SME
SEVEE & MAHER
ENGINEERS

4 Blanchard Road, P.O. Box 85A
Cumberland, ME 04021
Tel: 207.829.5016 • Fax: 207.829.5692
info@smemaine.com
smemaine.com

September 10, 2018

Mr. Chris Swain
Maine Department of Environmental Protection
17 State House Station
Augusta, Maine 04333-0017

Subject: 2nd Quarter 2018 Short-Term Comprehensive Monitoring Plan Data Report
Orrington Remediation Site, Orrington, Maine

Dear Mr. Swain:

Results from monitoring conducted in the second quarter of 2018 at the Orrington Remediation Site (Site) are provided in this letter report. Samples of groundwater, surface water, and sediment were obtained according to the February 24, 2017 Short-Term Comprehensive Monitoring Plan (CMP). Sampling locations included in the Short-Term CMP are shown on Figure 1.

Sampling in the second quarter 2018 was conducted to satisfy the following monitoring programs:

- Interim Extraction System (IES) Monitoring;
- Landfill 5 Groundwater Monitoring Program;
- Short-Term Remediation Monitoring; and
- Site Perimeter Monitoring.

Sampling was conducted during the weeks of April 9, May 14, and June 11, 2018. Samples were sent via courier to Alpha Analytical Laboratory (Alpha) of Westborough, Massachusetts, for analysis of parameters according to the Short-Term CMP and described further in the sections below.

Analytical results were quantified to the laboratory's method detection limit (MDL). Concentrations detected between the MDL and the laboratory's reporting limit (RL) were qualified by Alpha as estimated (J) values. According to the MEDEP approved Data Validation Protocol dated January 29, 2018, final laboratory analytical reports and electronic data deliverables (EDDs) containing unvalidated data were submitted to Maine Department of Environmental Protection (MEDEP) on May 29, June 8, and July 6, 2018. As discussed during a meeting between Mallinckrodt and MEDEP on June 14, 2018, a joint sampling event with Geosyntec was conducted on June 12 for monitoring points that overlap between the Short-

Term CMP and the chloropicrin remediation performance monitoring program. Geosyntec representatives obtained samples for laboratory analysis of mercury and chloropicrin, from wells monitored as part of the IES and Remediation (Landfill 1 and Plant Area) monitoring programs, and these data were submitted to MEDEP by Geosyntec on July 12, 2018.

SME conducted quality control review of the laboratory analytical data. Data review reports are provided in Attachment 1.

IES MONITORING

Operations and Maintenance

Groundwater extraction rates from the five extraction wells that comprise the IES were generally stable since established at the operational extraction rates in June 2015, into the second quarter of 2018 (as reported in monthly and quarterly reports in 2015 through 2018 to date). The four northern extraction wells have each operated at a nominal flow rate of 6 gallons per minute (gpm) and the southernmost extraction well, EW-3, has operated at a nominal flow rate of 4 gpm. Flow rates vary based on the pressure in the extraction system, which includes the treatment train in the Groundwater Treatment Plan (GWTP), and are modified as needed on a weekly basis by adjusting the individual potentiometers.

The flow from EW-4 began to decline in March and April 2018, presumably due to a decline in function of the pump in this well. The pump did not respond to manual adjustments of the potentiometer, even following replacement of the potentiometer on April 13 and again on July 9, 2018. A maximum flow of approximately 4 gpm was maintained by the end of the second quarter. The decision was made to not replace the pump in EW-4 given the short duration until operation of EW-4 was discontinued (August 7, 2018) and the well was decommissioned (August 23, 2018). The flow in other extraction wells was increased incrementally to maintain an overall flow from the IES of 26 to 28 gpm.

Following a power outage on June 3, high system pressure was observed following restart of the IES and GWTP. The IES was operating at reduced flows (extraction wells not responding to manual potentiometer increases) for approximately a week and a half, including the date of collection of the second quarter samples. During GWTP treatment train maintenance on June 14, 2018, a structural issue was identified in one of the carbon beds. Operation was switched to a different carbon bed, the system pressure reduced to normal operating conditions, and the IES flows increased to operational flows (with the exception of EW-4, as noted above). From this time through the end of the quarter and beyond, the well flows were nominally 6 gpm from EW-1, EW-2, and MW-601; 5 gpm from EW-3; and 3 to 4 gpm from EW-4.

