

Section 5-7 Scarborough Marsh Tributaries (Friends of Scarborough Marsh)

Scarborough Marsh and Tributaries

At roughly 3,000 acres, Scarborough Marsh (Marsh) is the largest salt marsh in Maine. Most of the Marsh is owned by the State of Maine and managed by the Maine Department of Inland Fisheries and Wildlife (IFW). State and federal environmental laws further protect it from development and other forms of human encroachment. The health of its saltmarsh ecosystem also depends on the influx of water and nutrients from the feeder rivers and streams that flow in from the upland regions of the Scarborough Marsh Watershed. Increase in land development and an extensive system of roads threaten both the quality and quantity of these waters.

Seven major rivers and streams discharge freshwater into the Marsh. The confluence of these waterways is the estuarine Scarborough River which discharges into Saco Bay. The outlet of the Scarborough River hosts fertile clam flats that are harvested by local commercial clammers. Elevated concentration of fecal coliform bacteria from urban runoff and faulty septic systems have prompted the Maine Department of Marine Resources to close these clam flats to harvesting in the past. A major focus of this volunteer monitoring program is therefore to monitor influx concentrations of bacteria in the seven major rivers and streams as well as assess overall health of these rivers and streams that discharge into the Marsh. FOSM will use these data to assess e. coli or enterococcus bacteria (as indicators of contamination from warm-blooded animals) input into the Marsh watershed and prioritize areas for further assessment (e.g. bracket sampling, watershed surveys) and mitigation.

Monitoring History

- The Maine DEP Biological Monitoring Program has monitored several tributaries. This data is available on DEP's website.
- The Friends of Scarborough Marsh is a nonprofit coalition of concerned citizens, landowners, businesses, state and federal agencies, environmental organizations, and others. This volunteer group was formed in 2000 and is dedicated to the conservation, protection, restoration, and enhancement of the Scarborough Marsh.
- The Friends of Scarborough Marsh joined the Volunteer River Monitoring Program in 2019.

Methods and Sampling Sites

Water quality sampling sites (Table 5-7-1 and Figure 5-7-1) have been established at 8 locations. Three of the sites are freshwater and 5 are brackish.

Following training by, and under the guidance of the MDEP, the volunteer sampling team conducted bi-weekly sampling from June to October. The sampling equipment was provided by the MDEP. Volunteer

monitors took direct measurements of water temperature, dissolved oxygen, and specific conductance using YSI Pro2030 meters. The monitors also collected water samples to measure bacteria for fecal coliform. Bacteria was analyzed using the IDEXX method by Katahdin Analytical Services.

At the freshwater sites, the monitoring was done before 8:00 AM whenever possible, as this is the time of day when dissolved oxygen is at the lowest level. At the tidal sites, monitors attempted to sample during the outgoing or ebb tide.

Table 5-7-1. Friends of Scarborough Marsh sampling sites. Sampling points on upstream side unless noted.

Site ID	Organization Site Code	Sample Location	Freshwater or Brackish	Class
MILL BROOK – SSCMB12 – VRMP	MBSE-01	Mill Brook Stream (East) – Route 1 culvert	Freshwater	C/SA
WILLOWDALE STREAM – SSCMBWD13 – VRMP	WDS-01	Willowdale Stream – Route 1 culvert	Freshwater	C/SA
PHILIPS BROOK – SSCDNPP13 – VRMP	PB-01	Phillips Brook - Payne Rd, downstream of culvert	Freshwater	C/SB
FINNERD BROOK – SSCDNFN02 – VRMP	FB-01	Finnerd Brook - Payne Rd. culvert	Brackish	B/SA
CASCADE BROOK – SSCCD-12 – VRMP	CS-01	Cascade Brook – Pine Point Rd. culvert	Brackish	B/C/SA
JONES CREEK – SSCJN-03 – VRMP	JC-01	Jones Creek - Pine Point Rd. culvert (from Snow's Cannery access road)	Brackish	SB
LIBBY RIVER – SSCLB00 – VRMP	LR-01	Libby River – Black Point Rd.	Brackish	C/SB
NONESUCH RIVER – SSCNN-50 – VRMP	NR-01	Nonesuch River – Black Point Rd. culvert	Brackish	B/C/SA

