different here than in other parts of the watershed. High bacteria concentrations are intermittent and not extreme, and are likely due to wildlife sources.

Cemetery Brook (CB1) and the Penjajawoc at Evergreen Woods (PJS2) have the best DO concentrations. CB1 has more green space in the watershed, including the partially wooded Mount Hope Cemetery and undeveloped forested areas. The lower Penjajawoc is also less intensively developed, transitioning from urban to partially wooded suburban residential in the lower watershed. The lower stream is also dominated by rocky riffle habitat and steeper gradients which promote turbulent mixing.

---

### **Water Temperature**

---

Temperature was measured at least 6 times for all sampling sites (Table 5-6-4). Monitoring for temperature occurred from February through August (note: graphed water temperature data does not include early season data). 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, excess heat, and toxic chemicals.

**Table 5-6-4:** A summary of minimum, maximum, and average temperature values (°C) at Penjajawoc Stream Team sites on the Penjajawoc Stream.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average
PJS1	Y	1	17.5	17.5	17.5
PJS2	Y	9	22	1	16.4
PJS3	Y	10	21	0.5	14.8
PJS4b	Y	10	20	0.5	13.2
MB1	Y	9	17	1	12.9
CB1	Y	0			

Temperatures measured during the summer at four Penjajawoc Stream sites ranged from 15.5°C to 22°C. Meadow Brook site MB1 was consistently colder than other sites. The lower main stem site PJS2 was the warmest with temperatures as high as 22°C. The warmest day of the year was on July 21st. The warmest temperatures of the year measured in the stream were down substantially from last year when the highest values were 27°C (a lethal 80.6°F for coldwater fishes). No temperature exceedances were observed, although temperature varied through the day and we cannot tell from single measurements what the real maximum or weekly averages were. The overall wet weather probably helped keep temperatures lower this year, in spite of high air temperatures.

Meadow Brook is consistently the coldest, and is obviously influenced by spring inputs. Cemetery Brook has the least developed watershed, but the Mount Hope Cemetery has some small ponds that are part of Cemetery Brook. Ponds act like solar collectors and can counter the benefits of forested headwaters.

### *Specific Conductance*

Specific conductance was measured at all six sites (Table 5-6-5). Monitoring occurred from February through August. Specific conductance is a measure of the amount of dissolved materials in the water (and it is inter-convertible with total dissolved solids, or TDS). While there are no numerical standards for specific conductance, in urban settings a relationship exists between conductivity and chloride which does have numerical criteria. In general, streams located in urban areas tend to have high specific conductance due to polluted urban stormwater runoff. This is due in part to salt contamination of surface water and groundwater from salt and sand applications during winter road maintenance. The highest specific conductance values (and by inference, chloride values) occur in the late winter and early spring (February & March).

Meadow Brook has the highest baseflow specific conductance (note the minimum values). Lab tests have confirmed that sodium chloride (road salt) is the dominant dissolved substance. If the highest conductivity values are converted to chloride, there would be chloride exceedances this year in Meadow

Brook and for all of the Penajawoc Stream sites (except PJS1 where we have only one summer time value). A specific conductance value of 854  $\mu\text{S}$  is equivalent to about 230 mg/L chloride whenever sodium chloride is the dominant salt in solution. For urban streams a concentration of 230 mg/L chloride exceeds the chronic contaminant threshold (4 days or more above the threshold). A specific conductance value of 3293  $\mu\text{S}$  would exceed the acute threshold (one hour or more) of 860 mg/L chloride, but no such values were recorded in 2012

Based on historic measurements in the Penajawoc Marsh (the upper watershed), the normal specific conductance for this watershed appears to be around 115  $\mu\text{S}/\text{cm}$ . This value could be used as a baseline for when there was no major development in the middle and lower watersheds. High minimum values show that groundwater has been contaminated with salt in the lower watershed. A DOT maintenance yard located at the corner of Mt Hope and the Hogan Road would have had uncovered salt sand piles up to the early 1980s.

**Table 5-6-5:** A summary of minimum, maximum, and average specific conductance values ( $\mu\text{S}/\text{cm}$ ) at Penajawoc Stream Team sites on the Penajawoc Stream.

Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average
PJS1	Y	1	448	448	448
PJS2	Y	10	268	1767	924
PJS3	Y	10	169	2250	1131
PJS4b	Y	10	47	1255	412
MB1	Y	10	328	1596	1132
CB1	Y	1	358	358	358

The average specific conductance values found in the Penajawoc and Meadow Brook have been creeping up slowly as development has continued in the watershed. Most of the new development has been in large retail outlets above Stillwater Avenue.

### *Turbidity*

Turbidity was primarily measured in the late winter and early spring (February and March) or in the fall (October to December) during high flows, or at any other time when cloudiness was observed in the water (Table 5-6-6). Maine has no statutory criteria for turbidity, but streams are supposed to support native wildlife, including native fishes. The impacts of turbidity are measured by a combination of intensity (measured in nephelometric turbidity units, NTU) and duration (hours, days or weeks). Negative impacts on aquatic organisms are expected when the intensity is greater than 10 NTU and the conditions last for weeks, or if the intensity is higher than about 100 NTU for many hours at a time. Both conditions are seen in Meadow Brook. Turbidity in the Penajawoc tends to be more short term and generally lower intensity.

