July 29, 2016

Mr. Chris Swain
Bureau of Remediation and Waste Management
Maine Department of Environmental Protection
17 State House Station
Augusta, ME 04333

Subject: Response to Maine DEP Comments Landfill 2 CMI Plan
Orrington Remediation Site
Orrington, ME

Dear Mr. Swain:

We have received the email from you dated May 26, 2016 providing comments on the Draft Landfill 2 Corrective Measures Implementation (CMI) Plan, dated January 13, 2016. Responses to the comments are presented below. Maine DEP comments are shown in italics and our response to each is shown below.

General Comments

A. On the Department's recommendation Mallinckrodt completed several follow-up soil borings in April 2016 to evaluate several mercury hits in deep soil samples that appeared to be due to cross-contamination of samples that occurred during drilling. The results showed that many of the deep mercury exceedances could not be confirmed. Mallinckrodt hasn't submitted a revised excavation plan that accounts for the new data, so comments on the excavation plan are not useful at this time.

Response: A Revised Excavation Plan (Drawing 10 of 18) was submitted for Maine DEP review on May 31, 2016 and discussed during a teleconference on June 1, 2016. The Revised Excavation Plan considers the results of the follow-up soil borings completed in April 2016. The text will be revised in Section 2.1 of the final CMI Plan to reflect that the additional soil borings were performed. The analytical results from the follow-up soil borings are provided in Attachment A-1 to this response and the laboratory analytical data reports are included as Attachment A-2. The original pre-design boring logs for the locations that were re-sampled are provided in Attachment B-1, and the boring logs from the follow-up borings are provided in Attachment B-2. Copies of the Revised Excavation Plan (Drawing 10 of 18) and Confirmation Sampling Plan (Drawing 9 of 18) are included as Attachment C to this response.

B. The soil boring and sampling methods used at Landfill 2 are the same as those used at the Northern Drainage Ditch, and the issues regarding error in elevation of the samples are the

same. Where the uncertainty in vertical position of critical samples exceeds the clearance between those samples and the proposed removal layer boundaries the Department will require a high density of post-excavation confirmations samples to assure adequate removal. Fewer confirmation samples will be necessary in areas where the bottoms of removal layers are in undisturbed native soils. The confirmation sampling plan in this work plan is inadequate. Confirmation sampling will need to be negotiated separately.

Response: A Revised Confirmation Sampling Plan was submitted for Maine DEP review on May 31, 2016 and discussed during a teleconference on June 1, 2016. A copy of the Revised Confirmation Sampling Plan is included in Attachment C to this response. Mallinckrodt agrees that there is some variability in the exact depth of each sample due to soil recoveries of less than 100%; however, Mallinckrodt does not agree that the uncertainty in the vertical location is often two feet or more. Mallinckrodt understands the Maine DEP concern that mercury concentrations above the MPS may be deeper than they are being characterized, which is why Mallinckrodt uses a multiple lines of evidence approach when determining the bottom elevation of excavation areas. These multiple lines of evidence include:

(1) Assignment of recovered soil in each core to discrete equal length intervals within the core with a conservative bias toward assigning soil to the deeper end of the core for cores with low recovery;
    - This is a conservative because uncertainty is addressed by assuming a deeper excavation depth and a larger excavation volume than may be required.

(2) Identification of the depth of contamination in each boring as the top of the first depth interval with mercury concentrations below 2.2 mg/kg;

(3) Definition of the bottom of excavation elevation as the maximum depth at which mercury concentrations are above 2.2 mg/kg from the entire group of borings that define each excavation area;
    - In other words, even if one boring shows mercury concentrations above 2.2 mg/kg at lower elevation than the surrounding borings, the entire area will be excavated to that elevation.

(4) Bias of post-excavation confirmation sampling locations to intentionally sample near the borings which define the excavation depth (i.e. governing borings) in areas where excavations do not extend to native materials; and

(5) Addition of confirmation samples next to the governing boring where recovery in the governing five foot or two foot sleeve is less than 60%.

Mallinckrodt discussed the approach used to interpret sample depths in samples with less than 100% recovery with Maine DEP during a conference call on June 1, 2016 and a meeting on June 15, 2016. The success of this approach to interpreting sample depths is demonstrated by the success of the confirmation sampling at the Landfill Ridge Area.

C. The Appendix J protocol for testing soils proposed for onsite reuse is inadequate. A confirmation procedure similar to that established for reuse soils at the Scrap Metal Yard will be needed.

Response: As discussed during the teleconference on June 1, 2016, the confirmation procedure for reuse layers in Landfill 2 will be similar to that established for reuse soils at the Scrap Metal Yard. An appendix has been added to the Soil Use Plan in Appendix J to reflect this change. The revised Soil Use Plan is provided as Attachment D to this response.

D. The results of the mercury speciation analyses are tabulated in Appendix A6 but there is no discussion of the results in the text. Part of the reason for the speciation was to improve understanding of the risk of mercury volatilization during excavation. Some discussion in the text of the meaning of those results might be useful for outside reviewers of the report. Information on mercury mobilization gained from workspace monitoring during test-pitting and boring at Landfill 2 should also be included in the discussion.

Response: The results from mercury speciation analysis indicate that the majority of the mercury is insoluble (fractions F04, F05, and F06) and is not likely to results in air quality concerns at the Site perimeter during excavation. Additionally, workspace monitoring during the pre-design test pitting and borings at Landfill 2 demonstrated that mercury concentrations were below action levels specified in the site-specific health and safety plan. Therefore, modifications to the excavation procedures are not required. This additional detail will be added to Section 2.1 of the CMI Plan.

E. This pre-design study did not determine if the high-mercury materials in the center of the landfill contain brine purification sludge. The statement that sludge was not observed is inconsistent with TechLaw observations.

Response: Mallinckrodt was not able to confirm the presence of brine sludge in Landfill 2 or that high-mercury concentrations directly correlate to where the brine-sludge was placed in the Landfill. As discussed in the Revised Landfills 1 & 2 Phase II Pre-Design Work Plan, dated May 15, 2015, heavy black staining was observed in SB-LF2-02. Testing of other parameters found in brine sludge were also found to be elevated in this boring which would suggest that brine sludge or the remains of charcoal filters from the process were disposed in the area of this boring. Mallinckrodt has reviewed the TechLaw photos of the pre-design work at Landfill 2. While there is no location information attached to each photo, the time stamps and dates were cross-referenced with the field records and educated guesses were made as to where the photos were taken. The pre-design boring logs generally note the presence of black staining or sheen consistent with the assumed locations of the TechLaw photos, however those observations alone are not indicative of the presence of brine sludge. The findings presented in the Revised Landfills 1 & 2 Phase II Pre-Design Work Plan will be

referenced in Section 2.1.2 of the text along with the summary above. Separate discussions with the Maine DEP regarding how the potential presence of brine sludge affects the characterization of the material to be removed from Landfill 2 are ongoing and results of these discussions will also be incorporated into the Final Landfill 2 CMI Plan as applicable.

Waste Characterization

2 .1.2 Preliminary Waste Characterization. Test pits were not dug in areas of highest mercury contamination. TCLP samples were not analyzed in areas of highest mercury contamination and therefore may not be representative of the waste that will be removed. In addition, mercury speciation has been performed at SB-LF2-15C, SB-LF2-23B, and SB-LF2-24B and total mercury, water soluble fraction and methylmercury results (summarized below) indicate the presence of both water soluble and highly volatile forms of mercury in Landfill 2. According to the Frontier Geosciences Standard Operating Procedure for Selective Sequential Extraction of Geological Samples for the Determination of Biogeochemically Relevant Inorganic Mercury Fractionation (FGS-090.3.1), Mercury extracted in the Water Soluble Mercury Test (F-1) is useful in assessing the potential leaching of soils by rain or groundwater and is a reasonably good (+ 50%) predictor of the performance of the sample on an official TCLP or EP-toxicity leaching test. High values for this parameter (greater than either 1 ug/g or 5% of the total Hg- as in the case of SB-LF2-23B and SB-LF2-15C) may warrant further investigations into the kinetics of leaching. The speciation samples were also collected at depth that may not represent the highest total mercury or agree with the results from the total mercury analyses at a particular sampling location. For example, the speciation sample at SB-LF2-15C was collected at a depth of 5-6'. The mercury result for this speciation sample as determined by Frontier Geoscience was 67.2 mg/Kg. The XRF mercury result for this depth was 493 mg/kg. The XRF result for this location at a depth of 10-11' was 5130 mg/Kg which might indicate a significant increase in both water soluble and methylmercury at this depth. It is highly likely that the soil from this location at a depth of 10-11' would fail TCLP. In addition, methylmercury was detected in all three samples.

SAMPLE_POINT_NAME	SAMPLE_DATE	SAMPLE_TYPE	TEST	PARAMETER	CONCENTRATION	UNITS
SB-LF2-24B	7/20/2015	SL	E1631M	MERCURY	28400	NG/G
SB-LF2-24B	7/20/2015	SL	E1631M	MERCURY (WATER SOLUBLE FRACTION)	404	NG/G
SB-LF2-24B	7/20/2015	SL	E1630M	METHYLMERCURY	21.3	NG/G
SB-LF2-23B	7/20/2015	SL	E1631M	MERCURY	130000	NG/G
SB-LF2-23B	7/20/2015	SL	E1631M	MERCURY (WATER SOLUBLE FRACTION)	1940	NG/G

SB-LF2-23B	7/20/2015	SL	E1630M	METHYLMERCURY	2.87	NG/G
SB-LF2-15C	7/22/2015	SL	E1631M	MERCURY	67200	NG/G
SB-LF2-15C	7/22/2015	SL	E1631M	MERCURY (WATER SOLUBLE FRACTION)	1150	NG/G
SB-LF2-15C	7/22/2015	SL	E1630M	METHYLMERCURY	47.5	NG/G
SB-LF2-24B	8/11/2015	SD	E1631M	MERCURY (WATER SOLUBLE FRACTION)	378.1	NG/G

Response: The purpose of the two test pit samples was to obtain preliminary information and identify potential disposal options. Subsequent to submittal of the Draft Landfill 2 CMI Plan, samples for waste characterization analysis have been collected at a frequency of approximately one sample per 500 tons of material to be disposed, resulting in 75 additional samples being collected across Landfill 2. The samples were analyzed in accordance with applicable regulations and disposal facility requirements including EPA Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). The total mercury concentration in the waste characterization samples ranged up to 720 mg/kg and none of the sample samples failed the TCLP for mercury.

Brine Sludge

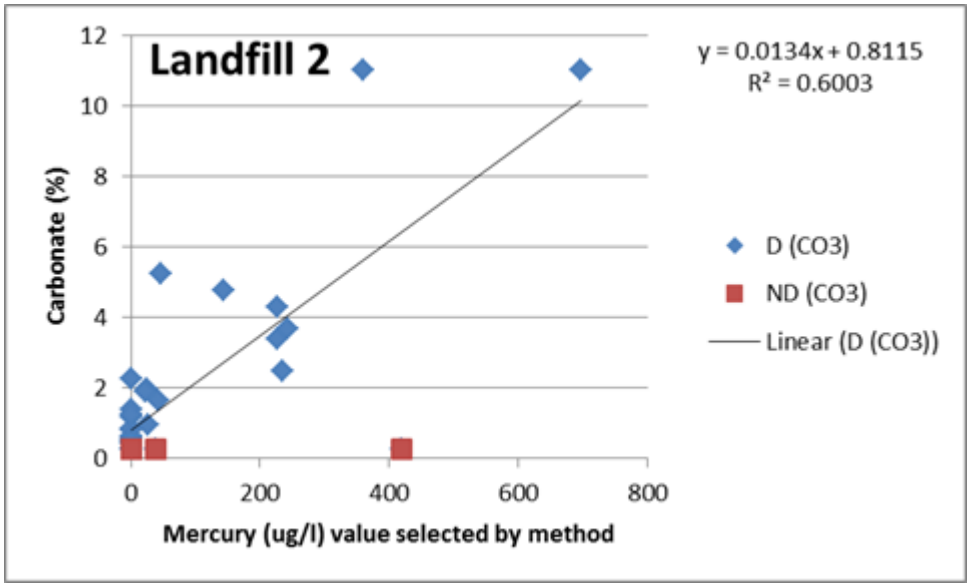
Comments provided to Mallinckrodt on April 10, 2015 regarding the Work Plan for the Landfills 1 &2 Phase II Pre-Design Work dated February 27, 2015, discussed the Department's opinion on the presence of sludge in Landfill 2. Acknowledgement of these comments should be included in section 2.1.2. An excerpt from these comments is provided below:

"Section 1.2.1. The discussion of characterization of brine sludge waste is inadequate. There needs to be a discussion of the bulking of the waste with soil and other materials which would alter its original appearance and dilute the listed waste and its components throughout the bulked material. An analysis of the existing data shows a correlation of the waste layer with sludge constituents and a consistent waste layer when looking at the mercury concentrations.

<u>Sludge constituents</u>

The text states that the materials encountered do not exhibit chemical characteristics of brine purification sludge. The composition of the sludge that was tabulated in the 1998 CDM investigation showed that the sludge was primarily calcium carbonate with smaller amounts of several other constituents. This report work plan included concentration-depth graphs (Figures 1-6A-B and 1-12A-K) for some of the sludge constituents. Sludge constituents were only analyzed from samples collected at four-foot intervals, so most of the profiles had only two or three analyses. Many for the sludge constituents are also abundant in the soils that were reportedly mixed in to strengthen the waste (Ba, Ca, Mg, Na, Sr). One of the plotted constituents

(Cl) is expected to be mobile in percolating soil moisture. Carbonate was analyzed but not shown on the graphs. Mercury was much more abundant in the sludge than in the bulking soil, and mercury is not very mobile in soil, so other major sludge constituents that are more abundant in the sludge and relatively resistant to leaching should correlate with mercury in the population of samples likely to be composed of a sludge-soil mixture. A scatter plot carbonate (%) over mercury (ppm) for just Landfill 2 samples (expected to be nearly all brine sludge) shows the major constituent of the sludge (carbonate) positively correlates with mercury despite the heterogeneity of the samples. Calcium also correlates positively with mercury. Furthermore, samples from SB-LF2-02 and SB-LF2-07 where the logger observed anomalous soil colors and textures had very elevated mercury concentrations. These observations and correlations support the Department's position that the landfill waste in Landfill 2 is overwhelmingly brine purification sludge. There are fewer data for Landfill 1, but the data that exists are consistent with this position."



Response: The information requested above was presented in the Revised Landfills 1 & 2 Phase II Pre-Design Work, dated May 15, 2015 and the associated response to comments included with that document submitted to the Maine DEP. Please see the response to General Comment E above for more information regarding the potential presence of brine sludge in Landfill 2. Separate discussions with the Maine DEP regarding how the potential presence of brine sludge affects the characterization of the material to be removed from Landfill 2 are ongoing and results of these discussions will also be incorporated into the Final Landfill 2 CMI Plan as applicable.

Engineering Comments

1. *2.2, Geotechnical Investigation Results. The geotechnical borings are not illustrated on Figure 2-1 as specified; however, they are shown on Drawing 4, Existing Conditions, within Appendix F. The narrative within Section 2.2 or Figure 2-1 should be updated as appropriate.*

Response: Figure 2-1 has been updated to include the geotechnical borings.

2. *4.6.1, Excavation. The narrative or other applicable section should be updated to specify provisions including timeframes and action levels for surveying the proposed railroad monitoring points. The monitoring locations are illustrated on Sheet 12 of the Drawings in Appendix F. A system for reporting exceedances of the action levels to the Department should be established. Action levels are provided in Appendix I-3 of the CMI Plan.*

Response: Specification Section 13020 (Subsection 3.08) has been revised to include the requested information. The revised specification is provided in Attachment E to this response. Exceedances of the Limiting Values (LVs) will be reported to the Remediation Project Manager. The Remediation Project Manager will notify Mallinckrodt and the Maine DEP onsite representative of any exceedances of the LVs. The Remediation Contractor's Excavation and Restoration Work Plan included in Attachment E to this response refers to Specification 13020.