Scarborough Marsh Tributaries Sampling Sites

Friends of Scarborough Marsh

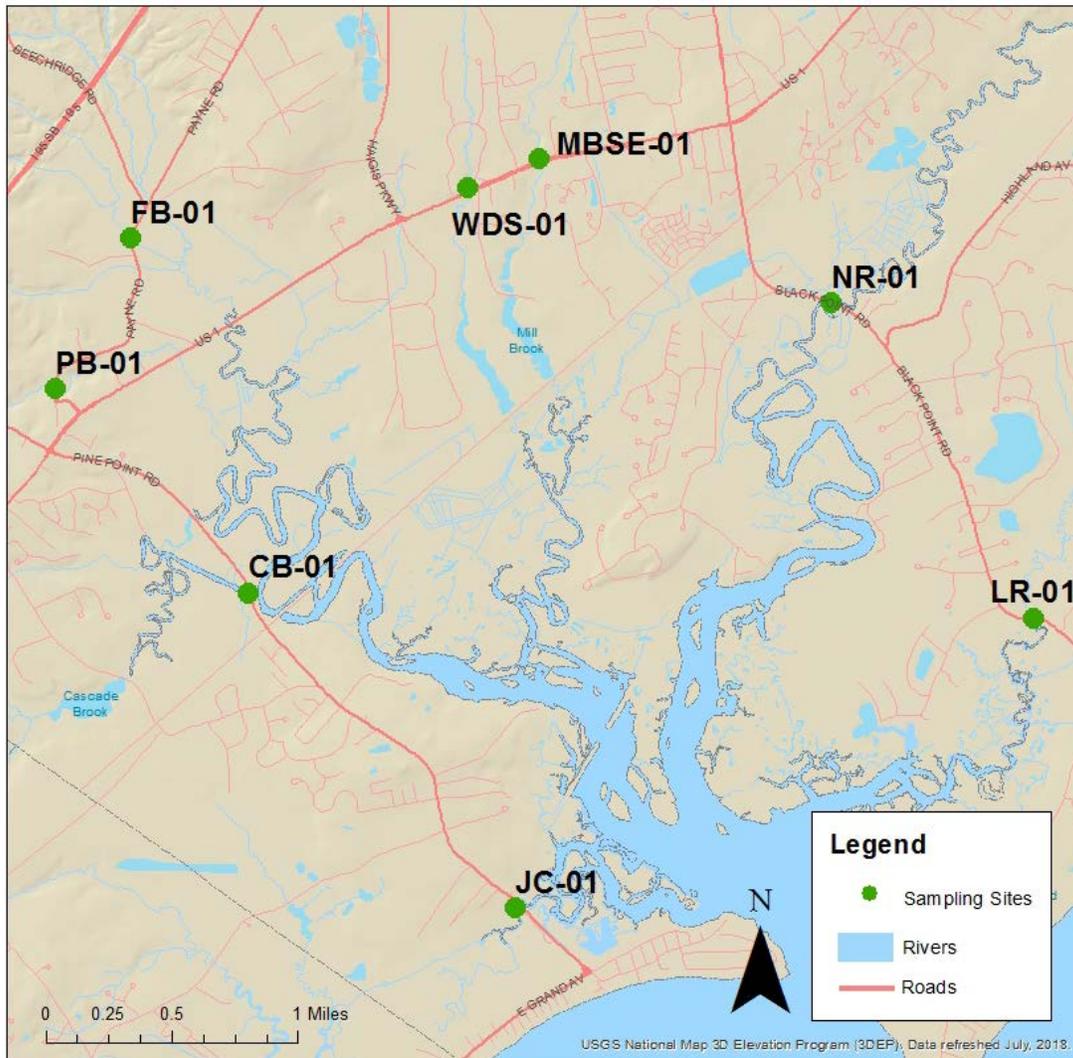


Figure 5-7-1: Map of Friends of Scarborough Marsh sampling sites.