Water Level Elevations

Water level elevations in the IES extraction wells and nearby monitoring points are recorded hourly by data logging pressure transducers. Pressure transducer graphs from individual monitoring points are provided in Attachment 2 and transducer data are provided in Attachment 3. Average groundwater elevations are shown on Figure 2. To remove the effects

of tidal variations to groundwater levels, the average water levels recorded over a four-day period between May 7 and 10, 2018 were used. Based on average water level elevations, we observe a drawdown of at least 0.1 feet at the extraction wells and we infer hydraulic capture of groundwater extending beyond the line of IES extraction wells. Figure 2 illustrates that the IES continues to be successful in capturing mercury in the groundwater emanating from the Landfill 1 area and upgradient.

Laboratory Analytical Data

Quarterly monitoring of IES extraction wells and the GWTP Influent was conducted according to the Short-Term CMP on June 12, 2018. Monitoring parameters are provided in Table 1. Samples for laboratory analysis of chloropicrin and total mercury were collected by Geosyntec representatives and submitted for laboratory analysis as part of both the chloropicrin remediation performance monitoring program and the Short-Term CMP IES and remediation monitoring programs.

TABLE 1

INTERIM EXTRACTION SYSTEM MONITORING

Monitoring Locations	Monitoring Frequency	Sample Parameters	Sampling Date
Extraction Wells EW-1, EW-2, EW-3, EW-4, and MW-601	Quarterly	Total mercury, chloropicrin, chloride	June 12, 2018
GWTP Influent	Quarterly	Total mercury, chloropicrin, MPS VOCs, chloride, alkalinity, iron, manganese, and sodium	June 12, 2018

A summary of analytical results is provided in Table 2. Analytical results from June 2018 sampling indicate mercury, chloropicrin, and chloride concentrations are within the range of historical detections with the exception of mercury in EW-1, MW-601, and the GWTP Influent. Detected mercury concentrations from each of these monitoring points were higher than previously detected in quarterly monitoring conducted by SME. Concentrations of volatile organic compounds (VOCs) in the GWTP sample are below Media Protection Standards (MPS) and are within historical ranges. Detected concentrations of mercury and chloropicrin over time in the five IES wells are shown on Figure 3. Summary tables of field parameters and laboratory analytical data are provided in Attachment 4. Field sampling documentation is also provided in Attachment 4.

TABLE 2

LABORATORY ANALYTICAL DATA SUMMARY – JUNE 12, 2018

Parameter	Analytical Method	EW-1	EW-2	EW-3	EW-4	MW-601	GWTP Influent
Mercury (µg/L)	7470	394	6.29	5.24	15.0	407	322
Chloropicrin (µg/L)	8011	20.7	5,410	2,570	6,000	769	1,740
Chloride (mg/L)	E300	170	400	310	470	240	270
Nominal Pumping Rate (gpm)	-	4	4	1	1	8	15

LANDFILL 5 MONITORING

Landfill 5 Assessment monitoring was conducted according to the Short-Term CMP during the week of June 11, 2018. A summary of the Landfill 5 monitoring programs is provided in Table 3. Laboratory analytical results are generally consistent with recent monitoring results with detected concentrations below MPS and within or near the historical range of detections. Attachment 5 provides summary data tables of field parameters, laboratory analytical data, and field sampling documentation.

TABLE 3

LANDFILL 5 MONITORING PROGRAMS

Program	Frequency	Monitoring Wells	Sample Parameters
Detection Monitoring	Semiannual (Quarters 1 and 3)[2]	B-304-B1/O1[1] B-306-B3[1] B-307-B1/B2 B-307-O1[1]	Total organic halogens, total organic carbon, pH, specific conductance, temperature, iron, manganese, sodium, mercury, chloride, sulfate, phenols
Assessment Monitoring	Quarterly	B-303-B1/B2/B3/O1[(1)] B-306-B1/B2	VOCs, mercury (unfiltered), pH, specific conductance

Notes:
1. Monitoring wells B-304-O1, B-306-B3, B-307-O1, and B-303-O1 have historically either been dry or yielded an insufficient quantity of groundwater to obtain a groundwater sample.
2. Quarters 1 and 3 are for January through March and July through September, respectively.