**Table 5-6-6:** A summary of minimum, maximum, and average turbidity values (NTU) at Penjajawoc Stream Team sites on the Penjajawoc Stream.

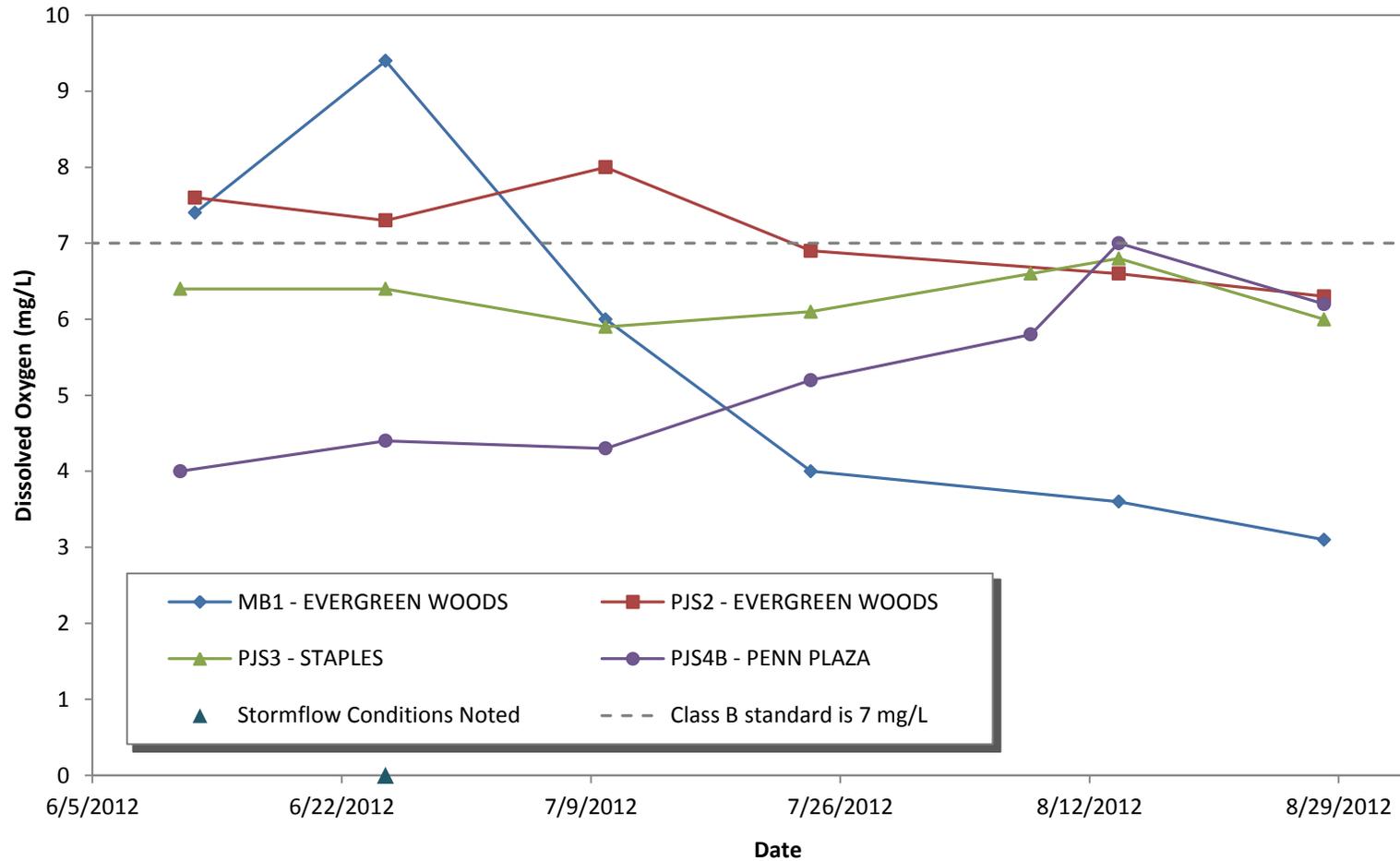
Site	Approved Site	# of Samples	Minimum Value	Maximum Value	Average
PJS1	Y	0			
PJS2	Y	4	16	43	33
PJS3	Y	3	9	44	22
PJS4b	Y	3	4	10	6
MB1	Y	4	42	295	144
CB1	Y	0			