3. *4.6.2, Excavation Dewatering. The Remediation Contractor's Construction Water Management Plan will need to be submitted for Department review and approval. The Plan will need to include provisions for the management of water around the excavation area, management of water within the excavation area, and installation of the temporary sheet pile wall around areas LF2-1 through LF2-6 and LF2-8. Based on the Contact Water Volume Calculation provided in Appendix I-2, a diversion berm will be installed between the Phase I and Phases 2 and 3 excavation areas. The diversion berm will need to be illustrated on the applicable drawing. Specification Section 02140 of the Specifications in Appendix G will need to be updated as appropriate.*

Response: The Remediation Contractor's Construction Water Management Plan included in Attachment E to this response includes the components requested. The proposed diversion berm between the Phase 1 and Phase 2 and 3 excavation areas are in the Remediation Contractor's Construction Water Management Plan.

4. *4.6.3, Excavation Support/Stability. Once completed, the Remediation Contractor's Excavation and Restoration Work Plan will need to be submitted for Department review and approval. The stability analysis provided in Appendix I-3 of the CMI Plan indicates that a stable configuration can be achieved with either a properly benched excavation or a steel sheet pile wall. A phased approach to restoration should be implemented that includes permanently seeding and mulching areas once they are excavated and backfilled.*

Response: The Remediation Contractor's Excavation and Restoration Plan is included in Attachment E to this response. The Remediation Contractor's Excavation Support Design will be submitted to the Maine DEP as a separate submittal in August 2016. A phased approach to restoration will be implemented to the extent practical. Management of areas not restored before winter will be described in the Site-wide Overwinter E&S Plan to be submitted to the Maine DEP in September 2016.

APPENDIX G, SPECIFICATIONS

Section 13030 - Steel Sheet Pile Shoring

1. Page 13030-2, Part 1.04. The Remediation Contractor's shoring wall design and drawings should be provided to the Department for review as part of the Excavation and Restoration Work Plan.

Response: The Remediation Contractor's Excavation Support Design will be provided to the Maine DEP as a separate submittal from the Excavation and Restoration Work Plan and will be submitted in August 2016.

2. Page 13030-4, Part 4.03. This section should be revised to note that the proposed sheet pile will be embedded a minimum of 4 feet into till layer as recommended in the stability analysis.

Response: The specification has been revised as requested. The revised specification is provided in Attachment F to this response.

Section 02200 - Earthwork

Page 02200-10, Part 3.03 H. 1. This section notes that structural fill and dense-graded gravel must be placed within 3% of the optimum moisture content while Section 02220-3 specifies that both structural fill and dense-graded gravel must be placed with a corresponding water content at "+/- 1% of the standard proctor value". Either standard seems reasonable. A clarification should be made.

Response: Specification Section 02220-3 has been updated to require +/-3% of the standard proctor value. The revised specification is provided in Attachment F to this response.

APPENDIX H, CONSTRUCTION QUALITY ASSURANCE PLAN

1.5.2, Progress Meetings. The Department's on-site oversight inspector should attend the weekly site progress meetings.

Response: Section 1.5.2 of the CQA Plan has been updated to indicate that the Maine DEP's on-site oversight inspector will be invited to attend the progress meetings. The revised CQA Plan with this change will be included in the Final Landfill 2 CMI Plan.

Table 2, Field CQA Testing Requirements for Earthwork and Backfilling. More frequent in-place moisture-density testing should be conducted on the common fill and on-site re-used material in order to verify that the specified requirements are being achieved. As proposed, 1 test will be conducted per 100,000 ft^2. Based on the ease of conducting this type of testing, we recommend that in-place moisture-density testing be conducted at a minimum of 5 per acre per lift.

Response: Table 2 of the CQA Plan has been revised to require in-place moisture-density testing of common fill and on-site reused material at a frequency of 1 per 10,000 ft^2, which is consistent with the frequency used the Landfill Ridge Area. The revised CQA Plan with this change will be included in the Final Landfill 2 CMI Plan.

Sincerely,

Kathryn Zeigler

Director, Environmental Remediation

Attachments:

Attachment A-1 – Analytical Data from Re-Sampling in the Landfill 2 Area

Attachment A-2 – DMA Analytical Laboratory Reports

Attachment B-1 – Pre-Design Investigation Logs
(for locations that were re-sampled in April 2016)

Attachment B-2 – Resampling Investigation Logs

Attachment C – Revised Excavation and Confirmation Sampling Plans

Attachment D – Revised Soil Use Plan

Attachment E – Contractor Work Plans

Attachment F – Revised Specifications

Cc:

Pat Duft – Mallinckrodt US LLC

John Weston – CDM Smith

Dean Carter – CDM Smith

Chris Greene – Geosyntec

ATTACHMENT A-1

Analytical Data from Re-Sampling in the Landfill 2 Area

Location	Location ID	Sample ID	Depth Interval (ft)	Sample Date	Mercury by XRF Analysis (mg/kg)	Mercury by Method 7473 (mg/kg)	Mercury by Method 7473 Qualifier	Mercury by Method 7471 (mg/kg)	Mercury by Method 7471 Qualifier
Landfill 2	SB-LF2-15D	SB-LF2-15D-160422-13-14	13 - 14	4/22/2016	6.2	**4.367**		--	
Landfill 2	SB-LF2-15D	BD-1604220910	13 - 14	4/22/2016	14.3	**3.096**		--	
Landfill 2	SB-LF2-15D	SB-LF2-15D-160422-14-15	14 - 15	4/22/2016	0	0.762		--	
Landfill 2	SB-LF2-15D	SB-LF2-15D-160422-15-16	15 - 16	4/22/2016	10.2	1.297		--	
Landfill 2	SB-LF2-15D	SB-LF2-15D-160422-16-17	16 - 17	4/22/2016	0	0.331	J	--	
Landfill 2	SB-LF2-15D	SB-LF2-15D-160422-17-18	17 - 18	4/22/2016	14	1.169		--	
Landfill 2	SB-LF2-23C	SB-LF2-23C-160422-8-9	8 - 9	4/22/2016	0	0.285	ND	--	
Landfill 2	SB-LF2-23C	BD-1604220844	8 - 9	4/22/2016	0	0.281	ND	--	
Landfill 2	SB-LF2-23C	SB-LF2-23C-160422-9-10	9 - 10	4/22/2016	0	0.285	ND	--	
Landfill 2	SB-LF2-23C	SB-LF2-23C-160422-10-11	10 - 11	4/22/2016	0	0.282	ND	--	
Landfill 2	SB-LF2-23C	SB-LF2-23C-160422-11-12	11 - 12	4/22/2016	**51**	0.608		--	
Landfill 2	SB-LF2-23C	SB-LF2-23C-160422-12-13	12 - 13	4/22/2016	0	0.282	ND	--	
Landfill 2	SB-LF2-24C	SB-LF2-24C-160421-12-13	12 - 13	4/21/2016	0	1.385		--	
Landfill 2	SB-LF2-24C	SB-LF2-24C-160421-13-14	13 - 14	4/21/2016	0	0.315	ND	--	
Landfill 2	SB-LF2-24C	SB-LF2-24C-160421-14-15	14 - 15	4/21/2016	0	0.295	ND	--	
Landfill 2	SB-LF2-24C	SB-LF2-24C-160421-15-16	15 - 16	4/21/2016	0	0.292	ND	--	
Landfill 2	SB-LF2-24C	SB-LF2-24C-160421-16-17	16 - 17	4/21/2016	0	0.295	ND	--	
Landfill 2	SB-LF2-25A	SB-LF2-25A-160421-9-10	9 - 10	4/21/2016	8	**5.938**		--	
Landfill 2	SB-LF2-25A	SB-LF2-25A-160421-10-11	10 - 11	4/21/2016	13	0.504	J	--	
Landfill 2	SB-LF2-25A	SB-LF2-25A-160421-11-12	11 - 12	4/21/2016	0	0.796		--	
Landfill 2	SB-LF2-25A	SB-LF2-25A-160421-12-13	12 - 13	4/21/2016	0	0.338	J	--	
Landfill 2	SB-LF2-25A	SB-LF2-25A-160421-13-14	13 - 14	4/21/2016	0	0.286	ND	--	
Landfill 2	SB-LF2-26C	SB-LF2-26C-160421-18-19	18 - 19	4/21/2016	0	0.503	J	--	
Landfill 2	SB-LF2-26C	SB-LF2-26C-160421-19-20	19 - 20	4/21/2016	0	0.278	ND	--	
Landfill 2	SB-LF2-26C	SB-LF2-26C-160421-20-21	20 - 21	4/21/2016	0	0.282	ND	--	
Landfill 2	SB-LF2-26C	SB-LF2-26C-160421-21-22	21 - 22	4/21/2016	0	0.281	ND	--	
Landfill 2	SB-LF2-26C	SB-LF2-26C-160421-22-23	22 - 23	4/21/2016	0	0.279	ND	--	
Landfill 2	SB-LF2-28C	SB-LF2-28C-160421-13-14	13 - 14	4/21/2016	0	0.374	J	--	
Landfill 2	SB-LF2-28C	SB-LF2-28C-160421-14-15	14 - 15	4/21/2016	0	0.459	J	--	
Landfill 2	SB-LF2-28C	SB-LF2-28C-160421-15-16	15 - 16	4/21/2016	0	0.285	ND	--	
Landfill 2	SB-LF2-28C	SB-LF2-28C-160421-16-17	16 - 17	4/21/2016	0	0.292	ND	--	
Landfill 2	SB-LF2-28C	SB-LF2-28C-160421-17-18	17 - 18	4/21/2016	0	0.294	ND	--	
Landfill 2	SB-LF2-28C	SB-LF2-28C-160421-17-18-LR	17 - 18	4/21/2016	--	0.294	ND	--	
Landfill 2	SB-LF2-32C	SB-LF2-32C-160421-13-14	13 - 14	4/21/2016	0	0.280	ND	--	
Landfill 2	SB-LF2-32C	SB-LF2-32C-160421-14-15	14 - 15	4/21/2016	0	0.281	ND	--	
Landfill 2	SB-LF2-32C	SB-LF2-32C-160421-15-16	15 - 16	4/21/2016	0	0.284	ND	--	
Landfill 2	SB-LF2-32C	SB-LF2-32C-160421-16-17	16 - 17	4/21/2016	0	0.278	ND	--	
Landfill 2	SB-LF2-32C	SB-LF2-32C-160421-17-18	17 - 18	4/21/2016	0	0.278	ND	--	
Landfill 2	SB-LF2-35C	SB-LF2-35C-160421-13-14	13 - 14	4/21/2016	0	0.283	ND	--	
Landfill 2	SB-LF2-35C	SB-LF2-35C-160421-14-15	14 - 15	4/21/2016	0	0.281	ND	--	
Landfill 2	SB-LF2-35C	SB-LF2-35C-160421-15-16	15 - 16	4/21/2016	0	0.276	ND	--	
Landfill 2	SB-LF2-35C	SB-LF2-35C-160421-16-17	16 - 17	4/21/2016	0	0.284	ND	--	
Landfill 2	SB-LF2-35C	SB-LF2-35C-160421-17-18	17 - 18	4/21/2016	0	0.279	ND	--	
Landfill 2	SB-LF2-36A	SB-LF2-36A-160421-9-10	9 - 10	4/21/2016	0	1.640		--	
Landfill 2	SB-LF2-36A	SB-LF2-36A-160421-10-11	10 - 11	4/21/2016	0	0.306	ND	--	
Landfill 2	SB-LF2-36A	SB-LF2-36A-160421-11-12	11 - 12	4/21/2016	0	0.322	ND	--	
Landfill 2	SB-LF2-36A	SB-LF2-36A-160421-12-13	12 - 13	4/21/2016	0	0.283	ND	--	
Landfill 2	SB-LF2-36A	SB-LF2-36A-160421-8-9	8 - 9	4/21/2016	0	0.707		--	
Landfill 2	SB-LF2-43A	SB-LF2-43A-160421-13-14	13 - 14	4/21/2016	5.6	0.553	J	--	
Landfill 2	SB-LF2-43A	SB-LF2-43A-160421-14-15	14 - 15	4/21/2016	0	0.280	ND	--	
Landfill 2	SB-LF2-43A	SB-LF2-43A-160421-15-16	15 - 16	4/21/2016	0	0.278	ND	--	
Landfill 2	SB-LF2-43A	SB-LF2-43A-160421-16-17	16 - 17	4/21/2016	0	0.276	ND	--	
Landfill 2	SB-LF2-43A	SB-LF2-43A-160421-17-18	17 - 18	4/21/2016	0	0.275	ND	--	
Landfill 2	SB-LF2-57C	SB-LF2-57C-160421-8-9	8 - 9	4/21/2016	**20**	0.407	J	--	
Landfill 2	SB-LF2-57C	SB-LF2-57C-160421-9-10	9 - 10	4/21/2016	**20**	0.283	ND	--	
Landfill 2	SB-LF2-57C	SB-LF2-57C-160421-10-11	10 - 11	4/21/2016	0	0.438	J	--	

Location	Location ID	Sample ID	Depth Interval (ft)	Sample Date	Mercury by XRF Analysis (mg/kg)	Mercury by Method 7473 (mg/kg)	Mercury by Method 7473 Qualifier	Mercury by Method 7471 (mg/kg)	Mercury by Method 7471 Qualifier
Landfill 2	SB-LF2-57C	SB-LF2-57C-160421-11-12	11 - 12	4/21/2016	0	0.279	ND	--	
Landfill 2	SB-LF2-57C	SB-LF2-57C-160421-12-13	12 - 13	4/21/2016	0	0.282	ND	--	
Landfill 2	SB-LF2-57C	SB-LF2-57C-160421-12-13-LR	12 - 13	4/21/2016	--	0.282	ND	--	

Notes:

Data are from the 2016 Re-Sampling in the Landfill 2 Area

-- indicates that the analyte was not measured.

Bold number indicates that the mercury concentration is over the MPS of 2.2 mg/kg by method 7473 or 7471 or XRF greater than 15 mg/kg.
'LR' noted after the Sample ID indicates samples that were run as laboratory replicates.
DMA analysis (method 7473) of the 2016 Re-Sampling in the Landfill 2 Area was conducted in a laboratory certified by the state of Maine.

Qualifiers:
- A blank cell indicates that there is no qualifier for the corresponding data
- J: Estimated; the compound was detected between the detection limit and the reporting limit
- ND: The compound was not detected above the reporting limit shown in the results column

ATTACHMENT A-2

DMA ANALYTICAL LABORATORY REPORTS

Analytical Report – 04212016

Laboratory ID Number: MED000242701

Laboratory Certificate Number: 2015020

Date of Issue: 6/8/2015

Date of Expiration: 6/8/2017

Laboratory Name: Geosyntec Consultants Field DMA-80 Laboratory

Laboratory Address: 99 Industrial Way
Orrington, ME 04474

Laboratory Contact: Regina Rancatti
413-822-6266
rrancatti@geosyntec.com

Client: Mallinckrodt US, LLC

Project Name: Orrington Remediation

Project Number: BR0292

Report Date: 05/06/2016

The original project report/data package is held by Geosyntec Consultants Field DMA-80 Laboratory. This report/data package is paginated and should be reproduced only in its entirety. Geosyntec Consultants Field DMA-80 Laboratory holds no responsibility for results and/or data that are not consistent with the original.

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Attachment 1 – Electronic COC

Attachment 2 – Laboratory Control Sample Certificate Of Analysis

Case Narrative

Samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the analysis unless otherwise noted. Samples were received in coolers with sufficient ice to start the cooling process required for mercury samples. Samples are received on the day of sampling and analyzed within the holding time.

Sample quality control data is listed at the end of the report. Data in each section is sorted by analysis time so that quality control parameters for DMA analysis can be associated with the corresponding samples.

Non-detect (U) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the detection limit and reporting limit columns column. These qualifiers are applied based off of the wet weight concentrations because the DMA directly measures wet weight concentration. The mercury concentrations in this report are corrected with the corresponding total solids measurements to provide data on a dry weight basis for use in making regulatory decisions.

Recovery for LCS-04212016C-03 was above the recovery limit. Per the DMA Standard Operating Guideline, one additional LCS was analyzed which fell within the recovery limits. Therefore, the run was continued as normal and LCS-04212016C-04 was used as part of the quality control check.