Parameters

Dissolved Oxygen

Dissolved oxygen (DO) levels are generally lowest early in the morning and then increase during the day, peaking in the 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 than normal, dissolved oxygen will be affected. Class A and Class B criteria for dissolved oxygen are a minimum of 7 mg/l (milligrams/liter) or 75% saturation. Class C criteria for dissolved oxygen are a minimum of 5 mg/l or 60 % saturation. To meet water quality criteria, both concentration and saturation standards must be met. The Class SB standard is 85% saturation and for Class SA dissolved oxygen must be as naturally occurs.

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 1st to September 1st, 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. These temperature criteria do not apply to this VRMP data.

Specific Conductance

Specific conductance (SPC) 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 higher 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.

Bacteria

Enterococcus bacteria are used as the indicator organism for marine waters and *Escherichia coli* (*E. coli*) bacteria are used as the indicator organism for freshwaters. While this type of bacteria is not a pathogen, its presence in the water may indicate the presence of other organisms including bacteria and viruses that can cause gastrointestinal illnesses. Monitoring should include at least six samples and include a mix of dry and storm event sampling.

Class B criteria for bacteria (effective August 1, 2018) are as follows: "Between April 15th and October 31st, the number of *Escherichia coli* bacteria in these waters may not exceed a geometric mean of 64 CFU per 100 milliliters over a 90-day interval or 236 CFU per 100 milliliters in more than 10% of the samples in any 90-day interval."

Class C criteria for bacteria (effective August 1, 2018) are as follows: "Between April 15th and October 31st, the number of *Escherichia coli* bacteria in Class C waters may not exceed a geometric mean of 100 CFU per 100 milliliters over a 90-day interval or 236 CFU per 100 milliliters in more than 10% of the samples in any 90-day interval."

The bacteria content of Class SA waters must be as naturally occurs, except that the number of enterococcus bacteria in these waters may not exceed a geometric mean of 8 CFU per 100 milliliters in any 90-day interval or 54 CFU per 100 milliliters in more than 10% of the samples in any 90-day interval.

Class SB criteria (effective August 1, 2018) are as follows: “Between April 15th and October 31st, the number of enterococcus bacteria in these waters may not exceed a geometric mean of 8 CFU per 100 milliliters in any 90-day interval or 54 CFU per 100 milliliters in more than 10% of the samples in any 90-day interval.”

Geometric means are calculated instead of averages because it is more appropriate to use this calculation for something like bacteria where there may be one or more high or low values that can skew the mean.

Discussion and Recommendations

There are numerous sources of pollution and other stresses to the Scarborough Marsh watershed 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, wildlife and pet feces) and polluted stormwater originating from impervious surfaces (e.g., streets, parking lots, driveways, rooftops), agriculture, and forestry.
- Dams and impoundments (which often create more pond-like aquatic habitat conditions that may have higher water temperatures and lower dissolved oxygen concentrations than if the river section was free-flowing).
- 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).
- Point sources (e.g., failing private septic systems, wastewater treatment plants, combined sewer overflows [CSO], and industrial discharges) of pollution.

The following are recommendations for future monitoring:

- Bacteria samples should be collected at least six times over the sampling season and include both baseflow and storm event samples.
- Continue monitoring at all stations to develop a long-term trend database.

Summary of Data by Site and Parameter

See the [Maine DEP VRMP Survey Dashboard](#) for water quality data and graphs of data collected by the Friends of Scarborough Marsh in the tributaries to the Scarborough Marsh in 2019.