## Discussion and Recommendations

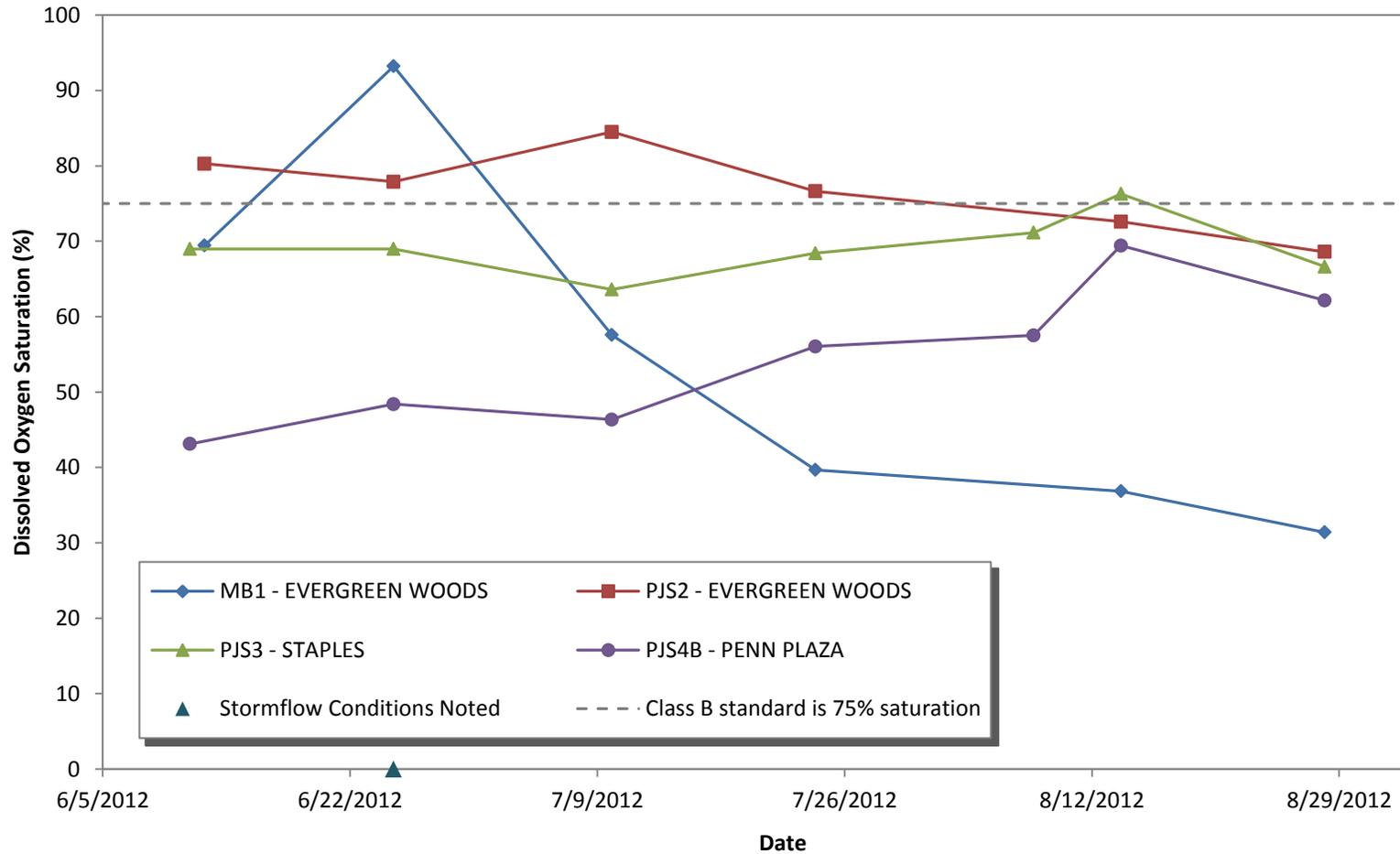
There are numerous sources of pollution and other stresses to the Penjajawoc sites monitored by the Penjajawoc Volunteer Monitoring Team that could potentially have an impact on water quality. Some of those sources of pollution and stress may include:

- Non-point source pollution (e.g., eroded soil, fertilizers, pesticides, heavy metals, petroleum residues, road salt, septic systems, wildlife, and pet feces) and polluted stormwater originating from urban sources
- 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).