REMEDIATION MONITORING

Mallinckrodt began remediation monitoring, according to the Short-Term CMP, in February 2017. Remediation monitoring during the second quarter 2018 included monthly monitoring in the vicinity of the Plant Area and Landfill 1 and quarterly monitoring in the vicinity of the Southerly Stream, Landfill 2, Plant Area, and Landfill 1 remediation areas. A summary of these monitoring programs is provided in Table 4. Summary data tables and field sampling documentation for each remediation area are provided in Attachment 6.

SME
SEVEE & MAHER
ENGINEERS

TABLE 4

REMEDIATION MONITORING PROGRAMS

Area	Media	Locations	Parameters	Frequency	Final Sample Date
Southerly Stream (southern)	Groundwater	B-321-B2, B327-O1, MW-504-O1/B1, MW-511-B2/B1, MW-702-O1/B2	Total Mercury	Quarterly	June 2018
	Water Level	B-321-O1/B1/B2, B-327-O1, MW-504-O1/B1, MW-505-B1/B2, MW-509-B1, MW-511-B1/B2, MW-702-O1/B1/B2, MW-703-B1/B2	N/A	Quarterly	June 2018
Landfill 2 and Southerly Stream (northern)	Groundwater	MW-409-O1/B1, MW-704-O1/O2, MW-705-O1, MW-706-O1/B1	Total Mercury, Carbon Tetrachloride	Quarterly	September 2018
	Water Level	B-301-O1/O2/B1, MW-409-O1/B1, MW-704-O1/O2, MW-705-O1, MW-706-O1/B1	N/A	Quarterly	September 2018
Plant Area	Groundwater	B-315-O1/O2/B1, B-316-O1/B1, B-327-O1, MW-403-O1/O2/B1, MW-509-B1, MW-701-O1/B1/B2	Total Mercury, Chloropicrin, MPS VOCs, MPS SVOCs	Quarterly	TBD
	Groundwater	Chlorate Building MH	Total Mercury, MPS VOCs	Monthly	
	Surface Water	SW15-7, SW15-10R		Monthly	
	Sediment	SD15-8, SD18-1	Total Mercury, Chloropicrin	Monthly	
	Water Level	B-315-O1/O2/B1, B-316-O1/B1, B-327-O1, MW-403-O1/O2/B1, MW-503-O1/B1, MW-509-B1, MW-701-O1/O2/B1/B2, MW-702-O1/B1/B2	N/A	Quarterly	
Landfill 1	Groundwater	EW-1, EW-2, EW-3, EW-4, MW-601	Total Mercury, Chloropicrin, MPS VOCs, MPS SVOCs	Monthly	TBD
	Groundwater	PZ14-12, PZ14-13, MW-602-O1		Quarterly	
	Surface Water	SW18-1	Total Mercury	Monthly	
	Sediment	SD18-2		Monthly	
	Water Level	MW-403-O1/O2/B1	N/A	Quarterly	

Notes:
1. Red text indicates sampling that was completed (final samples obtained) according to the Short-Term CMP in the second quarter of 2018.
2. Monitoring well MW-402-O1 is inaccessible for measurement of water levels. The area has been covered by a gravel roadway providing access to the Northern Drainage Ditch area. This monitoring point has been removed from the quarterly Landfill 1 water level monitoring program.

Southerly Stream

Groundwater sampling in the vicinity of the Southerly Stream remediation area was conducted during the week of June 11, 2018, in accordance with the Short-Term CMP. All analytical results are below MPS and within the historical range of detections. Quarterly monitoring in the Southerly Stream remediation area is completed according to the Short-Term CMP.

Landfill 2

Remediation monitoring in the vicinity of the Landfill 2 remediation area was conducted during the week of June 11, 2018, in accordance with the Short-Term CMP. Second quarter 2018 groundwater analytical results are below MPS and consistent with recent monitoring. Quarterly groundwater monitoring according to the Short-Term CMP will continue through September 2018.

Plant Area

Remediation monitoring in the vicinity of the Plant Area was conducted during the weeks of April 9, May 14, and June 11, 2018, in general accordance with the Short-Term CMP. Exceptions to the Short-Term CMP are:

- As reported in the first quarter 2018 data transmittal, surface water monitoring location SW15-10 is no longer accessible since surface water is piped from the containment area to a location approximately 240 feet southwest. The replacement sampling location SW15-10R is shown on Figure 1.
- Also, as reported in the first quarter 2018 data transmittal, monitoring locations MW-502-O1 and MW-510-O1 were permanently abandoned in early April (as previously approved by MEDEP and reported on May 21, 2018) and have been removed from the Plant Area monitoring program.
- Sampling locations SW15-6 and SD15-7 are located in an area that was excavated in April. Mercury-containing sediments were removed from this area. These monitoring points were not accessible during second-quarter monitoring. Following excavation and pending restoration of this vicinity, there is no longer surface water flow or sediment accumulation in this area and therefore these sampling locations have been removed from the monitoring program.