Appendix A

* Sampling depths are only reported for Tier 1 VRMP sites.

** "N/A" = normal environmental sample ; "D" = field duplicate; "L" = lab duplicate.

*** D.O. = dissolved oxygen; "Spec. Cond" = specific conductance; "TDS" = Total dissolved solids; "TSS" = total suspended solids."

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	* Sample Depth	Depth Unit	Water Temp (DEG C)	*** D.O. (MG/L)	*** D.O. Sat. (%)	*** Spec. Cond. (US/CM)	Fecal Coliform Bacteria (CFU/100ML)
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	5/27/2019	10:20 AM	NA			17.7			15670	
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	6/10/2019	9:36 AM	NA			18.3	6.8	78.9	28890	86
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	6/24/2019	9:52 AM	NA			19.8	6.1	69.3	14780	55.8
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	7/8/2019	10:05 AM	NA			21.2	5.0	64.0	36270	579.4
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	7/25/2019	11:13 AM	NA			22.1	8.1	99.5	15680	132
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	8/6/2019	9:15 AM	NA			20.3	9.1	101.0	40970	14
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	8/21/2019	10:00 AM	NA			22.8	8.4	98.0		13
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	9/4/2019	9:58 AM	NA			20.3	5.3	68.0		26
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	9/20/2019		NA			18.6	9.6	117.0	33550	26
CS-01	CASCADE BROOK - SSCCD-12 - VRMP	10/19/2019	10:10 AM	NA			10.5	8.3	78.0	16370	200
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	5/27/2019	9:50 AM	NA			16.2			749	
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	6/10/2019	9:07 AM	NA			23.2	9.0	103.7	8490	91
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	6/24/2019	9:19 AM	NA			18.2	6.3	66.5	1490	98
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	7/8/2019	9:36 AM	NA			22.9	4.1	50.8	20180	2419.6
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	7/25/2019	10:38 AM	NA			21.5	6.5	73.8	2767	200
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	8/6/2019	8:53 AM	NA			21.6	3.9	49.3	30060	200
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	8/21/2019	9:28 AM	NA			21.8	8.6	96.0		135
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	9/4/2019	9:25 AM	NA			20.8	6.5	78.0		200
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	9/20/2019	11:30 AM	NA			16.9	9.6	117.0	9830	14
FB-01	FINNERD BROOK - SSCDNFN02 - VRMP	10/19/2019	9:45 AM	NA			7.8	8.3	71.0	8500	200
JC-01	JONES CREEK - SSCJN-03 - VRMP	5/27/2019	10:30 AM	NA			17.6			23850	
JC-01	JONES CREEK - SSCJN-03 - VRMP	6/10/2019	9:43 AM	NA			17.4	8.3	96.2	35250	46
JC-01	JONES CREEK - SSCJN-03 - VRMP	6/24/2019	10:05 AM	NA			19.8	6.8	80.7	25070	78
JC-01	JONES CREEK - SSCJN-03 - VRMP	7/8/2019	10:19 AM	NA			19.7	8.1	102.6	38900	488.4
JC-01	JONES CREEK - SSCJN-03 - VRMP	7/25/2019	11:25 AM	NA			24.2	5.9	74.0	13890	112
JC-01	JONES CREEK - SSCJN-03 - VRMP	8/6/2019	9:25 AM	NA			19.6	8.8	99.0	42490	32
JC-01	JONES CREEK - SSCJN-03 - VRMP	8/21/2019	10:15 AM	NA			27.7	7.9	95.0		59
JC-01	JONES CREEK - SSCJN-03 - VRMP	9/4/2019	10:00 AM	NA			19.9	5.7	72.0		72
JC-01	JONES CREEK - SSCJN-03 - VRMP	9/20/2019	12:15 AM	NA			17.5	9.6	117.0	25960	121
JC-01	JONES CREEK - SSCJN-03 - VRMP	10/19/2019	10:25 AM	NA			10.6	7.3	68.0	13240	200