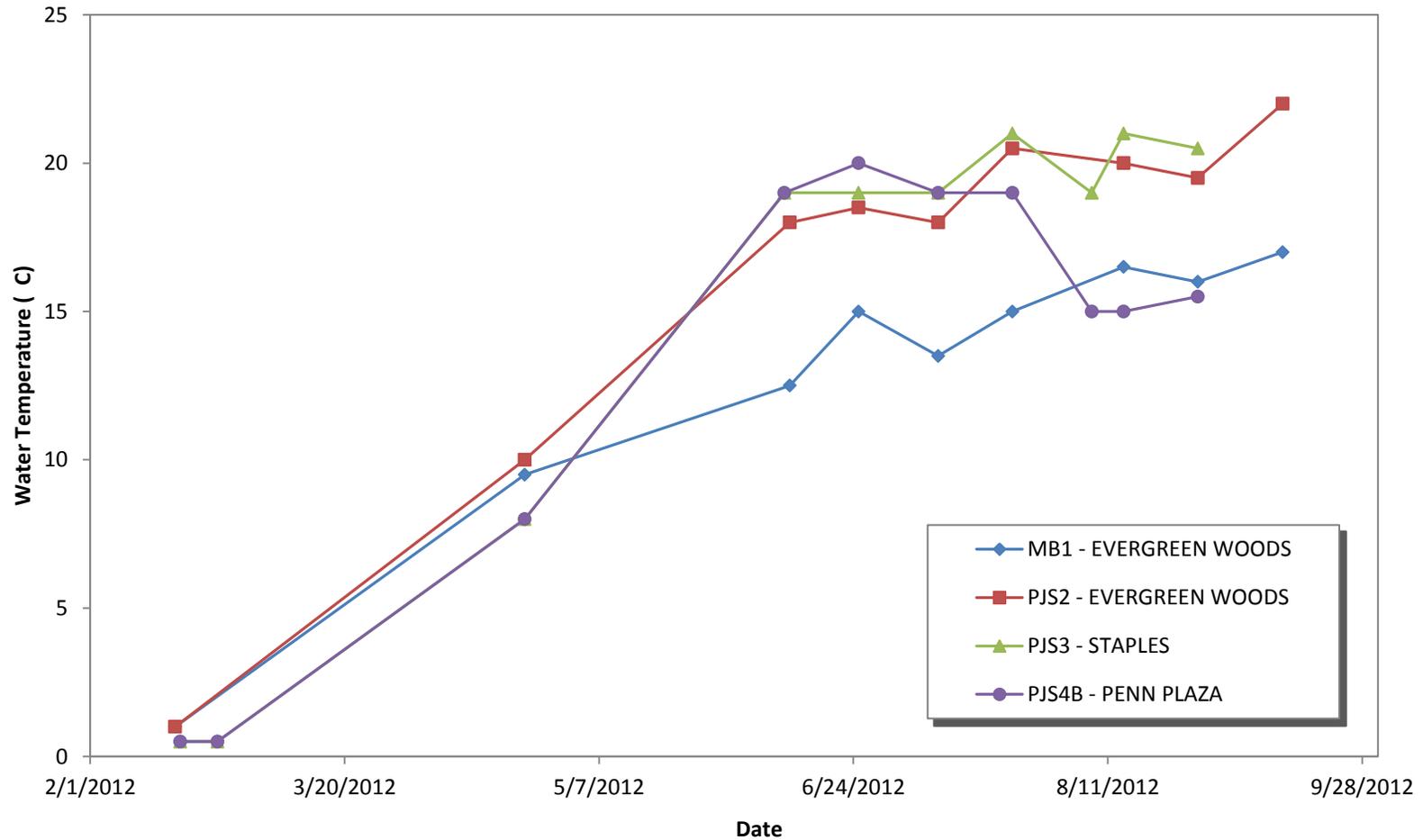
Since 2008, the first full year of monitoring, the VRMP program has established a good baseline for the Penjajawoc and has been able to accurately characterize the current water quality conditions. A number of problems have been identified.



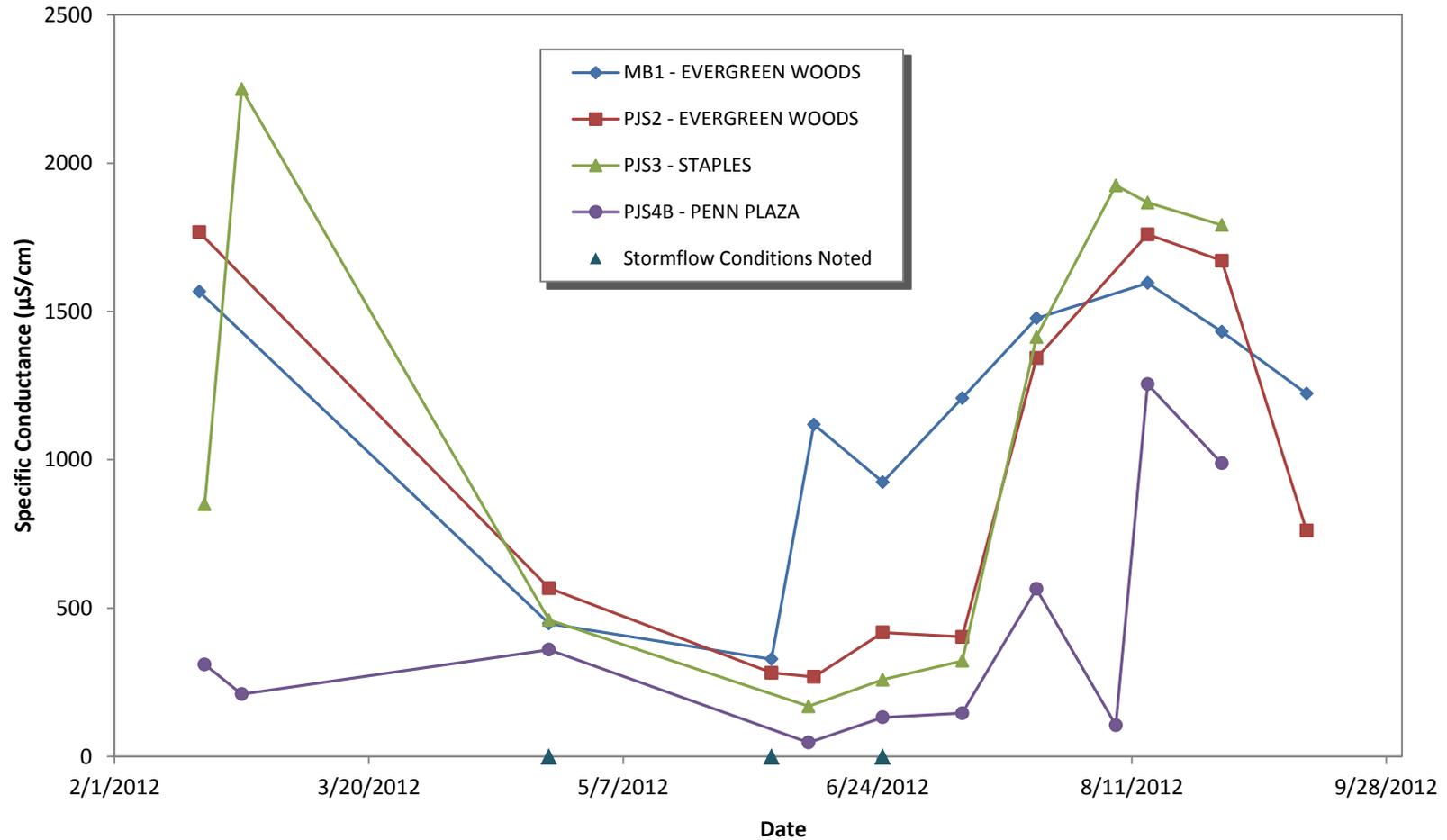
**Figure 5-6-3. Dissolved oxygen concentrations at Penjajawoc Stream Team approved monitoring sites on Penjajawoc Stream for 2012**