Results of DMA mercury analysis via Method 7473

DMA Mercury Analysis - Method 7473											
Sample ID	Sample Collection Date	Sample Collection Time	Date of Sample Receipt	Parameter Name	Dry Weight Concentration (mg/kg)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	Sample Analysis Date	Sample Analysis Time	Analyst
SB-LF2-24C-160421-12-13	4/21/2016	8:16:00	4/21/2016	Mercury	1.385		0.291	0.582	4/21/2016	14:42:00	RLR
SB-LF2-24C-160421-13-14	4/21/2016	8:18:00	4/21/2016	Mercury	0.315	U	0.315	0.631	4/21/2016	14:52:00	RLR
SB-LF2-24C-160421-14-15	4/21/2016	8:20:00	4/21/2016	Mercury	0.295	U	0.295	0.590	4/21/2016	14:59:00	RLR
SB-LF2-24C-160421-15-16	4/21/2016	8:22:00	4/21/2016	Mercury	0.292	U	0.292	0.585	4/21/2016	15:06:00	RLR
SB-LF2-24C-160421-16-17	4/21/2016	8:24:00	4/21/2016	Mercury	0.295	U	0.295	0.591	4/21/2016	15:12:00	RLR
SB-LF2-25A-160421-9-10	4/21/2016	8:50:00	4/21/2016	Mercury	5.938		0.322	0.644	4/21/2016	15:19:00	RLR
SB-LF2-25A-160421-10-11	4/21/2016	8:52:00	4/21/2016	Mercury	0.504	J	0.285	0.571	4/21/2016	15:29:00	RLR
SB-LF2-25A-160421-11-12	4/21/2016	8:54:00	4/21/2016	Mercury	0.796		0.285	0.570	4/21/2016	15:36:00	RLR
SB-LF2-25A-160421-12-13	4/21/2016	8:56:00	4/21/2016	Mercury	0.338	J	0.286	0.572	4/21/2016	15:47:00	RLR
SB-LF2-25A-160421-13-14	4/21/2016	8:58:00	4/21/2016	Mercury	0.286	U	0.286	0.572	4/21/2016	15:54:00	RLR
SB-LF2-26C-160421-18-19	4/21/2016	9:30:00	4/21/2016	Mercury	0.503	J	0.280	0.560	4/21/2016	16:11:00	RLR
SB-LF2-26C-160421-19-20	4/21/2016	9:32:00	4/21/2016	Mercury	0.278	U	0.278	0.556	4/21/2016	16:22:00	RLR
SB-LF2-26C-160421-20-21	4/21/2016	9:34:00	4/21/2016	Mercury	0.282	U	0.282	0.564	4/21/2016	16:28:00	RLR
SB-LF2-26C-160421-21-22	4/21/2016	9:36:00	4/21/2016	Mercury	0.281	U	0.281	0.561	4/21/2016	16:35:00	RLR
SB-LF2-26C-160421-22-23	4/21/2016	9:38:00	4/21/2016	Mercury	0.279	U	0.279	0.558	4/21/2016	16:42:00	RLR
SB-LF2-28C-160421-13-14	4/21/2016	10:00:00	4/21/2016	Mercury	0.374	J	0.278	0.555	4/21/2016	16:49:00	RLR
SB-LF2-28C-160421-14-15	4/21/2016	10:02:00	4/21/2016	Mercury	0.459	J	0.280	0.559	4/21/2016	16:55:00	RLR
SB-LF2-28C-160421-15-16	4/21/2016	10:04:00	4/21/2016	Mercury	0.285	U	0.285	0.570	4/21/2016	17:02:00	RLR
SB-LF2-28C-160421-16-17	4/21/2016	10:06:00	4/21/2016	Mercury	0.292	U	0.292	0.585	4/21/2016	17:09:00	RLR
SB-LF2-28C-160421-17-18	4/21/2016	10:08:00	4/21/2016	Mercury	0.294	U	0.294	0.588	4/21/2016	17:15:00	RLR

Results of Total Solids analysis via Method 2540G

Total Solids Analysis - Method 2540G											
Sample ID	Sample Collection Date	Sample Collection Time	Date of Sample Receipt	Parameter Name	Result (% Solids)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	Sample Analysis Date	Sample Analysis Time	Analyst
SB-LF2-24C-160421-12-13	4/21/2016	8:16:00	4/21/2016	Total Solids	85.92		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-24C-160421-13-14	4/21/2016	8:18:00	4/21/2016	Total Solids	79.25		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-24C-160421-14-15	4/21/2016	8:20:00	4/21/2016	Total Solids	84.78		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-24C-160421-15-16	4/21/2016	8:22:00	4/21/2016	Total Solids	85.53		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-24C-160421-16-17	4/21/2016	8:24:00	4/21/2016	Total Solids	84.61		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-25A-160421-10-11	4/21/2016	8:52:00	4/21/2016	Total Solids	87.58		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-25A-160421-11-12	4/21/2016	8:54:00	4/21/2016	Total Solids	87.72		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-25A-160421-12-13	4/21/2016	8:56:00	4/21/2016	Total Solids	87.41		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-25A-160421-13-14	4/21/2016	8:58:00	4/21/2016	Total Solids	87.34		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-25A-160421-9-10	4/21/2016	8:50:00	4/21/2016	Total Solids	77.70		NA	NA	4/21/2016	14:57:00	RLR
SB-LF2-26C-160421-18-19	4/21/2016	9:30:00	4/21/2016	Total Solids	89.26		NA	NA	4/21/2016	16:27:00	RLR
SB-LF2-26C-160421-19-20	4/21/2016	9:32:00	4/21/2016	Total Solids	89.85		NA	NA	4/21/2016	16:27:00	RLR
SB-LF2-26C-160421-20-21	4/21/2016	9:34:00	4/21/2016	Total Solids	88.63		NA	NA	4/21/2016	16:27:00	RLR
SB-LF2-26C-160421-21-22	4/21/2016	9:36:00	4/21/2016	Total Solids	89.10		NA	NA	4/21/2016	16:28:00	RLR
SB-LF2-26C-160421-22-23	4/21/2016	9:38:00	4/21/2016	Total Solids	89.60		NA	NA	4/21/2016	16:28:00	RLR
SB-LF2-28C-160421-13-14	4/21/2016	10:00:00	4/21/2016	Total Solids	90.01		NA	NA	4/21/2016	16:28:00	RLR
SB-LF2-28C-160421-14-15	4/21/2016	10:02:00	4/21/2016	Total Solids	89.39		NA	NA	4/21/2016	16:28:00	RLR
SB-LF2-28C-160421-15-16	4/21/2016	10:04:00	4/21/2016	Total Solids	87.71		NA	NA	4/21/2016	16:28:00	RLR
SB-LF2-28C-160421-16-17	4/21/2016	10:06:00	4/21/2016	Total Solids	85.51		NA	NA	4/21/2016	16:28:00	RLR
SB-LF2-28C-160421-17-18	4/21/2016	10:08:00	4/21/2016	Total Solids	85.04		NA	NA	4/21/2016	16:28:00	RLR

Quality Control Results via Method 7473

DMA Method Blank and Laboratory Control Sample									
Sample ID	Wet Weight Concentration (mg/kg)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	% R	% Recovery Limits	Sample Analysis Date	Sample Analysis Time	Analyst
MB-04212016C-01	0.25	U	0.25	0.5			4/21/2016	14:25:00	RLR
LCS-04212016C-01	4.01		0.25	0.5	110	80 - 120	4/21/2016	14:31:00	RLR
LCS-04212016C-02	3.96		0.25	0.5	109	80 - 120	4/21/2016	16:00:00	RLR
MB-04212016C-02	0.25	U	0.25	0.5			4/21/2016	17:29:00	RLR
LCS-04212016C-03	4.38		0.25	0.5	120	80 - 120	4/21/2016	17:35:00	RLR
LCS-04212016C-04	3.93		0.25	0.5	108	80 - 120	4/21/2016	17:47:00	RLR

Notes:

- MB and LCS ending in -01 are not associated with samples; they are used in addition to the daily calibration to check the DMA before running samples.
- LCS samples are run every 10 samples. MBs are run every 20 samples.
- Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

DMA MS/MSDs											
Sample ID	Spiked Sample	Native Sample Wet Weight (mg/kg)	MS/MSD Added (mg/kg)	MS/MSD Found (mg/kg)	% R	% Recovery Limits	RPD	RPD Limit	Sample Analysis Date	Sample Analysis Time	Analyst
MS-04212016C-01	SB-LF2-28C-160421-16-17	0.25 U	2.97	3.12	103	80 - 120			4/21/2016	17:57:00	RLR
MSD-04212016C-01	SB-LF2-28C-160421-16-17	0.25 U	3.04	3.21	104	80 - 120	1.3	< 20	4/21/2016	18:08:00	RLR

Notes:

- MS/MSDs are run every 20 samples.
- Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

DMA Laboratory Duplicate Results										
Sample ID	**Native Sample ID**	**Dry Weight Concentration (mg/kg)**	**Qual**	**Native Sample Dry Weight Concentration (mg/kg)**	**Native Sample Qual**	**RPD**	**RPD Limit**	**Duplicate Qual**	**Sample Analysis Date**	**Sample Analysis Time**
SB-LF2-28C-160421-17-18-LR	SB-LF2-28C-160421-17-18	0.294	U	0.294	U	0	50		4/21/2016	17:22:00

Notes:

- Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

Quality Control Results via Method 2540G

Total Solids Quality Control Results						
Native Sample ID	**Parameter Name**	**Native Sample Result (% Solids)**	**Duplicate Sample Result (% Solids)**	**RPD**	**Qual**	**RPD Limit**
SB-LF2-25A-160421-13-14	Total Solids	87.34	87.76	0		5
Associated samples: SB-LF2-24C-160421-12-13, SB-LF2-24C-160421-13-14, SB-LF2-24C-160421-14-15, SB-LF2-24C-160421-15-16, SB-LF2-24C-160421-16-17, SB-LF2-25A-160421-10-11, SB-LF2-25A-160421-11-12, SB-LF2-25A-160421-12-13, SB-LF2-25A-160421-13-14, SB-LF2-25A-160421-9-10						
SB-LF2-28C-160421-17-18	Total Solids	85.04	84.87	0		5
Associated samples: SB-LF2-26C-160421-18-19, SB-LF2-26C-160421-19-20, SB-LF2-26C-160421-20-21, SB-LF2-26C-160421-21-22, SB-LF2-26C-160421-22-23, SB-LF2-28C-160421-13-14, SB-LF2-28C-160421-14-15, SB-LF2-28C-160421-15-16, SB-LF2-28C-160421-16-17, SB-LF2-28C-160421-17-18						

Total Solids Laboratory Control Sample							
Sample ID	**Result (% Solids)**	**Actual LCS (% Solids)**	**% R**	**% Recovery Limits**	**Sample Analysis Date**	**Sample Analysis Time**	**Analyst**
LCS-TS-04212016-01	80.23	80.23	100	80-120	4/21/2016	16:28:00	RLR

Notes:

- LCS samples are run every 20 samples.

-Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

Qualifiers and Definitions

U – The compound was below the detection limit.

J – The compound was detected between the detection limit and the reporting limit.

E – The concentration exceeded the calibration. The sample will only be diluted and re-run if requested by the client.

LCS – Laboratory Control Sample

MB – Method Blank

MS – Matrix Spike

MSD – Matrix Spike Duplicate

Notes

There is no prep method for DMA analysis.

Dilution factor not applicable for soils

Results contained within this report relate only to the samples submitted under this Geosyntec Consultants Field DMA-80 Laboratory Report Number. This report must not be reproduced, except in full, without the written approval of the Geosyntec Consultants Field DMA-80 Laboratory.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Signed:

Regina Rancatti, Ph.D. Date: 05/06/2016
Laboratory Director

END OF REPORT

Attachment 1 – Electronic COC

Sample ID	Sample Date	Sample Time	Boring Receipt Date and Time	Relinquished By	Received By	Clearly Labeled as Required	Contained in the Appropriate Closed Container	Adequate Volume for Analysis	Received within the Proper Holding Time
SB-LF2-24C-160421-12-13	4/21/2016	8:16	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-24C-160421-13-14	4/21/2016	8:18	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-24C-160421-14-15	4/21/2016	8:20	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-24C-160421-15-16	4/21/2016	8:22	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-24C-160421-16-17	4/21/2016	8:24	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-25A-160421-9-10	4/21/2016	8:50	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-25A-160421-10-11	4/21/2016	8:52	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-25A-160421-11-12	4/21/2016	8:54	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-25A-160421-12-13	4/21/2016	8:56	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-25A-160421-13-14	4/21/2016	8:58	4/21/2016 12:38	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-26C-160421-18-19	4/21/2016	9:30	4/21/2016 12:39	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-26C-160421-19-20	4/21/2016	9:32	4/21/2016 12:39	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes

Sample ID	Sample Date	Sample Time	Boring Receipt Date and Time	Relinquished By	Received By	Clearly Labeled as Required	Contained in the Appropriate Closed Container	Adequate Volume for Analysis	Received within the Proper Holding Time
SB-LF2-26C-160421-20-21	4/21/2016	9:34	4/21/2016 12:39	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-26C-160421-21-22	4/21/2016	9:36	4/21/2016 12:39	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-26C-160421-22-23	4/21/2016	9:38	4/21/2016 12:39	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-28C-160421-13-14	4/21/2016	10:00	4/21/2016 12:40	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-28C-160421-14-15	4/21/2016	10:02	4/21/2016 12:40	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-28C-160421-15-16	4/21/2016	10:04	4/21/2016 12:40	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-28C-160421-16-17	4/21/2016	10:06	4/21/2016 12:40	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-28C-160421-17-18	4/21/2016	10:08	4/21/2016 12:40	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes

Attachment 2 – Laboratory Control Sample Certificate of Analysis

National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 2781

Domestic Sludge

This Standard Reference Material (SRM) is intended primarily for use in the evaluation of methods used for the analysis of sludges and other materials of a similar matrix. SRM 2781 is a dried and pulverized domestic sludge. A unit of SRM 2781 consists of 40 g of the dried material.

Certified Values: The certified values for 10 elements are listed in Table 1 and are based on concordant results from two or more analytical methods.

Analytical methods used for the characterization of this SRM are given in Table 3. All values are reported as mass fractions [1], on a dry mass basis and are based on measurements using a sample mass of at least 100 mg.

Noncertified Values: Noncertified values for eleven additional elements are listed in Table 2 and were derived from a combination of results from NIST and collaborating laboratories. These results may have sources of bias yet to be investigated and do not meet NIST criteria for certification.

Expiration of Certification: This certification is valid for five years from the date of shipment from NIST. However, the certification will be nullified if the SRM is contaminated or modified. Should any of the values change before the expiration of the certification, purchasers will be notified by NIST. Return of the attached registration card will facilitate notification.

Stability: This material is considered to be stable; however, its stability has not been rigorously assessed. NIST will continuously monitor this material and report any substantive changes in certification to the purchaser.

Use: A minimum sample mass of 100 mg (dry mass - see Instructions for Drying) should be used and sample preparation procedures should be designed to effect complete dissolution for analytical determinations to be related to the certified values provided.

Instructions for Drying: When nonvolatile elements are to be determined, samples should be vacuum dried at room temperature for 24 h or oven dried for 2 h at 110 °C. Volatile elements (e.g., arsenic, mercury, and selenium) should be determined on samples as received; separate samples should be dried according to these instructions to obtain a correction factor for moisture. Moisture corrections are then made to measurement values before comparing them to the certified values. [Note that the mass loss on drying at the time of certification was found to be in the range of 4.7 % to 6.6 % when using the recommended drying procedures.]

Statistical consultation was provided by L.M. Gill of the NIST Statistical Engineering Division.

The overall direction and coordination of the analyses were under the chairmanship of J.D. Fassett of the NIST Analytical Chemistry Division.

The technical and support aspects involved in the original preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by J.S. Kane. Revision of this certificate was coordinated through the Standard Reference Materials Program by B.S. MacDonald.

Gaithersburg, MD 20899
Certificate Issue Date: October 25, 1996
(Revision of certificate dated 6-22-95 to include addendum)

Thomas E. Gills, Chief
Standard Reference Materials Program

Source and Preparation of Material: The U.S. Geological Survey (USGS), under contract to NIST, obtained partially dehydrated sewage cake material from the Metropolitan Denver Sewage Disposal District No. 1. The material (approximately 182 kg) was placed in plastic-lined drums and transported to the USGS facilities in Lakewood, CO for processing. It was dried at ambient temperature in a forced air chamber, ground to pass a 74 m. (200 mesh) sieve, blended for 24 h to assure homogeneity of the pulverized material after which test samples were taken from the blender for preliminary homogeneity analyses. The material was then radiation sterilized. The sterilized material was shipped in bulk to NIST, where the material was bottled in 40 g units after reblending for 4 h.