Where parameters were detected in groundwater above laboratory reporting limits, they were generally below MPS and within the historical range of detections, with the following exceptions:

- B-316-O1: Mercury, chloropicrin, carbon tetrachloride, and hexachloroethane were detected at concentrations above MPS and within or near the range of previous detections. Groundwater from this area is captured by the groundwater extraction system in the Landfill 1 Area.
- B-316-B1: Chloropicrin and several VOCs (acetone, carbon disulfide, 1,1-dichloroethene, and trichloroethene) were detected at concentrations above MPS and concentrations were within or near the range of historical detections.

Groundwater from this area is captured by the groundwater extraction system in the Landfill 1 Area.

- Chlorate Building MH: Mercury was detected at a concentration above MPS and above the previous range of detections. Water from the manhole is pumped to the GWTP for treatment prior to discharge under the Site MEPDES Permit.

Surface water sampling results showed mercury below the MPS in all Plant Area surface water locations sampled this quarter; no MPS VOCs were detected above laboratory reporting limits in Plant Area surface water samples during second quarter monitoring.

Sediment sampling results from SD15-8 were below MPS and consistent with previous sampling results. Mercury concentrations exceeded MPS in all samples obtained from location SD18-1 in the second quarter. Due to the configuration of the surface water pond, sediment settles on the base of the paved sump rather than discharging with surface water; therefore, sediments remain relatively contained in the vicinity of SD18-1. Additionally, routine maintenance is conducted in the paved sump including removal of accumulated sediments. Consistent with previous monitoring, chloropicrin was not detected above laboratory reporting limits in any sediment samples obtained in the second quarter.

<u>Landfill 1 Area</u>

Remediation monitoring in the vicinity of the Landfill 1 Area began in June 2018. Monthly and quarterly monitoring was conducted during the week of June 11, 2018, in general accordance with the Short-Term CMP. Exceptions to the Short-Term CMP are: Sampling locations SW18-1 and SD18-2 were established at the locations shown on Figure 1, with the agreement of MEDEP (approval provided via email on July 5, 2018). During second-quarter monitoring, no surface water was observed at this location and no evidence was observed of sediment accumulation; therefore, no samples of these media were obtained during second-quarter monitoring. Continued observation will be made of this location, and in the event surface water is present and/or evidence of sediment accumulation is observed, samples will be obtained accordingly in future monitoring events.

Where parameters were detected in groundwater above laboratory reporting limits, they were below MPS with the following exceptions:

- Mercury and chloropicrin were detected at concentrations above MPS in all five extraction wells and monitoring well MW-602-O1.
- Carbon tetrachloride and hexachloroethane were detected at concentrations above MPS in extraction wells EW-2, EW-3, and EW-4.

Groundwater from this area is captured by the IES.

SITE PERIMETER MONITORING

A summary of the Site Perimeter monitoring program is provided in Table 5. Site Perimeter monitoring was conducted during the week of June 11, 2018. Sampling was conducted according to the Short-Term CMP, with the exception of the permanent removal of the Haseltine and Safian monitoring points from the sampling program as approved by MEDEP and reported in the first quarter 2018 data transmittal. A summary of Site Perimeter monitoring is provided in Table 5.

TABLE 5

SITE PERIMETER MONITORING PROGRAM

Monitoring Locations	Site Area	Sample Parameters
P-13-B1, P-13-B2	Landfill 3	Total mercury, chloropicrin, MPS VOCs, chloride
MW-704-O1/O2	Landfill 2	Total mercury, chloride
MW-511-B1/B2	Ferry Road	Total mercury, chloride
B-321-B1/B2	Ferry Road	Total mercury, chloride
B-320-O1/B1	Landfill 1	Total mercury, chloropicrin, chloride, MPS SVOCs

Second quarter laboratory analytical results for the Site Perimeter monitoring program are generally consistent with recent monitoring results. Detected concentrations were below MPS with the exception of P-13-B1, from which concentrations of chloropicrin, carbon tetrachloride, and 1,1-dichloroethene were above MPS. This area of the Site is the subject of additional pre-design testing, as described in the July 19, 2018 Pre-Design Work Plan for Landfills 3 through 5 Groundwater Conditions Assessment.