**Figure 5-6-4. Dissolved oxygen % saturation at Penjajawoc Stream Team approved monitoring sites on Penjajawoc Stream for 2012**



**Figure 5-6-5. Water temperatures of Penjajawoc approved monitoring sites on Penjajawoc Stream for 2012**



**Figure 5-6-6. Specific Conductance at Penjawoc Stream Team approved monitoring sites on Penjawoc Stream for 2012**

Appendix A-1. 2012 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; "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)	Turbidity (NTU)	** TSS (MG/L)	E Coli Bacteria (MPN/100ML)	Enterococci (MPN/100ML)
------------------------	--------------	------	------	--------------------------	----------------	------------	--------------------	------------------	----------------	------------------------	-----------------	-----------------	---------------	-----------------------------	-------------------------

**Penjajawoc Stream, Penjajawoc Stream Team - Approved Sites:**

CB1	CEMETERY BROOK - PPJCB02 - VRMP	7/10/2012	8:30 AM	N			16.5	77.82	7.6	358					
MB1 - EVERGREEN WOODS	MEADOW BROOK - PPJME01 - VRMP	2/17/2012	9:05 AM	N			1			1567		42			
MB1	MEADOW BROOK - PPJME01 - VRMP	4/23/2012	5:45 PM	N			9.5			448		295			
MB1	MEADOW BROOK - PPJME01 - VRMP	6/4/2012	7:45 AM	N						328		61			
MB1	MEADOW BROOK - PPJME01 - VRMP	6/12/2012	7:35 AM	N			12.5	69.45	7.4	1119					
MB1	MEADOW BROOK - PPJME01 - VRMP	6/25/2012	7:35 AM	N			15	93.22	9.4	925					
MB1	MEADOW BROOK - PPJME01 - VRMP	6/26/2012	9:08 AM	N								179			
MB1	MEADOW BROOK - PPJME01 - VRMP	7/10/2012	7:15 AM	N			13.5	57.58	6	1208					
MB1	MEADOW BROOK - PPJME01 - VRMP	7/24/2012	8:00 AM	N			15	39.67	4	1477					
MB1	MEADOW BROOK - PPJME01 - VRMP	8/14/2012	6:30 AM	N			16.5	36.86	3.6	1596					
MB1	MEADOW BROOK - PPJME01 - VRMP	8/28/2012	7:10 AM	N			16	31.41	3.1	1432					
MB1	MEADOW BROOK - PPJME01 - VRMP	9/13/2012	3:40 PM	N			17			1223					
PJS1	PENJAJAWOC STREAM - PPJ01 - VRMP	7/10/2012	8:15 AM	N			17.5	83.64	8	448					
PJS2 - EVERGREEN WOODS	PENJAJAWOC STREAM - PPJ08 - VRMP	2/17/2012	9:10 AM	N			1			1767		38			
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	4/23/2012	6:00 PM	N			10			567		34			
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	6/4/2012	7:55 AM	N						282		16			
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	6/12/2012	7:50 AM	N			18	80.28	7.6	268					
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	6/25/2012	7:50 AM	N			18.5	77.9	7.3	418					
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	6/26/2012	9:00 AM	N								43			
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	7/10/2012	7:30 AM	N			18	84.5	8	403					
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	7/24/2012	8:00 AM	N			20.5	76.64	6.9	1343					
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	8/14/2012	6:50 AM	N			20	72.59	6.6	1760					
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	8/28/2012	7:30 AM	N			19.5	68.6	6.3	1671					
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	9/13/2012	3:45 PM	N			22			761					
PJS3 - STAPLES	PENJAJAWOC STREAM - PPJ16 - VRMP	2/18/2012	2:00 PM	N			0.5			850		9			
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	2/25/2012	12:50 PM	N			0.5			2250		13			
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	4/23/2012	3:15 PM	N			8			460		44	1203		
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	6/11/2012	9:05 AM	N			19	68.99	6.4	169					