Analysis: The homogeneity was assessed at USGS on 10 replicate samples of bulk material for over 40 elements using x-ray fluorescence (XRF) and/or inductively coupled plasma atomic emission spectrometry (ICP-AES). Homogeneity was further assessed during certification analysis; at sample sizes of 100 mg or greater. No sample-to-sample variations in excess of those expected from the analytical measurements were detected.

Certified Values and Uncertainties: The certified values are the means of the results from two or more independent analytical methods as described by Schiller and Eberhardt [2]. The uncertainty is based on a 95 % confidence interval for the true value, and includes an allowance for differences between the analytical methods used [3].

Table 1. Certified Mass Fractions

Element	Mass Fraction (in mg/kg)	Element	Mass Fraction (in %)
Arsenic	7.82 ± 0.28	Nitrogen	4.78 ± 0.11
Cadmium	12.78 ± 0.72		
Copper	627.4 ± 13.5		
Lead	202.1 ± 6.5		
Mercury	3.64 ± 0.25		
Molybdenum	46.7 ± 3.2		
Nickel	80.2 ± 2.3		
Selenium	16.0 ± 1.6		
Zinc	1273 ± 53		

Noncertified Values and Uncertainties: The noncertified values are the means of the results from two or more independent analytical methods as described by Schiller and Eberhardt [2]. The uncertainty is based on a 95 % confidence interval for the mean, and includes an allowance for differences between the analytical methods used [3]. As the accuracy of the measurements could not be assessed from the data, the uncertainty associated with a noncertified value may fail to include all sources of uncertainties and may represent only a measure of the precision of the measurement methods.

Table 2. Noncertified Mass Fractions

Element	Mass Fraction (in mg/kg)	Element	Mass Fraction (in %)
Chromium	202 ± 9	Aluminum	1.6 ± 0.1
Silver	98 ± 8	Calcium	3.9 ± 0.1
		Iron	2.8 ± 0.1
		Magnesium	0.59 ± 0.04
		Phosphorus	2.42 ± 0.09
		Potassium	0.49 ± 0.03
		Silicon	5.1 ± 0.2
		Sodium	0.21 ± 0.02
		Titanium	0.32 ± 0.03

Table 3. Methods used for the Analysis of SRM 2781*

Aluminum	INAA, ICP-AES, XRF
Arsenic	**RNAA, Hyd. AAS**, INAA
Cadmium	**ID-ICPMS, PGAA, RNAA**, INAA, **TXRF**
Calcium	INAA, TXRF, ICP-AES, XRF
Chromium	INAA, TXRF, ICP-AES
Copper	**ID-ICPMS, RNAA**, INAA, TXRF
Iron	INAA, TXRF, ICP-AES, XRF
Lead	**ICP-AES, ID-ICPMS**, TXRF
Magnesium	INAA, ICP-AES, XRF
Mercury	**FIA-CV-AAS, RNAA**, INAA
Molybdenum	**ID-ICPMS, ICP-AES, TXRF**, INAA
Nickel	**ICP-AES, ID-ICPMS**, INAA, TXRF
Nitrogen	**Kjeldahl, PGAA**
Phosphorus	Color, ICP-AES, XRF
Potassium	INAA, TXRF, ICP-AES
Selenium	**Hyd. AAS, RNAA, INAA, TXRF**
Silicon	XRF
Silver	RNAA, INAA, TXRF
Sodium	INAA, ICP-AES, XRF
Titanium	INAA, TXRF, XRF
Zinc	**ICP-AES, ID-ICPMS, INAA, TXRF**

*Methods used for establishment of certified values are shown in bold-face type; methods used for information only values or to corroborate certified values are not in bold.

Methods

FIA-CV-AAS	Flow injection analysis cold vapor atomic absorption spectrometry
Hyd. AAS	Hydride generation atomic absorption spectrometry
ICP-AES	Inductively coupled plasma atomic emission spectrometry
ID-ICPMS	Isotope dilution inductively coupled plasma mass spectrometry
INAA	Instrumental neutron activation analysis
PGAA	Prompt gamma activation analysis
RNAA	Radiochemical neutron activation analysis
TXRF	Total reflectance x-ray fluorescence
XRF	Wavelength dispersive x-ray fluorescence

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[3] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed. ISO, Geneva, Switzerland, (1993): see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note, 1297, U.S. Government Printing Office, Washington D.C., (1994).

Addendum to Standard Reference Material® 2781

Domestic Sludge

Leachable Mass Fractions Using U.S. EPA and NJDEP Methods for Flame Atomic Absorption Spectrometry and Inductively Coupled Plasma Atomic Emission Spectrometry

The certified concentration values of constituent elements in this certificate are given as total mass fractions. To obtain total mass fractions, either subsamples of the SRM must be completely decomposed, or the sample must be analyzed directly in its solid form. For mixed acid dissolution, hydrofluoric acid must be included in the acid mixture to totally dissolve siliceous material present in sludge.

For a number of environmental monitoring purposes, acid extractable mass fractions of elements are often used rather than total mass fractions. Acid extractable methods do not necessarily result in total decomposition of the sludge. It should be noted that results obtained using acid leach conditions are often depicted in reports as total results. However, reported acid labile or extractable mass fractions of elements are generally lower than total mass fractions. Results are often presented as measured mass fractions in the leachate in comparison to the total or certified mass fractions. The recovery of an element as a percent of total is a function of several factors such as the mode of occurrence in the sample, leach medium, leach time, temperature conditions, and pH of the sample-leach medium mixture [1].

In its monitoring programs, the U.S. Environmental Protection Agency (U.S. EPA) has established a number of leach methods, such as Methods 3015, 3050, and 3051 [2,3] for the determination of acid labile or extractable mass fractions of elements. The New Jersey Department of the Environment (NJDEP) has developed its own leach method, NJDEP 100 for state use [4]. The NJDEP and the U.S. EPA prepared samples of SRM 2781 using the NJDEP 100 method and EPA Methods 3050 and 3051 and analyzed the resulting leachates by flame atomic absorption spectrometry (FAAS) and inductively coupled plasma atomic emission spectrometry (ICP-AES).

Reference values have been established for the acid-leachable mass fractions of several elements in SRM 2781. These values are the means of all results from the different leach measurement methods and combinations used. The reference values are listed in Table 1, along with their uncertainties which are based on 95 % confidence intervals of the means of results. For some of the elements (copper, iron, silver, vanadium), no statistically significant differences were found among results from the two laboratories using three or four combinations of sample preparation and instrumental measurement techniques (NJDEP 100 - FAAS; NJDEP 100 - ICP-AES; EPA 3050 - ICP-AES; EPA 3051 - ICP-AES). For all other elements, statistically significant between-laboratory differences were identified and are included in the stated uncertainties. These differences are small in comparison to control limits for many environmental monitoring programs. Therefore, the reference values are meaningful, despite the between-laboratory differences found.

Reference Values and Uncertainties: The reference values given in Table 1 are not NIST certified but are provided as a reference for U.S. EPA 3050 and 3051, and NJDEP 100 methods. The uncertainties are based on a 95 % confidence interval for the mean and include an allowance for differences between the analytical methods used.

Gaithersburg, MD 20899
Addendum Issue Date: October 25, 1996

Thomas E. Gills, Chief
Standard Reference Material Program

Table 1. Reference Leach Values for SRM 2781

Element	Leachable mass fraction (in mg/kg)			% Leach Recovery*
Aluminum	8 040	±	980	50
Barium	570	±	65	---
Cadmium	11	±	2	86
Calcium	36 440	±	1 830	93
Chromium	143	±	14	71
Copper	601	±	16	96
Iron	24 300	±	2 100	87
Lead	183	±	15	91
Magnesium	4 850	±	290	82
Manganese	745	±	33	---
Nickel	72.3	±	6.3	90
Silver	86.3	±	1.7	88
Vanadium	81.9	±	3.8	---
Zinc	1 120	±	34	88

$$* \text{ \% Leach Recovery} = 100 \times \frac{\text{Leach Value}}{\text{Certified or Noncertified Value}}$$

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[2] U.S. EPA 1991 Code of Federal Regulations, Title 40, Part 136, Paragraph 33.
[3] Federal Register 1-13-95 SW-846 update #2, Final.
[4] New Jersey Administrative Code, 1994. N.J.A.C. 7:14-4.

Analytical Report – 04222016

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Attachments:

Attachment 1 – Electronic COC

Attachment 2 – Laboratory Control Sample Certificate Of Analysis

Case Narrative

Samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the analysis unless otherwise noted. Samples were received in coolers with sufficient ice to start the cooling process required for mercury samples. Samples are received on the day of sampling and analyzed within the holding time.

Sample quality control data is listed at the end of the report. Data in each section is sorted by analysis time so that quality control parameters for DMA analysis can be associated with the corresponding samples.

Non-detect (U) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the detection limit and reporting limit columns column. These qualifiers are applied based off of the wet weight concentrations because the DMA directly measures wet weight concentration. The mercury concentrations in this report are corrected with the corresponding total solids measurements to provide data on a dry weight basis for use in making regulatory decisions.

Results of DMA mercury analysis via Method 7473

DMA Mercury Analysis - Method 7473											
Sample ID	Sample Collection Date	Sample Collection Time	Date of Sample Receipt	Parameter Name	Dry Weight Concentration (mg/kg)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	Sample Analysis Date	Sample Analysis Time	Analyst
SB-LF2-32C-160421-13-14	4/21/2016	10:16:00	4/21/2016	Mercury	0.280	U	0.280	0.560	4/22/2016	12:00:00	RLR
SB-LF2-32C-160421-14-15	4/21/2016	10:18:00	4/21/2016	Mercury	0.281	U	0.281	0.562	4/22/2016	12:07:00	RLR
SB-LF2-32C-160421-15-16	4/21/2016	10:20:00	4/21/2016	Mercury	0.284	U	0.284	0.568	4/22/2016	12:14:00	RLR
SB-LF2-32C-160421-16-17	4/21/2016	10:22:00	4/21/2016	Mercury	0.278	U	0.278	0.556	4/22/2016	12:21:00	RLR
SB-LF2-32C-160421-17-18	4/21/2016	10:24:00	4/21/2016	Mercury	0.278	U	0.278	0.556	4/22/2016	12:27:00	RLR
SB-LF2-35C-160421-13-14	4/21/2016	10:52:00	4/21/2016	Mercury	0.283	U	0.283	0.566	4/22/2016	12:34:00	RLR
SB-LF2-35C-160421-14-15	4/21/2016	10:54:00	4/21/2016	Mercury	0.281	U	0.281	0.562	4/22/2016	12:41:00	RLR
SB-LF2-35C-160421-15-16	4/21/2016	10:56:00	4/21/2016	Mercury	0.276	U	0.276	0.552	4/22/2016	12:47:00	RLR
SB-LF2-35C-160421-16-17	4/21/2016	10:58:00	4/21/2016	Mercury	0.284	U	0.284	0.567	4/22/2016	12:54:00	RLR
SB-LF2-35C-160421-17-18	4/21/2016	11:00:00	4/21/2016	Mercury	0.279	U	0.279	0.558	4/22/2016	13:01:00	RLR
SB-LF2-36A-160421-8-9	4/21/2016	11:20:00	4/21/2016	Mercury	0.707		0.299	0.599	4/22/2016	14:15:00	RLR
SB-LF2-36A-160421-9-10	4/21/2016	11:22:00	4/21/2016	Mercury	1.640		0.284	0.567	4/22/2016	14:25:00	RLR
SB-LF2-36A-160421-10-11	4/21/2016	11:24:00	4/21/2016	Mercury	0.306	U	0.306	0.613	4/22/2016	14:36:00	RLR
SB-LF2-36A-160421-11-12	4/21/2016	11:26:00	4/21/2016	Mercury	0.322	U	0.322	0.644	4/22/2016	14:43:00	RLR
SB-LF2-36A-160421-12-13	4/21/2016	11:28:00	4/21/2016	Mercury	0.283	U	0.283	0.565	4/22/2016	14:50:00	RLR
SB-LF2-57C-160421-8-9	4/21/2016	12:56:00	4/21/2016	Mercury	0.407	J	0.283	0.567	4/22/2016	14:57:00	RLR
SB-LF2-57C-160421-9-10	4/21/2016	12:58:00	4/21/2016	Mercury	0.283	U	0.283	0.565	4/22/2016	15:03:00	RLR
SB-LF2-57C-160421-10-11	4/21/2016	13:00:00	4/21/2016	Mercury	0.438	J	0.285	0.570	4/22/2016	15:10:00	RLR
SB-LF2-57C-160421-11-12	4/21/2016	13:02:00	4/21/2016	Mercury	0.279	U	0.279	0.559	4/22/2016	15:17:00	RLR
SB-LF2-57C-160421-12-13	4/21/2016	13:04:00	4/21/2016	Mercury	0.282	U	0.282	0.564	4/22/2016	15:23:00	RLR
SB-LF2-43A-160421-13-14	4/21/2016	12:44:00	4/21/2016	Mercury	0.553	J	0.282	0.564	4/22/2016	16:22:00	RLR
SB-LF2-43A-160421-14-15	4/21/2016	12:46:00	4/21/2016	Mercury	0.280	U	0.280	0.561	4/22/2016	16:33:00	RLR

DMA Mercury Analysis - Method 7473											
Sample ID	Sample Collection Date	Sample Collection Time	Date of Sample Receipt	Parameter Name	Dry Weight Concentration (mg/kg)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	Sample Analysis Date	Sample Analysis Time	Analyst
SB-LF2-43A-160421-15-16	4/21/2016	12:48:00	4/21/2016	Mercury	0.278	U	0.278	0.555	4/22/2016	16:39:00	RLR
SB-LF2-43A-160421-16-17	4/21/2016	12:50:00	4/21/2016	Mercury	0.276	U	0.276	0.552	4/22/2016	16:46:00	RLR
SB-LF2-43A-160421-17-18	4/21/2016	12:52:00	4/21/2016	Mercury	0.275	U	0.275	0.550	4/22/2016	16:53:00	RLR
SB-SMY-06B-160422-4-5	4/22/2016	7:24:00	4/22/2016	Mercury	1.230		0.291	0.583	4/22/2016	16:59:00	RLR
SB-SMY-06B-160422-5-6	4/22/2016	7:26:00	4/22/2016	Mercury	0.787		0.342	0.683	4/22/2016	17:10:00	RLR
SB-SMY-06B-160422-6-7	4/22/2016	7:28:00	4/22/2016	Mercury	1.109	U	1.109	2.217	4/22/2016	17:21:00	RLR
SB-SMY-06B-160422-7-8	4/22/2016	7:30:00	4/22/2016	Mercury	0.606	U	0.606	1.212	4/22/2016	17:27:00	RLR
SB-SMY-06B-160422-8-9	4/22/2016	7:32:00	4/22/2016	Mercury	0.365	U	0.365	0.731	4/22/2016	17:34:00	RLR

Results of Total Solids analysis via Method 2540G

Total Solids Analysis - Method 2540G											
Sample ID	Sample Collection Date	Sample Collection Time	Date of Sample Receipt	Parameter Name	Result (% Solids)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	Sample Analysis Date	Sample Analysis Time	Analyst
SB-LF2-32C-160421-13-14	4/21/2016	10:16:00	4/21/2016	Total Solids	89.27		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-32C-160421-14-15	4/21/2016	10:18:00	4/21/2016	Total Solids	88.96		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-32C-160421-15-16	4/21/2016	10:20:00	4/21/2016	Total Solids	87.97		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-32C-160421-16-17	4/21/2016	10:22:00	4/21/2016	Total Solids	89.97		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-32C-160421-17-18	4/21/2016	10:24:00	4/21/2016	Total Solids	89.87		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-35C-160421-13-14	4/21/2016	10:52:00	4/21/2016	Total Solids	88.38		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-35C-160421-14-15	4/21/2016	10:54:00	4/21/2016	Total Solids	88.94		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-35C-160421-15-16	4/21/2016	10:56:00	4/21/2016	Total Solids	90.64		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-35C-160421-16-17	4/21/2016	10:58:00	4/21/2016	Total Solids	88.11		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-35C-160421-17-18	4/21/2016	11:00:00	4/21/2016	Total Solids	89.56		NA	NA	4/22/2016	15:03:00	RLR
SB-LF2-36A-160421-10-11	4/21/2016	11:24:00	4/21/2016	Total Solids	81.57		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-36A-160421-11-12	4/21/2016	11:26:00	4/21/2016	Total Solids	77.58		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-36A-160421-12-13	4/21/2016	11:28:00	4/21/2016	Total Solids	88.45		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-36A-160421-8-9	4/21/2016	11:20:00	4/21/2016	Total Solids	83.49		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-36A-160421-9-10	4/21/2016	11:22:00	4/21/2016	Total Solids	88.14		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-57C-160421-10-11	4/21/2016	13:00:00	4/21/2016	Total Solids	87.73		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-57C-160421-11-12	4/21/2016	13:02:00	4/21/2016	Total Solids	89.52		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-57C-160421-12-13	4/21/2016	13:04:00	4/21/2016	Total Solids	88.71		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-57C-160421-8-9	4/21/2016	12:56:00	4/21/2016	Total Solids	88.24		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-57C-160421-9-10	4/21/2016	12:58:00	4/21/2016	Total Solids	88.43		NA	NA	4/22/2016	15:21:00	RLR
SB-LF2-43A-160421-13-14	4/21/2016	12:44:00	4/21/2016	Total Solids	88.70		NA	NA	4/22/2016	16:51:00	RLR
SB-LF2-43A-160421-14-15	4/21/2016	12:46:00	4/21/2016	Total Solids	89.15		NA	NA	4/22/2016	16:51:00	RLR
SB-LF2-43A-160421-15-16	4/21/2016	12:48:00	4/21/2016	Total Solids	90.02		NA	NA	4/22/2016	16:51:00	RLR