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	* Sample Depth	Depth Unit	Water Temp (DEG C)	*** D.O. (MG/L)	*** D.O. Sat. (%)	*** Spec. Cond. (US/CM)	Fecal Coliform Bacteria (CFU/100ML)
LR-01	LIBBY RIVER - SSCLB00 - VRMP	5/27/2019	8:40 AM	NA			16.2			26200	
LR-01	LIBBY RIVER - SSCLB00 - VRMP	6/10/2019	10:17 AM	NA			17.8	6.5	73.6	25940	66
LR-01	LIBBY RIVER - SSCLB00 - VRMP	6/24/2019	10:55 AM	NA			20.1	5.9	66.4	8670	79
LR-01	LIBBY RIVER - SSCLB00 - VRMP	7/8/2019	8:25 AM	NA			18.5	6.0	73.2	40830	1203.3
LR-01	LIBBY RIVER - SSCLB00 - VRMP	7/25/2019	9:45 AM	NA			20.4	4.2	49.1	16480	66
LR-01	LIBBY RIVER - SSCLB00 - VRMP	8/6/2019	10:15 AM	NA			19.9	7.9	93.0	40460	16
LR-01	LIBBY RIVER - SSCLB00 - VRMP	8/21/2019	8:40 AM	NA			22.5	8.2	95.0		23
LR-01	LIBBY RIVER - SSCLB00 - VRMP	9/4/2019	11:00 AM	NA			20.0	9.6	59.0		28
LR-01	LIBBY RIVER - SSCLB00 - VRMP	9/20/2019	8:45 AM	NA			16.2	9.6	103.0	17140	37
LR-01	LIBBY RIVER - SSCLB00 - VRMP	10/19/2019	8:25 AM	NA			9.9	6.3	61.0	26230	200
MBSE-01	MILL BROOK - SSCMB12 - VRMP	5/27/2019	9:25 AM	NA			14.0			279	
MBSE-01	MILL BROOK - SSCMB12 - VRMP	6/10/2019	8:37 AM	NA			13.5	9.8	90.8	277.1	103
MBSE-01	MILL BROOK - SSCMB12 - VRMP	6/24/2019	8:50 AM	NA			14.7	9.2	90.2	158.5	134.2
MBSE-01	MILL BROOK - SSCMB12 - VRMP	6/24/2019	8:50 AM	D			14.8	9.0	87.5	142.2	
MBSE-01	MILL BROOK - SSCMB12 - VRMP	7/8/2019	9:00 AM	NA			16.3	9.7	97.2	323.9	275.5
MBSE-01	MILL BROOK - SSCMB12 - VRMP	7/8/2019	9:00 AM	D			16.3	9.5	95.0	321.7	
MBSE-01	MILL BROOK - SSCMB12 - VRMP	7/25/2019	10:03 AM	NA			17.7	8.2	86.5	409.2	200
MBSE-01	MILL BROOK - SSCMB12 - VRMP	7/25/2019	10:03 AM	D			17.7	8.4	88.1	390.3	
MBSE-01	MILL BROOK - SSCMB12 - VRMP	8/6/2019	8:18 AM	NA			16.5	8.2	84.2	243.2	57
MBSE-01	MILL BROOK - SSCMB12 - VRMP	8/6/2019	8:18 AM	D			16.5	8.5	86.5	234.6	
MBSE-01	MILL BROOK - SSCMB12 - VRMP	8/21/2019	9:00 AM	NA			17.9	8.8	97.0		200
MBSE-01	MILL BROOK - SSCMB12 - VRMP	8/21/2019	9:00 AM	D			17.9	8.8	97.0		
MBSE-01	MILL BROOK - SSCMB12 - VRMP	9/4/2019	8:45 AM	NA			16.8	9.5	98.0		200
MBSE-01	MILL BROOK - SSCMB12 - VRMP	9/4/2019	8:45 AM	D			16.9	9.6	99.0		
MBSE-01	MILL BROOK - SSCMB12 - VRMP	9/20/2019	9:50 AM	NA			14.2	9.6	117.0	34610	200
MBSE-01	MILL BROOK - SSCMB12 - VRMP	10/19/2019	9:15 AM	NA			7.8	10.8	89.0	505	200
MBSE-01	MILL BROOK - SSCMB12 - VRMP	10/19/2019	9:15 AM	D			7.8	10.5	88.0	494.2	
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	5/27/2019	9:00 AM	NA			17.3			1480	
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	6/10/2019	10:02 AM	NA			19.0	8.0	84.7	1667	46
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	6/24/2019	10:33 AM	NA			19.6	8.0	86.1	614	86
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	7/8/2019	8:53 AM	NA			23.4	6.9	84.0	15100	727
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	7/25/2019	9:25 AM	NA			28.2	7.0	85.2	7930	104
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	8/6/2019	10:00 AM	NA			23.1	8.2	98.0	24390	55
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	8/21/2019	8:30 AM	NA			24.4	8.4	97.0		47
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	9/4/2019	10:45 AM	NA			28.9	7.5	89.0		200
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	9/20/2019	9:15 AM	NA			14.2	9.2	103.0	34710	17
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	9/20/2019	9:15 AM	D				9.2	103.0	34610	
NR-01	NONESUCH RIVER - SSCNN-50 - VRMP	10/19/2019	8:50 AM	NA			10.4	8.5	77.0	5580	200