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)	** TSS (MG/L)	E Coli Bacteria (MPN/100ML)	Enterococci (MPN/100ML)
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	6/25/2012	8:45 AM	N			19	68.99	6.4	259					
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	7/10/2012	8:55 AM	N			19	63.6	5.9	322					
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	7/24/2012	8:48 AM	N			21	68.42	6.1	1414					
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	8/8/2012	8:40 AM	N			19	71.15	6.6	1925					
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	8/14/2012	8:45 AM	N			21	76.28	6.8	1867					
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	8/28/2012	8:43 AM	N			20.5	66.64	6	1791					
PJS4B - PENN PLAZA	PENJAJAWOC STREAM - PPJ21 - VRMP	2/18/2012	1:40 PM	N			0.5			310		4			
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	2/25/2012	12:20 PM	N			0.5			210		4			
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	4/23/2012	3:00 PM	N			8			360		10		921	
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	6/11/2012	8:25 AM	N			19	43.12	4	47					
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	6/25/2012	8:25 AM	N			20	48.39	4.4	132					
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	7/10/2012	8:23 AM	N			19	46.35	4.3	146					
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	7/24/2012	8:25 AM	N			19	56.06	5.2	565					
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	8/8/2012	8:15 AM	N			15	57.52	5.8	105					
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	8/14/2012	8:18 AM	N			15	69.42	7	1255					
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	8/28/2012	8:10 AM	N			15.5	62.15	6.2	988					

Appendix A-2. 2012 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; "D.O." = dissolved oxygen; "Spec. Cond" = specific conductance; "Turb" = turbidity  
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
------------------------	--------------	------	------	--------------------------	------	-------	---------------	-----------------	-----------------	---------------	-------------------	---------	------------	------------------	----------