Total Solids Analysis - Method 2540G											
Sample ID	**Sample Collection Date**	**Sample Collection Time**	**Date of Sample Receipt**	**Parameter Name**	**Result (% Solids)**	**Qual**	**Method Detection Limit (mg/kg)**	**Reporting Limit (mg/kg)**	**Sample Analysis Date**	**Sample Analysis Time**	**Analyst**
SB-LF2-43A-160421-16-17	4/21/2016	12:50:00	4/21/2016	Total Solids	90.65		NA	NA	4/22/2016	16:51:00	RLR
SB-LF2-43A-160421-17-18	4/21/2016	12:52:00	4/21/2016	Total Solids	90.93		NA	NA	4/22/2016	16:51:00	RLR
SB-SMY-06B-160422-4-5	4/22/2016	7:24:00	4/22/2016	Total Solids	85.82		NA	NA	4/22/2016	16:51:00	RLR
SB-SMY-06B-160422-5-6	4/22/2016	7:26:00	4/22/2016	Total Solids	73.19		NA	NA	4/22/2016	16:51:00	RLR
SB-SMY-06B-160422-6-7	4/22/2016	7:28:00	4/22/2016	Total Solids	22.55		NA	NA	4/22/2016	16:51:00	RLR
SB-SMY-06B-160422-7-8	4/22/2016	7:30:00	4/22/2016	Total Solids	41.24		NA	NA	4/22/2016	16:51:00	RLR
SB-SMY-06B-160422-8-9	4/22/2016	7:32:00	4/22/2016	Total Solids	68.43		NA	NA	4/22/2016	16:51:00	RLR

Quality Control Results via Method 7473

DMA Method Blank and Laboratory Control Sample									
Sample ID	Wet Weight Concentration (mg/kg)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	% R	% Recovery Limits	Sample Analysis Date	Sample Analysis Time	Analyst
MB-04222016C-01	0.25	U	0.25	0.5			4/22/2016	11:43:00	RLR
LCS-04222016C-01	3.80		0.25	0.5	104	80 - 120	4/22/2016	11:50:00	RLR
LCS-04222016C-02	3.94		0.25	0.5	108	80 - 120	4/22/2016	13:07:00	RLR
MB-04222016C-02	0.25	U	0.25	0.5			4/22/2016	15:37:00	RLR
LCS-04222016C-03	3.91		0.25	0.5	107	80 - 120	4/22/2016	15:43:00	RLR
MB-04222016C-03	0.25	U	0.25	0.5			4/22/2016	17:47:00	RLR
LCS-04222016C-04	3.91		0.25	0.5	107	80 - 120	4/22/2016	17:54:00	RLR

Notes:

- MB and LCS ending in -01 are not associated with samples; they are used in addition to the daily calibration to check the DMA before running samples.
- LCS samples are run every 10 samples. MBs are run every 20 samples.
- Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

DMA MS/MSDs											
Sample ID	Spiked Sample	Native Sample Wet Weight (mg/kg)	MS/MSD Added (mg/kg)	MS/MSD Found (mg/kg)	% R	% Recovery Limits	RPD	RPD Limit	Sample Analysis Date	Sample Analysis Time	Analyst
MS-04222016C-01	SB-LF2-57C-160421-11-12	0.25 U	2.98	3.11	100	80 - 120			4/22/2016	15:54:00	RLR
MSD-04222016C-01	SB-LF2-57C-160421-11-12	0.25 U	3.06	3.17	100	80 - 120	0.4	< 20	4/22/2016	16:05:00	RLR
MS-04222016C-02	SB-SMY-06B-160422-7-8	0.25 U	2.98	3.16	104	80 - 120			4/22/2016	18:05:00	RLR
MSD-04222016C-02	SB-SMY-06B-160422-7-8	0.25 U	3.03	3.22	104	80 - 120	0.4	< 20	4/22/2016	18:15:00	RLR

Notes:

- MS/MSDs are run every 20 samples.
- Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

DMA Laboratory Duplicate Results										
Sample ID	Native Sample ID	Dry Weight Concentration (mg/kg)	Qual	Native Sample Dry Weight Concentration (mg/kg)	Native Sample Qual	RPD	RPD Limit	Duplicate Qual	Sample Analysis Date	Sample Analysis Time
SB-LF2-57C-160421-12-13-LR	SB-LF2-57C-160421-12-13	0.282	U	0.282	U	0	50		4/22/2016	15:30:00
SB-SMY-06B-160422-8-9-LR	SB-SMY-06B-160422-8-9	0.365	U	0.365	U	0	50		4/22/2016	17:41:00

Notes:

- Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

Quality Control Results via Method 2540G

Total Solids Quality Control Results						
Native Sample ID	**Parameter Name**	**Native Sample Result (% Solids)**	**Duplicate Sample Result (% Solids)**	**RPD**	**Qual**	**RPD Limit**
SB-LF2-35C-160421-17-18	Total Solids	89.56	88.77	1		5
Associated samples: SB-LF2-32C-160421-13-14, SB-LF2-32C-160421-14-15, SB-LF2-32C-160421-15-16, SB-LF2-32C-160421-16-17, SB-LF2-32C-160421-17-18, SB-LF2-35C-160421-13-14, SB-LF2-35C-160421-14-15, SB-LF2-35C-160421-15-16, SB-LF2-35C-160421-16-17, SB-LF2-35C-160421-17-18						
SB-LF2-57C-160421-12-13	Total Solids	88.71	88.93	0		5
Associated samples: SB-LF2-36A-160421-10-11, SB-LF2-36A-160421-11-12, SB-LF2-36A-160421-12-13, SB-LF2-36A-160421-8-9, SB-LF2-36A-160421-9-10, SB-LF2-57C-160421-10-11, SB-LF2-57C-160421-11-12, SB-LF2-57C-160421-12-13, SB-LF2-57C-160421-8-9, SB-LF2-57C-160421-9-10						
SB-SMY-06B-160422-8-9	Total Solids	68.43	68.83	1		5
Associated samples: SB-LF2-43A-160421-13-14, SB-LF2-43A-160421-14-15, SB-LF2-43A-160421-15-16, SB-LF2-43A-160421-16-17, SB-LF2-43A-160421-17-18, SB-SMY-06B-160422-4-5, SB-SMY-06B-160422-5-6, SB-SMY-06B-160422-6-7, SB-SMY-06B-160422-7-8, SB-SMY-06B-160422-8-9						

Total Solids Laboratory Control Sample							
Sample ID	**Result (% Solids)**	**Actual LCS (% Solids)**	**% R**	**% Recovery Limits**	**Sample Analysis Date**	**Sample Analysis Time**	**Analyst**
LCS-TS-04222016-01	80.07	80.05	100	80-120	4/22/2016	15:21:00	RLR
LCS-TS-04222016-02	80.23	80.23	100	80-120	4/22/2016	16:51:00	RLR

Notes:

- LCS samples are run every 20 samples.

-Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

Qualifiers and Definitions

U – The compound was below the detection limit.

J – The compound was detected between the detection limit and the reporting limit.

E – The concentration exceeded the calibration. The sample will only be diluted and re-run if requested by the client.

LCS – Laboratory Control Sample

MB – Method Blank

MS – Matrix Spike

MSD – Matrix Spike Duplicate

Notes

There is no prep method for DMA analysis.

Dilution factor not applicable for soils

Results contained within this report relate only to the samples submitted under this Geosyntec Consultants Field DMA-80 Laboratory Report Number. This report must not be reproduced, except in full, without the written approval of the Geosyntec Consultants Field DMA-80 Laboratory.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Signed:

Regina Rancatti, Ph.D. Date: 05/06/2016
Laboratory Director

END OF REPORT

Attachment 1 – Electronic COC

Sample ID	Sample Date	Sample Time	Boring Receipt Date and Time	Relinquished By	Received By	Clearly Labeled as Required	Contained in the Appropriate Closed Container	Adequate Volume for Analysis	Received within the Proper Holding Time
SB-LF2-32C-160421-13-14	4/21/2016	10:16	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-32C-160421-14-15	4/21/2016	10:18	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-32C-160421-15-16	4/21/2016	10:20	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-32C-160421-16-17	4/21/2016	10:22	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-32C-160421-17-18	4/21/2016	10:24	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-35C-160421-13-14	4/21/2016	10:52	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-35C-160421-14-15	4/21/2016	10:54	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-35C-160421-15-16	4/21/2016	10:56	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-35C-160421-16-17	4/21/2016	10:58	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-35C-160421-17-18	4/21/2016	11:00	4/21/2016 12:42	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-36A-160421-8-9	4/21/2016	11:20	4/21/2016 12:43	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-36A-160421-9-10	4/21/2016	11:22	4/21/2016 12:43	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes

Sample ID	Sample Date	Sample Time	Boring Receipt Date and Time	Relinquished By	Received By	Clearly Labeled as Required	Contained in the Appropriate Closed Container	Adequate Volume for Analysis	Received within the Proper Holding Time
SB-LF2-36A-160421-10-11	4/21/2016	11:24	4/21/2016 12:43	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-36A-160421-11-12	4/21/2016	11:26	4/21/2016 12:43	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-36A-160421-12-13	4/21/2016	11:28	4/21/2016 12:43	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-57C-160421-8-9	4/21/2016	12:56	4/21/2016 15:45	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-57C-160421-9-10	4/21/2016	12:58	4/21/2016 15:45	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-57C-160421-10-11	4/21/2016	13:00	4/21/2016 15:45	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-57C-160421-11-12	4/21/2016	13:02	4/21/2016 15:45	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-57C-160421-12-13	4/21/2016	13:04	4/21/2016 15:45	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-43A-160421-13-14	4/21/2016	12:44	4/21/2016 15:46	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-43A-160421-14-15	4/21/2016	12:46	4/21/2016 15:46	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-43A-160421-15-16	4/21/2016	12:48	4/21/2016 15:46	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-43A-160421-16-17	4/21/2016	12:50	4/21/2016 15:46	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes

Sample ID	Sample Date	Sample Time	Boring Receipt Date and Time	Relinquished By	Received By	Clearly Labeled as Required	Contained in the Appropriate Closed Container	Adequate Volume for Analysis	Received within the Proper Holding Time
SB-LF2-43A-160421-17-18	4/21/2016	12:52	4/21/2016 15:46	Laura Pasquine	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-06B-160422-4-5	4/22/2016	7:24	4/22/2016 14:34	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-06B-160422-5-6	4/22/2016	7:26	4/22/2016 14:34	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-06B-160422-6-7	4/22/2016	7:28	4/22/2016 14:34	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-06B-160422-7-8	4/22/2016	7:30	4/22/2016 14:34	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-06B-160422-8-9	4/22/2016	7:32	4/22/2016 14:34	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes

Attachment 2 – Laboratory Control Sample Certificate of Analysis

National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 2781

Domestic Sludge

This Standard Reference Material (SRM) is intended primarily for use in the evaluation of methods used for the analysis of sludges and other materials of a similar matrix. SRM 2781 is a dried and pulverized domestic sludge. A unit of SRM 2781 consists of 40 g of the dried material.

Certified Values: The certified values for 10 elements are listed in Table 1 and are based on concordant results from two or more analytical methods.

Analytical methods used for the characterization of this SRM are given in Table 3. All values are reported as mass fractions [1], on a dry mass basis and are based on measurements using a sample mass of at least 100 mg.

Noncertified Values: Noncertified values for eleven additional elements are listed in Table 2 and were derived from a combination of results from NIST and collaborating laboratories. These results may have sources of bias yet to be investigated and do not meet NIST criteria for certification.

Expiration of Certification: This certification is valid for five years from the date of shipment from NIST. However, the certification will be nullified if the SRM is contaminated or modified. Should any of the values change before the expiration of the certification, purchasers will be notified by NIST. Return of the attached registration card will facilitate notification.

Stability: This material is considered to be stable; however, its stability has not been rigorously assessed. NIST will continuously monitor this material and report any substantive changes in certification to the purchaser.

Use: A minimum sample mass of 100 mg (dry mass - see Instructions for Drying) should be used and sample preparation procedures should be designed to effect complete dissolution for analytical determinations to be related to the certified values provided.

Instructions for Drying: When nonvolatile elements are to be determined, samples should be vacuum dried at room temperature for 24 h or oven dried for 2 h at 110 °C. Volatile elements (e.g., arsenic, mercury, and selenium) should be determined on samples as received; separate samples should be dried according to these instructions to obtain a correction factor for moisture. Moisture corrections are then made to measurement values before comparing them to the certified values. [Note that the mass loss on drying at the time of certification was found to be in the range of 4.7 % to 6.6 % when using the recommended drying procedures.]

Statistical consultation was provided by L.M. Gill of the NIST Statistical Engineering Division.

The overall direction and coordination of the analyses were under the chairmanship of J.D. Fassett of the NIST Analytical Chemistry Division.

The technical and support aspects involved in the original preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by J.S. Kane. Revision of this certificate was coordinated through the Standard Reference Materials Program by B.S. MacDonald.

Gaithersburg, MD 20899
Certificate Issue Date: October 25, 1996
(Revision of certificate dated 6-22-95 to include addendum)

Thomas E. Gills, Chief
Standard Reference Materials Program

Source and Preparation of Material: The U.S. Geological Survey (USGS), under contract to NIST, obtained partially dehydrated sewage cake material from the Metropolitan Denver Sewage Disposal District No. 1. The material (approximately 182 kg) was placed in plastic-lined drums and transported to the USGS facilities in Lakewood, CO for processing. It was dried at ambient temperature in a forced air chamber, ground to pass a 74 m. (200 mesh) sieve, blended for 24 h to assure homogeneity of the pulverized material after which test samples were taken from the blender for preliminary homogeneity analyses. The material was then radiation sterilized. The sterilized material was shipped in bulk to NIST, where the material was bottled in 40 g units after reblending for 4 h.

Analysis: The homogeneity was assessed at USGS on 10 replicate samples of bulk material for over 40 elements using x-ray fluorescence (XRF) and/or inductively coupled plasma atomic emission spectrometry (ICP-AES). Homogeneity was further assessed during certification analysis; at sample sizes of 100 mg or greater. No sample-to-sample variations in excess of those expected from the analytical measurements were detected.

Certified Values and Uncertainties: The certified values are the means of the results from two or more independent analytical methods as described by Schiller and Eberhardt [2]. The uncertainty is based on a 95 % confidence interval for the true value, and includes an allowance for differences between the analytical methods used [3].

Table 1. Certified Mass Fractions

Element	Mass Fraction (in mg/kg)	Element	Mass Fraction (in %)
Arsenic	7.82 ± 0.28	Nitrogen	4.78 ± 0.11
Cadmium	12.78 ± 0.72		
Copper	627.4 ± 13.5		
Lead	202.1 ± 6.5		
Mercury	3.64 ± 0.25		
Molybdenum	46.7 ± 3.2		
Nickel	80.2 ± 2.3		
Selenium	16.0 ± 1.6		
Zinc	1273 ± 53		

Noncertified Values and Uncertainties: The noncertified values are the means of the results from two or more independent analytical methods as described by Schiller and Eberhardt [2]. The uncertainty is based on a 95 % confidence interval for the mean, and includes an allowance for differences between the analytical methods used [3]. As the accuracy of the measurements could not be assessed from the data, the uncertainty associated with a noncertified value may fail to include all sources of uncertainties and may represent only a measure of the precision of the measurement methods.