Summary data tables and field sheets are provided in Attachment 7. Please note that there is some overlap between the Site Perimeter and Remediation monitoring programs and therefore field documentation for some Site Perimeter monitoring points is provided in Attachment 6.

SME
SEVEE & MAHER
ENGINEERS

CLOSING

The third quarter 2018 sampling and water level monitoring event is being conducted during the week of September 10, 2018 and MEDEP has been informed of that sampling schedule. If you have any questions concerning the monitoring programs conducted as part of the Short-Term CMP, please do not hesitate to contact Kathryn Zeigler or me.

Very truly yours,

SEVEE & MAHER ENGINEERS, INC.

Lisa J. Jacob, C.G.
Senior Geologist

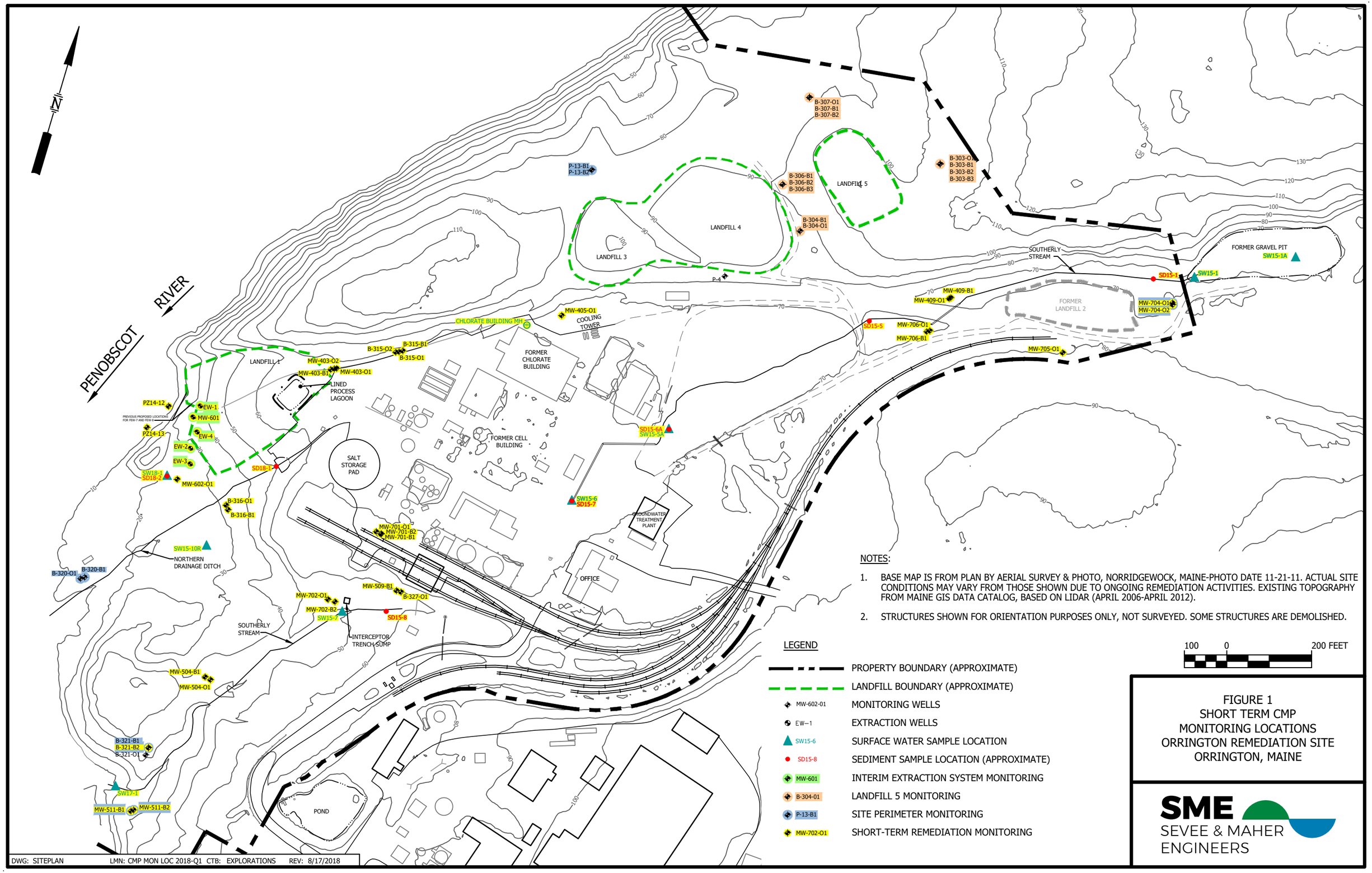
Attachments:

Figure 1 – Short-Term CMP Monitoring Locations
Figure 2 – Average Groundwater Elevations
Figure 3 – Mercury and Chloropicrin Concentration Plots
Attachment 1 – Data Review Reports
Attachment 2 – Transducer Graphs
Attachment 3 – Transducer Data (Excel Format)
Attachment 4 – Interim Extraction System Data Summary Tables and Field Sheets
Attachment 5 – Landfill 5 Data Summary Tables and Field Sheets
Attachment 6 – Remediation Monitoring Data Summary Tables and Field Sheets
Attachment 7 – Site Perimeter Data Summary Tables and Field Sheets

cc: Kathryn Zeigler, Mallinckrodt US LLC (email only)
Chris Evans, Maine DEP (email only)
Chris Greene, Geosyntec (email only)
Orrington Public Library (hard copy only)

FIGURES

SME
SEVEE & MAHER
ENGINEERS



NOTES:

1. BASE MAP IS FROM PLAN BY AERIAL SURVEY & PHOTO, NORRIDGEWOCK, MAINE-PHOTO DATE 11-21-11. ACTUAL SITE CONDITIONS MAY VARY FROM THOSE SHOWN DUE TO ONGOING REMEDIATION ACTIVITIES. EXISTING TOPOGRAPHY FROM MAINE GIS DATA CATALOG, BASED ON LIDAR (APRIL 2006-APRIL 2012).
2. STRUCTURES SHOWN FOR ORIENTATION PURPOSES ONLY, NOT SURVEYED. SOME STRUCTURES ARE DEMOLISHED.

LEGEND

- PROPERTY BOUNDARY (APPROXIMATE)
- LANDFILL BOUNDARY (APPROXIMATE)
- MW-602-01 — MONITORING WELLS
- EW-1 — EXTRACTION WELLS
- SW15-6 — SURFACE WATER SAMPLE LOCATION
- SD15-8 — SEDIMENT SAMPLE LOCATION (APPROXIMATE)
- MW-601 — INTERIM EXTRACTION SYSTEM MONITORING
- B-304-01 — LANDFILL 5 MONITORING
- P-13-B1 — SITE PERIMETER MONITORING
- MW-702-O1 — SHORT-TERM REMEDIATION MONITORING