**Penjajawoc Stream, Penjajawoc Stream Team - Approved Sites:**

CB1	CEMETERY BROOK - PPJC802 - VRMP	7/10/2012	8:30 AM	N				WADING	CLEAR	CALM	CLEAR				DID NOT COMPLETED CHAIN OF CUSTODY FOR DATASHEET. DID NOT RECORD ANY OF THE OBSERVATIONAL DATA.
MB1 - EVERGREEN WOODS	MEADOW BROOK - PPJME01 - VRMP	2/17/2012	9:05 AM	N	BASE FLOW	LOW	3.333	WADING	LIGHT RAIN		CLOUDY, LIGHT RAIN	RIFFLE		MILKY	WADEABLE/MID-DEPTH
MB1	MEADOW BROOK - PPJME01 - VRMP	4/23/2012	5:45 PM	N	STORM FLOW	HIGH	13.89	BANK	CLOUDY, LIGHT RAIN		CLOUDY, HEAVY RAIN, LIGHT RAIN	RUN		TURBID	BACTERIA SAMPLES KEPT BEYOND 24 HRS WADEABLE/1.5 FT BELOW SURFACE BACTERIA KEPT OVERNIGHT BEYOND TYPICAL HOLDING TIME OF 8 HRS, USE COUNT WITH CAUTION
MB1	MEADOW BROOK - PPJME01 - VRMP	6/4/2012	7:45 AM	N	STORM FLOW	HIGH		BANK	LIGHT RAIN	BREEZE	HEAVY RAIN	RIFFLE		TURBID	WADEABLE/MID-DEPTH
MB1	MEADOW BROOK - PPJME01 - VRMP	6/12/2012	7:35 AM	N	BASE FLOW	MED	18.33	BANK	CLEAR		CLEAR	RIFFLE		DARKLY STAINED	WADEABLE/MID-DEPTH
MB1	MEADOW BROOK - PPJME01 - VRMP	6/25/2012	7:35 AM	N	STORM FLOW	MED	18.33	BANK	CLOUDY	CALM	CLEAR, CLOUDY, LIGHT RAIN, SHOWERS	RIFFLE		MILKY	WADEABLE/MID-DEPTH DID NOT COMPLETE CHAIN OF CUSTODY FOR DATASHEET.
MB1	MEADOW BROOK - PPJME01 - VRMP	6/26/2012	9:08 AM	N					SHOWERS	CALM	HEAVY RAIN, SHOWERS				1" RAIN OVERNIGHT DID NOT COMPLETED CHAIN OF CUSTODY FOR DATASHEET. DID NOT RECORD ANY OF THE OBSERVATIONAL DATA.
MB1	MEADOW BROOK - PPJME01 - VRMP	7/10/2012	7:15 AM	N	BASE FLOW	HIGH	21.11	BANK	CLEAR		CLEAR	RIFFLE		CLEAR	WADEABLE/MID-DEPTH DID NOT COMPLETE CHAIN OF CUSTODY FOR DATASHEET.
MB1	MEADOW BROOK - PPJME01 - VRMP	7/24/2012	8:00 AM	N			20	WADING	CLOUDY, SHOWERS	CALM	CLEAR, CLOUDY, SHOWERS				WEATHER VERY DRY LATELY WADEABLE/MID-DEPTH DID NOT COMPLETED CHAIN OF CUSTODY FOR DATASHEET. DID NOT RECORD ANY OF THE OBSERVATIONAL DATA.
MB1	MEADOW BROOK - PPJME01 - VRMP	8/14/2012	6:30 AM	N	BASE FLOW	LOW	21.11	BANK	CLOUDY		CLEAR, CLOUDY	RIFFLE		CLEAR	WADEABLE/MID-DEPTH DID NOT COMPLETED CHAIN OF CUSTODY FOR DATASHEET.
MB1	MEADOW BROOK - PPJME01 - VRMP	8/28/2012	7:10 AM	N	BASE FLOW	LOW	21.11	BANK	CLOUDY, LIGHT RAIN	CALM	CLEAR, LIGHT RAIN	RIFFLE		CLEAR	LOW FLOW, LIGHT RAIN HAD LITTLE EFFECT WADEABLE/MID-DEPTH DID NOT COMPLETE CHAIN OF CUSTODY FOR DATASHEET.
MB1	MEADOW BROOK - PPJME01 - VRMP	9/13/2012	3:40 PM	N	BASE FLOW	LOW	25.56	BANK	CLEAR		CLEAR, PARTLY CLOUDY	RUN		CLEAR	WADEABLE/MID-DEPTH DID NOT COMPLETE CHAIN OF CUSTODY FOR DATASHEET.
PJS1	PENJAJAWOC STREAM - PPJ01 - VRMP	7/10/2012	8:15 AM	N				WADING	CLEAR	CALM	CLEAR				DID NOT COMPLETED CHAIN OF CUSTODY FOR DATASHEET. DID NOT RECORD ANY OF THE OBSERVATIONAL DATA.
PJS2 - EVERGREEN WOODS	PENJAJAWOC STREAM - PPJ08 - VRMP	2/17/2012	9:10 AM	N	BASE FLOW	LOW	3.333	BANK	LIGHT RAIN		CLEAR, LIGHT RAIN	RIFFLE		MILKY	THAW WEATHER LAST 48 HOURS WADEABLE/MID-DEPTH OK
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	4/23/2012	6:00 PM	N	STORM FLOW	HIGH	13.89	BANK	CLOUDY, LIGHT RAIN		CLOUDY, HEAVY RAIN, LIGHT RAIN	RUN		TURBID	WADEABLE/1.5 FT BELOW SURFACE BACTERIA KEPT OVERNIGHT BEYOND TYPICAL HOLDING TIME OF 8 HRS SO NOT INCLUDED.
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	6/4/2012	7:55 AM	N	STORM FLOW	HIGH		BANK	LIGHT RAIN	BREEZE	HEAVY RAIN	RIFFLE		TURBID	WADEABLE/MID-DEPTH
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	6/12/2012	7:50 AM	N	BASE FLOW	MED	18.33	BANK	CLEAR		CLEAR	RUN		MED STAINED	WADEABLE/MID-DEPTH
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	6/25/2012	7:50 AM	N	STORM FLOW	MED	18.33	BANK	CLOUDY	CALM	CLEAR, CLOUDY, LIGHT RAIN, SHOWERS	RUN		MED STAINED	WADEABLE/MID-DEPTH DID NOT COMPLETE CHAIN OF CUSTODY FOR DATASHEET.
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	6/26/2012	9:00 AM	N					SHOWERS	CALM	HEAVY RAIN, SHOWERS				1" RAIN OVERNIGHT DID NOT COMPLETE CHAIN OF CUSTODY FOR DATASHEET. DID NOT RECORD ANY OF THE OBSERVATIONAL 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
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	7/10/2012	7:30 AM	N	BASE FLOW	MED	21.11	BANK	CLEAR		CLEAR	RUN		MED STAINED	WADEABLE/1.5 FT BELOW SURFACE DID NOT COMPLETE CHAIN OF CUSTODY FOR DATASHEET.