Table 2. Noncertified Mass Fractions

Element	Mass Fraction (in mg/kg)	Element	Mass Fraction (in %)
Chromium	202 ± 9	Aluminum	1.6 ± 0.1
Silver	98 ± 8	Calcium	3.9 ± 0.1
		Iron	2.8 ± 0.1
		Magnesium	0.59 ± 0.04
		Phosphorus	2.42 ± 0.09
		Potassium	0.49 ± 0.03
		Silicon	5.1 ± 0.2
		Sodium	0.21 ± 0.02
		Titanium	0.32 ± 0.03

Table 3. Methods used for the Analysis of SRM 2781*

Aluminum	INAA, ICP-AES, XRF
Arsenic	**RNAA, Hyd. AAS**, INAA
Cadmium	**ID-ICPMS, PGAA, RNAA**, INAA, **TXRF**
Calcium	INAA, TXRF, ICP-AES, XRF
Chromium	INAA, TXRF, ICP-AES
Copper	**ID-ICPMS, RNAA**, INAA, TXRF
Iron	INAA, TXRF, ICP-AES, XRF
Lead	**ICP-AES, ID-ICPMS**, TXRF
Magnesium	INAA, ICP-AES, XRF
Mercury	**FIA-CV-AAS, RNAA**, INAA
Molybdenum	**ID-ICPMS, ICP-AES, TXRF**, INAA
Nickel	**ICP-AES, ID-ICPMS**, INAA, TXRF
Nitrogen	**Kjeldahl, PGAA**
Phosphorus	Color, ICP-AES, XRF
Potassium	INAA, TXRF, ICP-AES
Selenium	**Hyd. AAS, RNAA, INAA, TXRF**
Silicon	XRF
Silver	RNAA, INAA, TXRF
Sodium	INAA, ICP-AES, XRF
Titanium	INAA, TXRF, XRF
Zinc	**ICP-AES, ID-ICPMS, INAA, TXRF**

*Methods used for establishment of certified values are shown in bold-face type; methods used for information only values or to corroborate certified values are not in bold.

Methods

FIA-CV-AAS	Flow injection analysis cold vapor atomic absorption spectrometry
Hyd. AAS	Hydride generation atomic absorption spectrometry
ICP-AES	Inductively coupled plasma atomic emission spectrometry
ID-ICPMS	Isotope dilution inductively coupled plasma mass spectrometry
INAA	Instrumental neutron activation analysis
PGAA	Prompt gamma activation analysis
RNAA	Radiochemical neutron activation analysis
TXRF	Total reflectance x-ray fluorescence
XRF	Wavelength dispersive x-ray fluorescence

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REFERENCES

[1] Taylor, B.N., "Guide for the Use of the International System of Units (SI)," NIST Special Publication 811, 1995 Ed., (April 1995).

[2] Schiller, S.B. and Eberhardt, K.R., Combining Data from Independent Chemical Analysis Methods, **Spectrochimical Acta, 46B** (12), pp 1607-1613, (1991).

[3] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed. ISO, Geneva, Switzerland, (1993): see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note, 1297, U.S. Government Printing Office, Washington D.C., (1994).

Addendum to Standard Reference Material® 2781

Domestic Sludge

Leachable Mass Fractions Using U.S. EPA and NJDEP Methods for Flame Atomic Absorption Spectrometry and Inductively Coupled Plasma Atomic Emission Spectrometry

The certified concentration values of constituent elements in this certificate are given as total mass fractions. To obtain total mass fractions, either subsamples of the SRM must be completely decomposed, or the sample must be analyzed directly in its solid form. For mixed acid dissolution, hydrofluoric acid must be included in the acid mixture to totally dissolve siliceous material present in sludge.

For a number of environmental monitoring purposes, acid extractable mass fractions of elements are often used rather than total mass fractions. Acid extractable methods do not necessarily result in total decomposition of the sludge. It should be noted that results obtained using acid leach conditions are often depicted in reports as total results. However, reported acid labile or extractable mass fractions of elements are generally lower than total mass fractions. Results are often presented as measured mass fractions in the leachate in comparison to the total or certified mass fractions. The recovery of an element as a percent of total is a function of several factors such as the mode of occurrence in the sample, leach medium, leach time, temperature conditions, and pH of the sample-leach medium mixture [1].

In its monitoring programs, the U.S. Environmental Protection Agency (U.S. EPA) has established a number of leach methods, such as Methods 3015, 3050, and 3051 [2,3] for the determination of acid labile or extractable mass fractions of elements. The New Jersey Department of the Environment (NJDEP) has developed its own leach method, NJDEP 100 for state use [4]. The NJDEP and the U.S. EPA prepared samples of SRM 2781 using the NJDEP 100 method and EPA Methods 3050 and 3051 and analyzed the resulting leachates by flame atomic absorption spectrometry (FAAS) and inductively coupled plasma atomic emission spectrometry (ICP-AES).

Reference values have been established for the acid-leachable mass fractions of several elements in SRM 2781. These values are the means of all results from the different leach measurement methods and combinations used. The reference values are listed in Table 1, along with their uncertainties which are based on 95 % confidence intervals of the means of results. For some of the elements (copper, iron, silver, vanadium), no statistically significant differences were found among results from the two laboratories using three or four combinations of sample preparation and instrumental measurement techniques (NJDEP 100 - FAAS; NJDEP 100 - ICP-AES; EPA 3050 - ICP-AES; EPA 3051 - ICP-AES). For all other elements, statistically significant between-laboratory differences were identified and are included in the stated uncertainties. These differences are small in comparison to control limits for many environmental monitoring programs. Therefore, the reference values are meaningful, despite the between-laboratory differences found.

Reference Values and Uncertainties: The reference values given in Table 1 are not NIST certified but are provided as a reference for U.S. EPA 3050 and 3051, and NJDEP 100 methods. The uncertainties are based on a 95 % confidence interval for the mean and include an allowance for differences between the analytical methods used.

Gaithersburg, MD 20899
Addendum Issue Date: October 25, 1996

Thomas E. Gills, Chief
Standard Reference Material Program

Table 1. Reference Leach Values for SRM 2781

Element	Leachable mass fraction (in mg/kg)			% Leach Recovery*
Aluminum	8 040	±	980	50
Barium	570	±	65	---
Cadmium	11	±	2	86
Calcium	36 440	±	1 830	93
Chromium	143	±	14	71
Copper	601	±	16	96
Iron	24 300	±	2 100	87
Lead	183	±	15	91
Magnesium	4 850	±	290	82
Manganese	745	±	33	---
Nickel	72.3	±	6.3	90
Silver	86.3	±	1.7	88
Vanadium	81.9	±	3.8	---
Zinc	1 120	±	34	88

$$* \text{ \% Leach Recovery} = 100 \times \frac{\text{Leach Value}}{\text{Certified or Noncertified Value}}$$

Cooperating Analysts and Laboratories:

S.J. Nagourney; New Jersey Department of the Environment, Trenton, NJ.
J. Birri, K. Peist; U.S. Environmental Protection Agency, Edison, NJ.

REFERENCES

[1] Kane, J.S., Leach Data vs Total: Which is Relevant for SRMs, Fresenius J. Anal. Chem. 352: pp 209-213, (1995).
[2] U.S. EPA 1991 Code of Federal Regulations, Title 40, Part 136, Paragraph 33.
[3] Federal Register 1-13-95 SW-846 update #2, Final.
[4] New Jersey Administrative Code, 1994. N.J.A.C. 7:14-4.

Analytical Report – 04252016

Laboratory ID Number: MED000242701

Laboratory Certificate Number: 2015020

Date of Issue: 6/8/2015

Date of Expiration: 6/8/2017

Laboratory Name: Geosyntec Consultants Field DMA-80 Laboratory

Laboratory Address: 99 Industrial Way
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Client: Mallinckrodt US, LLC

Project Name: Orrington Remediation

Project Number: BR0292

Report Date: 05/06/2016

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Attachment 1 – Electronic COC

Attachment 2 – Laboratory Control Sample Certificate Of Analysis

Case Narrative

Samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the analysis unless otherwise noted. Samples were received in coolers with sufficient ice to start the cooling process required for mercury samples. Samples are received on the day of sampling and analyzed within the holding time.

Sample quality control data is listed at the end of the report. Data in each section is sorted by analysis time so that quality control parameters for DMA analysis can be associated with the corresponding samples.

Non-detect (U) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the detection limit and reporting limit columns column. These qualifiers are applied based off of the wet weight concentrations because the DMA directly measures wet weight concentration. The mercury concentrations in this report are corrected with the corresponding total solids measurements to provide data on a dry weight basis for use in making regulatory decisions.

Results of DMA mercury analysis via Method 7473

DMA Mercury Analysis - Method 7473											
Sample ID	Sample Collection Date	Sample Collection Time	Date of Sample Receipt	Parameter Name	Dry Weight Concentration (mg/kg)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	Sample Analysis Date	Sample Analysis Time	Analyst
SB-LF2-15D-160422-13-14	4/22/2016	9:10:00	4/22/2016	Mercury	4.367		0.284	0.569	4/25/2016	13:51:00	RLR
SB-LF2-15D-160422-14-15	4/22/2016	9:12:00	4/22/2016	Mercury	0.762		0.283	0.566	4/25/2016	14:01:00	RLR
SB-LF2-15D-160422-15-16	4/22/2016	9:14:00	4/22/2016	Mercury	1.297		0.283	0.565	4/25/2016	14:12:00	RLR
SB-LF2-15D-160422-16-17	4/22/2016	9:16:00	4/22/2016	Mercury	0.331	J	0.281	0.562	4/25/2016	14:23:00	RLR
SB-LF2-15D-160422-17-18	4/22/2016	9:18:00	4/22/2016	Mercury	1.169		0.275	0.550	4/25/2016	14:29:00	RLR
SB-LF2-23C-160422-8-9	4/22/2016	8:44:00	4/22/2016	Mercury	0.285	U	0.285	0.570	4/25/2016	14:40:00	RLR
SB-LF2-23C-160422-9-10	4/22/2016	8:46:00	4/22/2016	Mercury	0.285	U	0.285	0.569	4/25/2016	14:47:00	RLR
SB-LF2-23C-160422-10-11	4/22/2016	8:48:00	4/22/2016	Mercury	0.282	U	0.282	0.563	4/25/2016	14:53:00	RLR
SB-LF2-23C-160422-11-12	4/22/2016	8:50:00	4/22/2016	Mercury	0.608		0.283	0.565	4/25/2016	15:00:00	RLR
SB-LF2-23C-160422-12-13	4/22/2016	8:52:00	4/22/2016	Mercury	0.282	U	0.282	0.564	4/25/2016	15:11:00	RLR
BD-1604220724	4/22/2016	7:24:00	4/22/2016	Mercury	1.988		0.301	0.602	4/25/2016	15:28:00	RLR
BD-1604220812	4/22/2016	8:12:00	4/22/2016	Mercury	0.300	U	0.300	0.600	4/25/2016	15:39:00	RLR
BD-1604220910	4/22/2016	9:10:00	4/22/2016	Mercury	3.096		0.283	0.566	4/25/2016	15:45:00	RLR
BD-1604220844	4/22/2016	8:44:00	4/22/2016	Mercury	0.281	U	0.281	0.561	4/25/2016	15:56:00	RLR
SB-SMY-07D-160422-9-10	4/22/2016	8:12:00	4/22/2016	Mercury	1.336		0.297	0.595	4/25/2016	16:03:00	RLR
SB-SMY-07D-160422-10-11	4/22/2016	8:14:00	4/22/2016	Mercury	0.303	U	0.304	0.607	4/25/2016	16:13:00	RLR
SB-SMY-07D-160422-11-12	4/22/2016	8:16:00	4/22/2016	Mercury	0.280	U	0.280	0.560	4/25/2016	16:20:00	RLR
SB-SMY-07D-160422-12-13	4/22/2016	8:18:00	4/22/2016	Mercury	0.281	U	0.281	0.563	4/25/2016	16:27:00	RLR
SB-SMY-07D-160422-13-14	4/22/2016	8:20:00	4/22/2016	Mercury	0.280	U	0.280	0.560	4/25/2016	16:34:00	RLR

Results of Total Solids analysis via Method 2540G

Total Solids Analysis - Method 2540G											
Sample ID	Sample Collection Date	Sample Collection Time	Date of Sample Receipt	Parameter Name	Result (% Solids)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	Sample Analysis Date	Sample Analysis Time	Analyst
SB-LF2-23C-160422-10-11	4/22/2016	8:48:00	4/22/2016	Total Solids	88.80		NA	NA	4/25/2016	14:10:00	RLR
SB-LF2-23C-160422-11-12	4/22/2016	8:50:00	4/22/2016	Total Solids	88.48		NA	NA	4/25/2016	14:10:00	RLR
SB-LF2-23C-160422-12-13	4/22/2016	8:52:00	4/22/2016	Total Solids	88.62		NA	NA	4/25/2016	14:10:00	RLR
SB-LF2-23C-160422-8-9	4/22/2016	8:44:00	4/22/2016	Total Solids	87.70		NA	NA	4/25/2016	14:10:00	RLR
SB-LF2-23C-160422-9-10	4/22/2016	8:46:00	4/22/2016	Total Solids	87.87		NA	NA	4/25/2016	14:10:00	RLR
SB-SMY-07D-160422-10-11	4/22/2016	8:14:00	4/22/2016	Total Solids	82.37		NA	NA	4/25/2016	14:10:00	RLR
SB-SMY-07D-160422-11-12	4/22/2016	8:16:00	4/22/2016	Total Solids	89.31		NA	NA	4/25/2016	14:10:00	RLR
SB-SMY-07D-160422-12-13	4/22/2016	8:18:00	4/22/2016	Total Solids	88.83		NA	NA	4/25/2016	14:10:00	RLR
SB-SMY-07D-160422-13-14	4/22/2016	8:20:00	4/22/2016	Total Solids	89.23		NA	NA	4/25/2016	14:10:00	RLR
SB-SMY-07D-160422-9-10	4/22/2016	8:12:00	4/22/2016	Total Solids	84.08		NA	NA	4/25/2016	14:10:00	RLR
BD-1604220724	4/22/2016	7:24:00	4/22/2016	Total Solids	83.00		NA	NA	4/25/2016	14:23:00	RLR
BD-1604220812	4/22/2016	8:12:00	4/22/2016	Total Solids	83.32		NA	NA	4/25/2016	14:23:00	RLR
BD-1604220844	4/22/2016	8:44:00	4/22/2016	Total Solids	89.09		NA	NA	4/25/2016	14:23:00	RLR
BD-1604220910	4/22/2016	9:10:00	4/22/2016	Total Solids	88.41		NA	NA	4/25/2016	14:23:00	RLR
SB-LF2-15D-160422-13-14	4/22/2016	9:10:00	4/22/2016	Total Solids	87.90		NA	NA	4/25/2016	14:23:00	RLR
SB-LF2-15D-160422-14-15	4/22/2016	9:12:00	4/22/2016	Total Solids	88.32		NA	NA	4/25/2016	14:23:00	RLR
SB-LF2-15D-160422-15-16	4/22/2016	9:14:00	4/22/2016	Total Solids	88.47		NA	NA	4/25/2016	14:23:00	RLR
SB-LF2-15D-160422-16-17	4/22/2016	9:16:00	4/22/2016	Total Solids	88.90		NA	NA	4/25/2016	14:23:00	RLR
SB-LF2-15D-160422-17-18	4/22/2016	9:18:00	4/22/2016	Total Solids	90.87		NA	NA	4/25/2016	14:23:00	RLR

Quality Control Results via Method 7473

DMA Method Blank and Laboratory Control Sample									
Sample ID	Wet Weight Concentration (mg/kg)	Qual	Method Detection Limit (mg/kg)	Reporting Limit (mg/kg)	% R	% Recovery Limits	Sample Analysis Date	Sample Analysis Time	Analyst
MB-04252016C-01	0.25	U	0.25	0.5			4/25/2016	13:34:00	RLR
LCS-04252016C-01	3.86		0.25	0.5	106	80 - 120	4/25/2016	13:40:00	RLR
LCS-04252016C-02	3.84		0.25	0.5	106	80 - 120	4/25/2016	15:17:00	RLR
MB-04252016C-02	0.25	U	0.25	0.5			4/25/2016	16:47:00	RLR
LCS-04252016C-03	3.84		0.25	0.5	106	80 - 120	4/25/2016	16:54:00	RLR