Organization Site Code	VRMP Site ID	Date	Time	** Sample Type Qualifier	* Sample Depth	Depth Unit	Water Temp (DEG C)	*** D.O. (MG/L)	*** D.O. Sat. (%)	*** Spec. Cond. (US/CM)	Fecal Coliform Bacteria (CFU/100ML)
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	5/27/2019	9:55 AM	NA			14.3			1480	
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	6/10/2019	9:21 AM	NA			13.4	10.1	95.0	440	198
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	6/24/2019	9:32 AM	NA			15.1	9.2	90.7	397.9	160
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	7/8/2019	9:50 AM	NA			15.8	8.9	89.7	481.4	325.5
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	7/25/2019	10:55 AM	NA			17.9	7.9	82.9	516	200
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	8/6/2019	9:05 AM	NA			15.8	9.0	96.0	474.3	192
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	8/21/2019	9:40 AM	NA			16.7	9.4	99.0		200
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	9/4/2019	9:35 AM	NA			16.2	8.6	89.0		200
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	9/20/2019	11:45 AM	NA							
PB-01	PHILLIPS BROOK - SSCDNPP13 - VRMP	10/19/2019	10:00 AM	NA			7.4	10.4	86.0	439.3	200
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	5/27/2019	9:34 AM	NA			14.9			465.7	
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	6/10/2019	8:52 AM	NA			14.7	9.2	88.4	446.9	46
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	6/10/2019	8:52 AM	D			14.8	9.3	89.3	455.9	
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	6/24/2019	9:07 AM	NA			16.2	8.5	86.2	379.1	96
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	7/8/2019	9:20 AM	NA			17.5	9.0	93.1	940	1986.3
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	7/25/2019	10:22 AM	NA			18.4	8.3	88.2	1012	200
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	8/6/2019	8:40 AM	NA			17.3	8.1	84.0	259.1	81
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	8/21/2019	9:15 AM	NA			18.4	8.7	97.0		200
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	9/4/2019	9:00 AM	NA			17.3	9.5	99.0		88
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	9/20/2019	10:10 AM	NA			10.0	9.6	117.0	35860	16
WDS-01	WILLOWDALE STREAM - SSCMBWD13 - VRMP	10/19/2019	9:30 AM	NA			8.4	10.1	85.0	668	200