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	7/24/2012	8:00 AM	N			20	BANK	CLOUDY, SHOWERS	CALM	CLEAR, CLOUDY, SHOWERS				WEATHER VERY DRY LATELY WADEABLE/MID-DEPTH DID NOT COMPLETED CHAIN OF CUSTODY FOR DATASHEET. DID NOT RECORD ANY OF THE OBSERVATIONAL DATA.
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	8/14/2012	6:50 AM	N	BASE FLOW	LOW	21.11	BANK	CLOUDY		CLEAR, CLOUDY	RUN		CLEAR	WADEABLE/MID-DEPTH DID NOT COMPLETE CHAIN OF CUSTODY FOR DATASHEET.
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	8/28/2012	7:30 AM	N			21.11	WADING	CLOUDY, LIGHT RAIN		CLEAR, LIGHT RAIN				LOW FLOW, LIGHT RAIN HAD LITTLE EFFECT WADEABLE/MID-DEPTH DID NOT COMPLETED CHAIN OF CUSTODY FOR DATASHEET. DID NOT RECORD ANY OF THE OBSERVATIONAL DATA.
PJS2	PENJAJAWOC STREAM - PPJ08 - VRMP	9/13/2012	3:45 PM	N	BASE FLOW	LOW	25.56	BANK	CLEAR		CLEAR, PARTLY CLOUDY	RUN		DARKLY STAINED	WADEABLE/MID-DEPTH DID NOT COMPLETE CHAIN OF CUSTODY FOR DATASHEET.
PJS3 - STAPLES	PENJAJAWOC STREAM - PPJ16 - VRMP	2/18/2012	2:00 PM	N	BASE FLOW		4.444	WADING	CLOUDY		CLEAR, PARTLY CLOUDY				WADEABLE/MID-DEPTH DATA SHEET NOT COMPLETED-RESULTS FROM NOTES.
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	2/25/2012	12:50 PM	N	BASE FLOW	MED	-1.67	WADING	CLOUDY		LIGHT RAIN, SNOW	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	4/23/2012	3:15 PM	N	STORM FLOW	HIGH	11.11	WADING	LIGHT RAIN	STRONG WIND	HEAVY RAIN	RUN		TURBID	WADEABLE/MID-DEPTH
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	6/11/2012	9:05 AM	N	BASE FLOW	HIGH	17.78	WADING	PARTLY CLOUDY	BREEZE	PARTLY CLOUDY	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	6/25/2012	8:45 AM	N	BASE FLOW	MED	17.22	WADING	CLOUDY	CALM	CLEAR, LIGHT RAIN	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	7/10/2012	8:55 AM	N	BASE FLOW	LOW	18.89	WADING	CLEAR	BREEZE	CLEAR, PARTLY CLOUDY	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	7/24/2012	8:48 AM	N	BASE FLOW	LOW	21.11	WADING	CLOUDY, SHOWERS	BREEZE	CLEAR, CLOUDY	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	8/8/2012	8:40 AM	N	BASE FLOW	LOW	18.89	WADING	CLEAR		CLEAR, CLOUDY	RIFFLE		DARKLY STAINED	MANY SMALL FISH PRESENT WADEABLE/MID-DEPTH
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	8/14/2012	8:45 AM	N	BASE FLOW	LOW	22.22	WADING	PARTLY CLOUDY	CALM	CLEAR, PARTLY CLOUDY	RIFFLE		CLEAR	SCHOOLS OF FISH WADEABLE/MID-DEPTH
PJS3	PENJAJAWOC STREAM - PPJ16 - VRMP	8/28/2012	8:43 AM	N	BASE FLOW	LOW	21.11	WADING	CLOUDY	CALM	CLOUDY, LIGHT RAIN	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS4B - PENN PLAZA	PENJAJAWOC STREAM - PPJ21 - VRMP	2/18/2012	1:40 PM	N	BASE FLOW		4.444	WADING	CLOUDY		CLEAR, PARTLY CLOUDY				WADEABLE/MID-DEPTH DATA SHEET NOT COMPLETED-RESULTS FROM NOTES.
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	2/25/2012	12:20 PM	N	BASE FLOW	MED	-1.67	WADING	CLOUDY		LIGHT RAIN, SNOW	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	4/23/2012	3:00 PM	N	STORM FLOW	HIGH	11.11	WADING	CLOUDY, LIGHT RAIN		CLOUDY, HEAVY RAIN	RUN		CLEAR	WADEABLE/MID-DEPTH
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	6/11/2012	8:25 AM	N	BASE FLOW	HIGH	17.78	WADING	PARTLY CLOUDY	BREEZE	PARTLY CLOUDY	RUN		MED STAINED	WADEABLE/MID-DEPTH
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	6/25/2012	8:25 AM	N	BASE FLOW	MED	17.22	WADING	CLOUDY	CALM	CLEAR, LIGHT RAIN	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	7/10/2012	8:23 AM	N	BASE FLOW	LOW	18.89	WADING	CLEAR	BREEZE	CLEAR, PARTLY CLOUDY	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	7/24/2012	8:25 AM	N	BASE FLOW	LOW	21.11	WADING	CLOUDY, SHOWERS	BREEZE	CLEAR, CLOUDY	RIFFLE		MED STAINED	WADEABLE/MID-DEPTH
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	8/8/2012	8:15 AM	N	BASE FLOW	LOW	18.89	WADING	CLEAR		CLEAR, CLOUDY	RIFFLE		DARKLY STAINED	WADEABLE/MID-DEPTH
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	8/14/2012	8:18 AM	N	BASE FLOW	LOW	22.22	WADING	PARTLY CLOUDY	CALM	CLEAR, CLOUDY	RIFFLE		MED STAINED	D.O. SAMPLE TAKEN IN STILL WATER IN ORDER TO GET WATER DEEP ENOUGH WADEABLE/MID-DEPTH
PJS4B	PENJAJAWOC STREAM - PPJ21 - VRMP	8/28/2012	8:10 AM	N	BASE FLOW	LOW	21.11	WADING	CLOUDY		CLOUDY, LIGHT RAIN	RIFFLE		DARKLY STAINED	WADEABLE/MID-DEPTH