Notes:

- MB and LCS ending in -01 are not associated with samples; they are used in addition to the daily calibration to check the DMA before running samples.
- LCS samples are run every 10 samples. MBs are run every 20 samples.
- Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

DMA MS/MSDs											
Sample ID	Spiked Sample	Native Sample Wet Weight (mg/kg)	MS/MSD Added (mg/kg)	MS/MSD Found (mg/kg)	% R	% Recovery Limits	RPD	RPD Limit	Sample Analysis Date	Sample Analysis Time	Analyst
MS-04252016C-01	SB-SMY-07D-160422-12-13	0.25 U	3.00	3.10	101	80 - 120			4/25/2016	17:04:00	RLR
MSD-04252016C-01	SB-SMY-07D-160422-12-13	0.25 U	2.99	3.19	105	80 - 120	3.9	< 20	4/25/2016	17:15:00	RLR

Notes:

- MS/MSDs are run every 20 samples.
- Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

DMA Laboratory Duplicate Results										
Sample ID	**Native Sample ID**	**Dry Weight Concentration (mg/kg)**	**Qual**	**Native Sample Dry Weight Concentration (mg/kg)**	**Native Sample Qual**	**RPD**	**RPD Limit**	**Duplicate Qual**	**Sample Analysis Date**	**Sample Analysis Time**
SB-SMY-07D-160422-13-14-LR	SB-SMY-07D-160422-13-14	0.280	U	0.280	U	0	50		4/25/2016	16:40:00

Notes:

- Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

Quality Control Results via Method 2540G

Total Solids Quality Control Results						
Native Sample ID	**Parameter Name**	**Native Sample Result (% Solids)**	**Duplicate Sample Result (% Solids)**	**RPD**	**Qual**	**RPD Limit**
SB-SMY-07D-160422-13-14	Total Solids	89.23	89.86	1		5
Associated samples: SB-LF2-23C-160422-10-11, SB-LF2-23C-160422-11-12, SB-LF2-23C-160422-12-13, SB-LF2-23C-160422-8-9, SB-LF2-23C-160422-9-10, SB-SMY-07D-160422-10-11, SB-SMY-07D-160422-11-12, SB-SMY-07D-160422-12-13, SB-SMY-07D-160422-13-14, SB-SMY-07D-160422-9-10						
SB-LF2-15D-160422-17-18	Total Solids	90.87	90.68	0		5
Associated samples: BD-1604220724, BD-1604220812, BD-1604220844, BD-1604220910, SB-LF2-15D-160422-13-14, SB-LF2-15D-160422-14-15, SB-LF2-15D-160422-15-16, SB-LF2-15D-160422-16-17, SB-LF2-15D-160422-17-18						

Total Solids Laboratory Control Sample							
Sample ID	**Result (% Solids)**	**Actual LCS (% Solids)**	**% R**	**% Recovery Limits**	**Sample Analysis Date**	**Sample Analysis Time**	**Analyst**
LCS-TS-04252016-01	80.06	79.93	100	80-120	4/25/2016	14:23:00	RLR

Notes:

- LCS samples are run every 20 samples.

-Associated samples are those run before the corresponding QC sample and can be determined by looking at analysis time.

Qualifiers and Definitions

U – The compound was below the detection limit.

J – The compound was detected between the detection limit and the reporting limit.

E – The concentration exceeded the calibration. The sample will only be diluted and re-run if requested by the client.

LCS – Laboratory Control Sample

MB – Method Blank

MS – Matrix Spike

MSD – Matrix Spike Duplicate

Notes

There is no prep method for DMA analysis.

Dilution factor not applicable for soils

Results contained within this report relate only to the samples submitted under this Geosyntec Consultants Field DMA-80 Laboratory Report Number. This report must not be reproduced, except in full, without the written approval of the Geosyntec Consultants Field DMA-80 Laboratory.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Signed:

Regina Rancatti, Ph.D. Date: 05/06/2016
Laboratory Director

END OF REPORT

Attachment 1 – Electronic COC

Sample ID	Sample Date	Sample Time	Boring Receipt Date and Time	Relinquished By	Received By	Clearly Labeled as Required	Contained in the Appropriate Closed Container	Adequate Volume for Analysis	Received within the Proper Holding Time
SB-LF2-23C-160422-10-11	4/22/2016	8:48	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-23C-160422-11-12	4/22/2016	8:50	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-23C-160422-12-13	4/22/2016	8:52	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-23C-160422-8-9	4/22/2016	8:44	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-23C-160422-9-10	4/22/2016	8:46	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-07D-160422-10-11	4/22/2016	8:14	4/22/2016 10:12	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-07D-160422-11-12	4/22/2016	8:16	4/22/2016 10:12	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-07D-160422-12-13	4/22/2016	8:18	4/22/2016 10:12	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-07D-160422-13-14	4/22/2016	8:20	4/22/2016 10:12	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-SMY-07D-160422-9-10	4/22/2016	8:12	4/22/2016 10:12	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
BD-1604220724	4/22/2016	7:24	4/22/2016 14:34	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
BD-1604220812	4/22/2016	8:12	4/22/2016 10:12	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes

Sample ID	Sample Date	Sample Time	Boring Receipt Date and Time	Relinquished By	Received By	Clearly Labeled as Required	Contained in the Appropriate Closed Container	Adequate Volume for Analysis	Received within the Proper Holding Time
BD-1604220844	4/22/2016	8:44	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
BD-1604220910	4/22/2016	9:10	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-15D-160422-13-14	4/22/2016	9:10	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-15D-160422-14-15	4/22/2016	9:12	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-15D-160422-15-16	4/22/2016	9:14	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-15D-160422-16-17	4/22/2016	9:16	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes
SB-LF2-15D-160422-17-18	4/22/2016	9:18	4/22/2016 10:13	Pat Troy	Regina Rancatti	Yes	Yes	Yes	Yes

Attachment 2 – Laboratory Control Sample Certificate of Analysis

National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material® 2781

Domestic Sludge

This Standard Reference Material (SRM) is intended primarily for use in the evaluation of methods used for the analysis of sludges and other materials of a similar matrix. SRM 2781 is a dried and pulverized domestic sludge. A unit of SRM 2781 consists of 40 g of the dried material.

Certified Values: The certified values for 10 elements are listed in Table 1 and are based on concordant results from two or more analytical methods.

Analytical methods used for the characterization of this SRM are given in Table 3. All values are reported as mass fractions [1], on a dry mass basis and are based on measurements using a sample mass of at least 100 mg.

Noncertified Values: Noncertified values for eleven additional elements are listed in Table 2 and were derived from a combination of results from NIST and collaborating laboratories. These results may have sources of bias yet to be investigated and do not meet NIST criteria for certification.

Expiration of Certification: This certification is valid for five years from the date of shipment from NIST. However, the certification will be nullified if the SRM is contaminated or modified. Should any of the values change before the expiration of the certification, purchasers will be notified by NIST. Return of the attached registration card will facilitate notification.

Stability: This material is considered to be stable; however, its stability has not been rigorously assessed. NIST will continuously monitor this material and report any substantive changes in certification to the purchaser.

Use: A minimum sample mass of 100 mg (dry mass - see Instructions for Drying) should be used and sample preparation procedures should be designed to effect complete dissolution for analytical determinations to be related to the certified values provided.

Instructions for Drying: When nonvolatile elements are to be determined, samples should be vacuum dried at room temperature for 24 h or oven dried for 2 h at 110 °C. Volatile elements (e.g., arsenic, mercury, and selenium) should be determined on samples as received; separate samples should be dried according to these instructions to obtain a correction factor for moisture. Moisture corrections are then made to measurement values before comparing them to the certified values. [Note that the mass loss on drying at the time of certification was found to be in the range of 4.7 % to 6.6 % when using the recommended drying procedures.]

Statistical consultation was provided by L.M. Gill of the NIST Statistical Engineering Division.

The overall direction and coordination of the analyses were under the chairmanship of J.D. Fassett of the NIST Analytical Chemistry Division.

The technical and support aspects involved in the original preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by J.S. Kane. Revision of this certificate was coordinated through the Standard Reference Materials Program by B.S. MacDonald.

Gaithersburg, MD 20899
Certificate Issue Date: October 25, 1996
(Revision of certificate dated 6-22-95 to include addendum)

Thomas E. Gills, Chief
Standard Reference Materials Program

Source and Preparation of Material: The U.S. Geological Survey (USGS), under contract to NIST, obtained partially dehydrated sewage cake material from the Metropolitan Denver Sewage Disposal District No. 1. The material (approximately 182 kg) was placed in plastic-lined drums and transported to the USGS facilities in Lakewood, CO for processing. It was dried at ambient temperature in a forced air chamber, ground to pass a 74 m. (200 mesh) sieve, blended for 24 h to assure homogeneity of the pulverized material after which test samples were taken from the blender for preliminary homogeneity analyses. The material was then radiation sterilized. The sterilized material was shipped in bulk to NIST, where the material was bottled in 40 g units after reblending for 4 h.

Analysis: The homogeneity was assessed at USGS on 10 replicate samples of bulk material for over 40 elements using x-ray fluorescence (XRF) and/or inductively coupled plasma atomic emission spectrometry (ICP-AES). Homogeneity was further assessed during certification analysis; at sample sizes of 100 mg or greater. No sample-to-sample variations in excess of those expected from the analytical measurements were detected.

Certified Values and Uncertainties: The certified values are the means of the results from two or more independent analytical methods as described by Schiller and Eberhardt [2]. The uncertainty is based on a 95 % confidence interval for the true value, and includes an allowance for differences between the analytical methods used [3].

Table 1. Certified Mass Fractions

Element	Mass Fraction (in mg/kg)	Element	Mass Fraction (in %)
Arsenic	7.82 ± 0.28	Nitrogen	4.78 ± 0.11
Cadmium	12.78 ± 0.72		
Copper	627.4 ± 13.5		
Lead	202.1 ± 6.5		
Mercury	3.64 ± 0.25		
Molybdenum	46.7 ± 3.2		
Nickel	80.2 ± 2.3		
Selenium	16.0 ± 1.6		
Zinc	1273 ± 53		

Noncertified Values and Uncertainties: The noncertified values are the means of the results from two or more independent analytical methods as described by Schiller and Eberhardt [2]. The uncertainty is based on a 95 % confidence interval for the mean, and includes an allowance for differences between the analytical methods used [3]. As the accuracy of the measurements could not be assessed from the data, the uncertainty associated with a noncertified value may fail to include all sources of uncertainties and may represent only a measure of the precision of the measurement methods.

Table 2. Noncertified Mass Fractions

Element	Mass Fraction (in mg/kg)	Element	Mass Fraction (in %)
Chromium	202 ± 9	Aluminum	1.6 ± 0.1
Silver	98 ± 8	Calcium	3.9 ± 0.1
		Iron	2.8 ± 0.1
		Magnesium	0.59 ± 0.04
		Phosphorus	2.42 ± 0.09
		Potassium	0.49 ± 0.03
		Silicon	5.1 ± 0.2
		Sodium	0.21 ± 0.02
		Titanium	0.32 ± 0.03

Table 3. Methods used for the Analysis of SRM 2781*

Aluminum	INAA, ICP-AES, XRF
Arsenic	**RNAA, Hyd. AAS**, INAA
Cadmium	**ID-ICPMS, PGAA, RNAA**, INAA, **TXRF**
Calcium	INAA, TXRF, ICP-AES, XRF
Chromium	INAA, TXRF, ICP-AES
Copper	**ID-ICPMS, RNAA**, INAA, TXRF
Iron	INAA, TXRF, ICP-AES, XRF
Lead	**ICP-AES, ID-ICPMS**, TXRF
Magnesium	INAA, ICP-AES, XRF
Mercury	**FIA-CV-AAS, RNAA**, INAA
Molybdenum	**ID-ICPMS, ICP-AES, TXRF**, INAA
Nickel	**ICP-AES, ID-ICPMS**, INAA, TXRF
Nitrogen	**Kjeldahl, PGAA**
Phosphorus	Color, ICP-AES, XRF
Potassium	INAA, TXRF, ICP-AES
Selenium	**Hyd. AAS, RNAA, INAA, TXRF**
Silicon	XRF
Silver	RNAA, INAA, TXRF
Sodium	INAA, ICP-AES, XRF
Titanium	INAA, TXRF, XRF
Zinc	**ICP-AES, ID-ICPMS, INAA, TXRF**

*Methods used for establishment of certified values are shown in bold-face type; methods used for information only values or to corroborate certified values are not in bold.

Methods

FIA-CV-AAS	Flow injection analysis cold vapor atomic absorption spectrometry
Hyd. AAS	Hydride generation atomic absorption spectrometry
ICP-AES	Inductively coupled plasma atomic emission spectrometry
ID-ICPMS	Isotope dilution inductively coupled plasma mass spectrometry
INAA	Instrumental neutron activation analysis
PGAA	Prompt gamma activation analysis
RNAA	Radiochemical neutron activation analysis
TXRF	Total reflectance x-ray fluorescence
XRF	Wavelength dispersive x-ray fluorescence

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REFERENCES

[1] Taylor, B.N., "Guide for the Use of the International System of Units (SI)," NIST Special Publication 811, 1995 Ed., (April 1995).

[2] Schiller, S.B. and Eberhardt, K.R., Combining Data from Independent Chemical Analysis Methods, **Spectrochimical Acta, 46B** (12), pp 1607-1613, (1991).

[3] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed. ISO, Geneva, Switzerland, (1993): see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note, 1297, U.S. Government Printing Office, Washington D.C., (1994).

Addendum to Standard Reference Material® 2781

Domestic Sludge

Leachable Mass Fractions Using U.S. EPA and NJDEP Methods for Flame Atomic Absorption Spectrometry and Inductively Coupled Plasma Atomic Emission Spectrometry

The certified concentration values of constituent elements in this certificate are given as total mass fractions. To obtain total mass fractions, either subsamples of the SRM must be completely decomposed, or the sample must be analyzed directly in its solid form. For mixed acid dissolution, hydrofluoric acid must be included in the acid mixture to totally dissolve siliceous material present in sludge.

For a number of environmental monitoring purposes, acid extractable mass fractions of elements are often used rather than total mass fractions. Acid extractable methods do not necessarily result in total decomposition of the sludge. It should be noted that results obtained using acid leach conditions are often depicted in reports as total results. However, reported acid labile or extractable mass fractions of elements are generally lower than total mass fractions. Results are often presented as measured mass fractions in the leachate in comparison to the total or certified mass fractions. The recovery of an element as a percent of total is a function of several factors such as the mode of occurrence in the sample, leach medium, leach time, temperature conditions, and pH of the sample-leach medium mixture [1].

In its monitoring programs, the U.S. Environmental Protection Agency (U.S. EPA) has established a number of leach methods, such as Methods 3015, 3050, and 3051 [2,3] for the determination of acid labile or extractable mass fractions of elements. The New Jersey Department of the Environment (NJDEP) has developed its own leach method, NJDEP 100 for state use [4]. The NJDEP and the U.S. EPA prepared samples of SRM 2781 using the NJDEP 100 method and EPA Methods 3050 and 3051 and analyzed the resulting leachates by flame atomic absorption spectrometry (FAAS) and inductively coupled plasma atomic emission spectrometry (ICP-AES).

Reference values have been established for the acid-leachable mass fractions of several elements in SRM 2781. These values are the means of all results from the different leach measurement methods and combinations used. The reference values are listed in Table 1, along with their uncertainties which are based on 95 % confidence intervals of the means of results. For some of the elements (copper, iron, silver, vanadium), no statistically significant differences were found among results from the two laboratories using three or four combinations of sample preparation and instrumental measurement techniques (NJDEP 100 - FAAS; NJDEP 100 - ICP-AES; EPA 3050 - ICP-AES; EPA 3051 - ICP-AES). For all other elements, statistically significant between-laboratory differences were identified and are included in the stated uncertainties. These differences are small in comparison to control limits for many environmental monitoring programs. Therefore, the reference values are meaningful, despite the between-laboratory differences found.

Reference Values and Uncertainties: The reference values given in Table 1 are not NIST certified but are provided as a reference for U.S. EPA 3050 and 3051, and NJDEP 100 methods. The uncertainties are based on a 95 % confidence interval for the mean and include an allowance for differences between the analytical methods used.