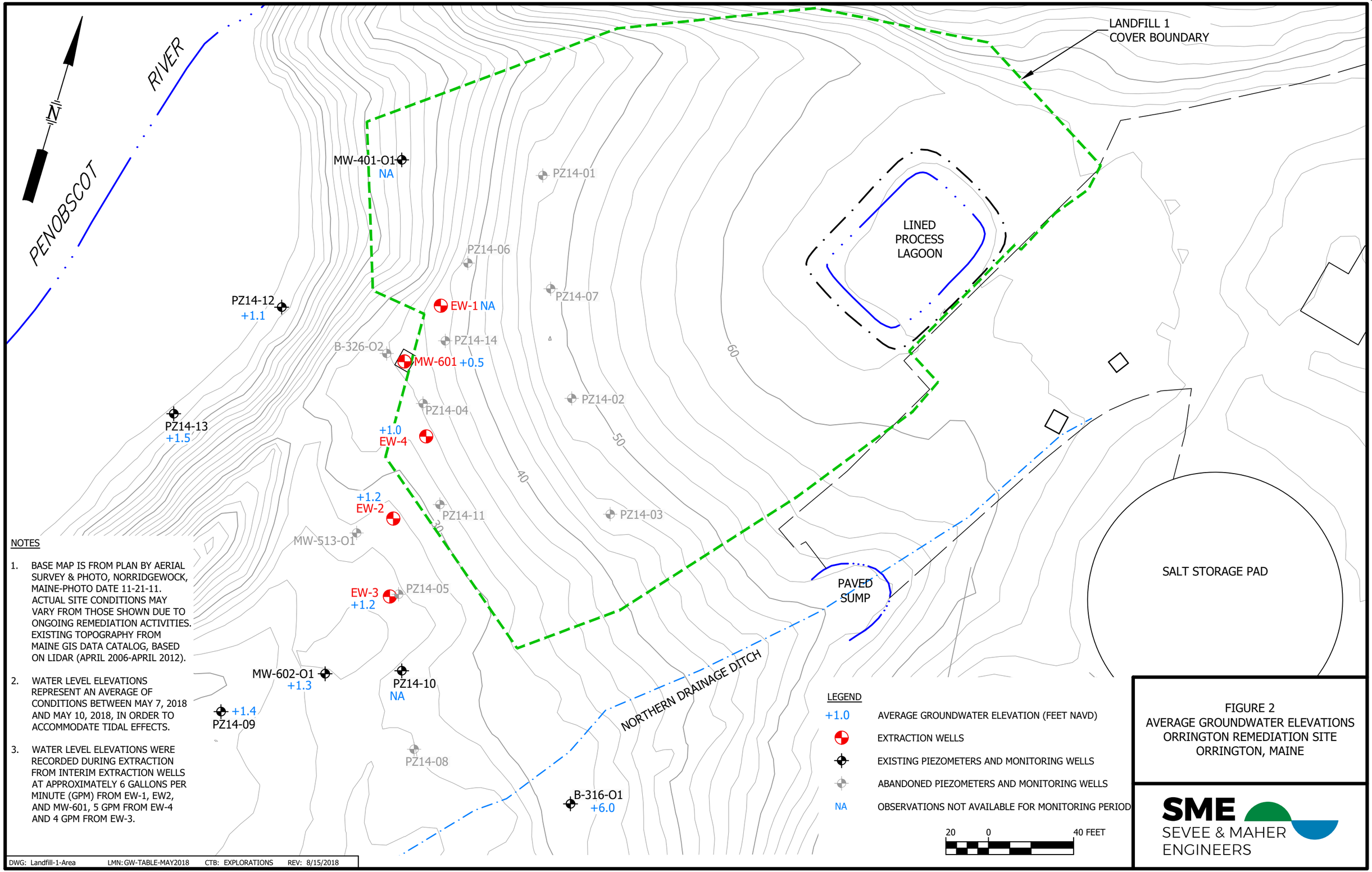
100 0 200 FEET

FIGURE 1
SHORT TERM CMP
MONITORING LOCATIONS
ORRINGTON REMEDIATION SITE
ORRINGTON, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: SITEPLAN LMN: CMP MON LOC 2018-Q1 CTB: EXPLORATIONS REV: 8/17/2018

\\server\CFS\Covidien\HoltraChem\Acad\Figures\Siteplan.dwg, 8/17/2018 3:27:43 PM, jrl



NOTES

1. BASE MAP IS FROM PLAN BY AERIAL SURVEY & PHOTO, NORRIDGEWOCK, MAINE-PHOTO DATE 11-21-11. ACTUAL SITE CONDITIONS MAY VARY FROM THOSE SHOWN DUE TO ONGOING REMEDIATION ACTIVITIES. EXISTING TOPOGRAPHY FROM MAINE GIS DATA CATALOG, BASED ON LIDAR (APRIL 2006-APRIL 2012).
2. WATER LEVEL ELEVATIONS REPRESENT AN AVERAGE OF CONDITIONS BETWEEN MAY 7, 2018 AND MAY 10, 2018, IN ORDER TO ACCOMMODATE TIDAL EFFECTS.
3. WATER LEVEL ELEVATIONS WERE RECORDED DURING EXTRACTION FROM INTERIM EXTRACTION WELLS AT APPROXIMATELY 6 GALLONS PER MINUTE (GPM) FROM EW-1, EW2, AND MW-601, 5 GPM FROM EW-4 AND 4 GPM FROM EW-3.

FIGURE 2
AVERAGE GROUNDWATER ELEVATIONS
ORRINGTON REMEDIATION SITE
ORRINGTON, MAINE

SME
SEVEE & MAHER ENGINEERS

\\nserver\CFS\Covidien\HoltraChem\Acad\Figures\Landfill-1-area.dwg, 8/15/2018 10:03:25 AM, jrl

FIGURE 3

MERCURY AND CHLOROPICRIN CONCENTRATION PLOTS
INTERIM EXTRACTION SYSTEM
ORRINGTON REMEDIATION SITE
ORRINGTON, MAINE