Gaithersburg, MD 20899
Addendum Issue Date: October 25, 1996

Thomas E. Gills, Chief
Standard Reference Material Program

Table 1. Reference Leach Values for SRM 2781

Element	Leachable mass fraction (in mg/kg)			% Leach Recovery*
Aluminum	8 040	±	980	50
Barium	570	±	65	---
Cadmium	11	±	2	86
Calcium	36 440	±	1 830	93
Chromium	143	±	14	71
Copper	601	±	16	96
Iron	24 300	±	2 100	87
Lead	183	±	15	91
Magnesium	4 850	±	290	82
Manganese	745	±	33	---
Nickel	72.3	±	6.3	90
Silver	86.3	±	1.7	88
Vanadium	81.9	±	3.8	---
Zinc	1 120	±	34	88

$$* \text{ \% Leach Recovery} = 100 \times \frac{\text{Leach Value}}{\text{Certified or Noncertified Value}}$$

Cooperating Analysts and Laboratories:

S.J. Nagourney; New Jersey Department of the Environment, Trenton, NJ.
J. Birri, K. Peist; U.S. Environmental Protection Agency, Edison, NJ.

REFERENCES

[1] Kane, J.S., Leach Data vs Total: Which is Relevant for SRMs, Fresenius J. Anal. Chem. 352: pp 209-213, (1995).
[2] U.S. EPA 1991 Code of Federal Regulations, Title 40, Part 136, Paragraph 33.
[3] Federal Register 1-13-95 SW-846 update #2, Final.
[4] New Jersey Administrative Code, 1994. N.J.A.C. 7:14-4.

ATTACHMENT B-1

Pre-Design Investigation Logs
(for locations that were re-sampled in April 2016)

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-15

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 76.2
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 20
Drillers: John Chase, Bobby Orsini
Abandonment Method: Bentonite Chips
Drilling Date: Start: 6/23/2015 **End:** 6/23/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: G. Barr, J. Kocis

N 392,374.82 E 900,716.13

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.) 76.2	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			0				FILL	(0'-0.3') Dry, brown, SILT, little fine sand, organics (ML)
							FILL	(0.3'-2.2') Dry, brown, SILT, little fine sand, trace fine gravel, trace clay (ML)
GP	S-1	60/46		0.0	0.019		FILL	(2.2'-4.4') Moist, brown, medium to fine SAND, some coarse to fine gravel, trace silt (SP)
			71.2				FILL	(4.4'-5') Moist, dark brown, medium to fine SAND, little silt, trace clay (SM)
			5				FILL	(5'-6') Wet, brown, medium to fine SAND, trace silt (SM)
							FILL	(6'-8') Wet, black, medium to fine granular material with metallic sheen, very fine black silt
GP	S-2	60/43		0.0	0.006		FILL	(8'-10') Wet, gray, SILT, some coarse to fine gravel Observed wet, gray, coarse to medium sand lense (ML) at 9.0 ft bgs
			66.2					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Reviewed by: G. Barr **Date:** 11/02/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

BOREHOLE LOG

SB-LF2-15

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			66.2					
GP	S-3	60/44	10	0.0	0.000		FILL	(10'-13') Wet, gray-black, medium to fine granular material and very fine silt
							ML	(13'-15') Moist, light brown, SILT, little medium to fine gravel, trace fine sand (TILL)
			61.2					
GP	S-4	60/48	15	0.0	0.000		ML	(15'-17') Moist, light brown SILT, little medium to fine gravel, trace fine sand (TILL)
							GM	(17'-20') Moist, gray, coarse to medium GRAVEL, little silt, trace fine sand (TILL)
			56.2					
			20					End of exploration at 20 ft bgs
			51.2					
			25					

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BOREHOLE LOG

SB-LF2-15B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 76.2
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 20
Drillers: John Chase, Bobby Orsini
Abandonment Method: Bentonite Chips
Drilling Date: Start: 06/26/2015 **End:** 06/26/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: G. Barr, J. Kocis

N 392,374.82 E 900,716.13

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			76.2 0					(0'-15') See SB-LF2-15 boring log for lithologic description.
			71.2 5					
			66.2					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Re-sample at 15-20 ft bgs due to potential smearing of shallower material on original samples. Offset ~1.5 East of original location. Soil boring SB-LF2-15A was not performed.

Reviewed by: **Date:**

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-15B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			66.2 10 61.2					
GP	S-1	60/36	15 56.2	0.0	0.000		ML	(15'-20') Moist, light brown, SILT and coarse to fine gravel, trace fine sand
			20 51.2 25					End of Boring at 20 ft bgs

GEOSYNTEC BL_NO BLOWS PID/JEROME_ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

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BOREHOLE LOG

SB-LF2-15C

Client: Mallinckrodt US LLC
Project Location: Orrington, Maine
Project Name: Orrington Remediation Site
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Drilling Method/Rig: DPT/Geoprobe 6620DT
Drillers: J. Emma, M. Rash
Drilling Date: Start: 7/20/2015 **End:** 7/20/2015
Borehole Coordinates:
N 392,374.82 E 900,716.13

Surface Elevation (ft.): 76.19
Total Depth (ft.): 6
Abandonment Method: Backfilled with bentonite chips
Field Screening Instrument: PID, Jerome MVA
Logged By: P. Donohue

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.) 76.2	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			0					(0-5') See SB-LF5-15 boring log for lithologic description.
			71.2					
GP	S-1	12/11	5	0.0	0.000		FILL	(5-6') Moist, dark brown-dark gray-black, coarse-fine SAND, little silt. (SW)
								End of Exploration at 6' BGS.
			66.2					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled discretely from 5-6' BGS for Hg speciation. The Jerome MVA readings indicated represent the highest recorded values in that range.
Offset of SB-LF1-15, 1' north of original boring location.

Reviewed by: E. Ashley **Date:** 10/23/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

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BOREHOLE LOG

SB-LF2-23

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 77.4
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 19
Drillers: John Chase, Bobby Orsini
Abandonment Method: Bentonite Chips
Drilling Date: Start: 06/24/2015 **End:** 06/24/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: G. Barr, J. Kocis

N 392,384.94 E 900,783.28

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			77.4					
GP	S-1	60/44	0	0.0	0.000		FILL	(0'-1') Moist, brown, medium to fine SAND, some silt little medium to fine gravel (SW-SM)
							FILL	(1'-4.6') Moist, brown-gray, medium to fine SAND, trace silt (SW)
			72.4				FILL	(4.6'-5') Moist, black, graphite-like material
GP	S-2	60/30	5	0.0	0.000		FILL	(5'-7.2') Wet, brown, SILT, some fine sand, little wood debris (ML)
							FILL	(7.2'-10') Moist, gray, coarse to fine GRAVEL, some silt, little fine sand (GM)
			67.4					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

VOCs and chloropicrin collected at 1-2 ft and 2-3 ft

Reviewed by: G. Barr **Date:** 11/02/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

BOREHOLE LOG

SB-LF2-23

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			67.4					
			10				FILL	(10'-12') Moist, gray-brown, SILT and medium to fine SAND, little medium to fine gravel, trace clay (ML/GM)
GP	S-3	60/42		0.0	0.000		ML	(12'-15') Moist, brown, SILT, some fine sand, little medium to fine gravel (TILL) Observed medium sand lense (SP) at 13.6-13.7 ft bgs
			62.4					
			15				ML	(15'-17') Moist, brown, SILT, some fine sand, little medium to fine gravel (TILL)
GP	S-4	60/44		0.0	0.000		GM	(17'-19') Moist, gray, coarse to fine GRAVEL, some fine sand, trace silt (TILL)
			57.4					
			20					End of exploration at 20 ft bgs.
			52.4					
			25					

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

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BOREHOLE LOG

SB-LF2-23B

Client: Mallinckrodt US LLC
Project Location: Orrington, Maine
Project Name: Orrington Remediation Site
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Drilling Method/Rig: DPT/Geoprobe 6620DT
Drillers: J. Emma, M. Rash
Drilling Date: Start: 7/20/2015 **End:** 7/20/2015
Borehole Coordinates:
N 392,384.94 E 900,783.28

Surface Elevation (ft.): 77.36
Total Depth (ft.): 3
Abandonment Method: Backfilled with bentonite chips
Field Screening Instrument: PID, Jerome MVA
Logged By: P. Donohue

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			77.4 0					(0-2') See SB-LF2-23 boring log for lithologic descriptions.
GP	S-1	12/12		0.0	0.000		FILL	(2-3') Dry, brown, coarse-fine SAND, trace medium-fine rounded gravel, trace silt. (SW)
			72.4 5 67.4					End of Exploration/advancement at 3' BGS.

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled discretely from 2-3' BGS for Hg speciation. Offset of SB-LF2-23, 1' west of original boring location. The Jerome MVA readings indicated represent the highest recorded values in that range.

Reviewed by: E. Ashley **Date:** 10/23/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

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BOREHOLE LOG

SB-LF2-24

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 73.4
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 18
Drillers: John Chase, Eric Woodward
Abandonment Method: Bentonite Chips
Drilling Date: Start: 06/16/2015 **End:** 06/16/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: G. Barr, J. Kocis

N 392,470.45 E 900,808.17

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			73.4					
			0				FILL	(0'-0.4') Top Soil
							FILL	(0.4'-2') Dry, red brown-brown, fine SAND, some silt (SM)
GP	S-1	60/44		0.0	0.000		FILL	(2'-4.6') Dry, light brown, SAND with gravel and silt, trace clay (SM)
			68.4				FILL	(4.6'-5') Moist, gray, medium to fine SAND, some clay, trace gravel (SC)
			5				FILL	(5'-8.3') Moist, gray, medium to fine SAND, some clay, some gravel (SC)
GP	S-2	60/42		0.0	0.000		FILL	(8.3'-8.5') Moist, dark gray, SILT, wood debris (ML)
							FILL	(8.5'-10') Moist, red brown, SILT, wood debris (ML)
			63.4					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Reviewed by: G. Barr **Date:** 11/02/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

BOREHOLE LOG

SB-LF2-24

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			63.4					
GP	S-3	60/42	10	0.0	0.000		FILL	(10'-11') Moist, dark brown, SILT, trace organics (OL)
							FILL	(11'-13') Moist, dark brown, SILT, trace organics (OL)
							FILL	(13'-13.5') Moist, gray, CLAY (CL)
							FILL	(13.5'-14') Moist, gray, CLAY, some silt, some gravel, little fine sand (CL)
							GW	(14'-15') Moist, light gray-brown, GRAVEL, some coarse to fine sand, some silt (TILL)
			58.4					
GP	S-4	60/30	15	0.0	0.000		GW	(15'-16') Moist, light gray-brown, GRAVEL, some coarse to fine sand, some silt (TILL)
							SW	(16'-18') Moist, light gray, medium to fine SAND (TILL)
			53.4					
			20					End of exploration at 20 ft bgs.
			48.4					
			25					

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

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BOREHOLE LOG

SB-LF2-24B

Client: Mallinckrodt US LLC
Project Location: Orrington, Maine
Project Name: Orrington Remediation Site
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Drilling Method/Rig: DPT/Geoprobe 6620DT
Drillers: J. Emma, M. Rash
Drilling Date: Start: 7/20/2015 **End:** 7/20/2015
Borehole Coordinates:
N 392,470.45 E 900,808.17

Surface Elevation (ft.): 73.37
Total Depth (ft.): 3
Abandonment Method: Backfilled with bentonite chips
Field Screening Instrument: PID, Jerome MVA
Logged By: P. Donohue

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			73.4 0					(0-2') See SB-LF2-24 boring logs for lithologic descriptions.
GP	S-1	12/12		0.0	0.000		FILL	(2-3') Moist, brown, SILT, some fine sand, little coarse-fine sub-angular and angular gravel, trace clay. (ML)
			68.4 5 63.4					End of Exploration at 3' BGS.

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled discretely from 2-3' BGS for Hg speciation. Offset of SB-LF2-24. 1' east of original boring location. The Jerome MVA readings indicated represent the highest recorded values in that range.

Reviewed by: E. Ashley **Date:** 10/23/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

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BOREHOLE LOG

SB-LF2-25

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 78.4
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 20
Drillers: John Chase, Bobby Orsini
Abandonment Method: Bentonite Chips
Drilling Date: Start: 06/22/2015 **End:** 06/22/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: J.Gillen, J.Kocis

N 392,419.77 E 900,799.72

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.4					
GP	S-1	60/41	0	0.0	0.000		FILL	(0'-1.25') Moist, brown, medium to fine SAND and SILT trace fine gravel, organics (SM)
							FILL	(1.25'-2.5') Moist, brown, SILT and coarse to fine SAND, little medium to fine gravel (ML)
							FILL	(2.5'-5') Moist, brown, coarse to fine SAND, trace silt (SW-SM) Observed a tan clay seam at 3.75 ft bgs and black sand material at 5 ft bgs
			73.4					
GP	S-2	60/43	5	0.0	0.000		FILL	(5'-6.75') Wet, black, medium to fine graphite-like material
							FILL	(6.75'-8.75') Wet, gray-brown, medium to fine SAND, trace silt, trace medium gravel (SP-SM)
							FILL	(8.75'-10') Wet, brown, SILT, some some coarse to fine sand, trace fine gravel, trace organics (ML) Observed an organic seam at 9.75 ft bgs
			68.4					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Jerome reading for 5-6.75 ft bgs = 0.017 mg/m3
Driller notes hole"tightened" at ~12 to 14 ft
Jerome reading at 11.5 ft bgs= 0.003 mg/m3
Native material encountered at 12.5 ft
Sampling ended at 17 ft

Reviewed by: J. Gillen **Date:** 11/18/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/30/15

BOREHOLE LOG

SB-LF2-25

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.4					
GP	S-3	60/47	10	0.0	0.000		FILL	(10'-12.5') Wet, gray-blck, coarse to fine SAND, little gravel little silt (SP-SM)
							ML	(12.5'-15') Wet, gray-brown, SILT, some coarse to fine sand, trace fractured rock (TILL)
			63.4					
GP	S-4	60/46	15	0.0	0.000		ML	(15'-18') Moist, brown-gray, SILT, some coarse to fine sand, trace medium to fine gravel, trace fractured rock (TILL)
							ML	(18'-20') Moist, brown-gray, SILT, some coarse to fine sand, some medium to fine gravel, little fractured rock (TILL)
			58.4					
			20					End of exploration at 20 ft bgs.
			53.4					
			25					

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/30/15

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BOREHOLE LOG

SB-LF2-26

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 77.9
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 25
Drillers: John Chase, Eric Woodward
Abandonment Method: Bentonite Chips
Drilling Date: Start: 06/18/2015 **End:** 06/18/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: G. Barr, J. Kocis

N 392,399.30 E 900,806.92

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			77.9					
GP	S-1	60/48	0	0.0	0.000		FILL	(0'-2') Dry, light brown, SILT, little gravel, trace fine sand, trace clay (ML)
							FILL	(2'-3.3') Dry, dark yellowish brown, medium to fine SAND, trace fine gravel (SP)
							FILL	(3.3'-3.8') Black, medium to fine coarse granular material with metallic sheen
							FILL	(3.8'-5') Moist, yellowish brown-grayish brown fine SAND, trace coarse to fine gravel (SP/SC) Observed a clay layer at 4.0 ft bgs
			72.9					
GP	S-2	60/36	5	0.0	0.000		FILL	(5'-6') Moist, grayish brown, coarse to fine SAND and CLAY, some coarse to fine gravel, trace organics (SW/SC)
							FILL	(6'-7.5') Moist, dark brown, wood debris, little gravel
							FILL	(7.5'-10') Moist-wet, light gray, fine SAND, some coarse to fine gravel, little silt, little clay (SW)
			67.9					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Borehole reading 08:53 PID:0.0, Jerome:0.0, 4-gas: 0.0,0.0,20.9,0.0
~10 ft bgs increase pressure on Geoprobe
~19-20 ft bgs, very high pressure increase on Geoprobe

Reviewed by: G. Barr **Date:** 11/02/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

BOREHOLE LOG

SB-LF2-26

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			67.9					
GP	S-3	60/40	10	0.0	0.000		FILL	(10'-11.4') Wet, light gray, fine SAND, some coarse to fine gravel, some silt, little clay (SW)
							FILL	(11.4-15) Moist, yellowish brown, SILT, some clay, some coarse to fine gravel (ML)
			62.9					
GP	S-4	60/60	15	0.0	0.000		FILL	(15'-16') Moist, yellowish brown, SILT, some clay, some coarse to fine gravel (ML)
							FILL	(16'-20') Moist, gray, SILT, some coarse to fine gravel, little clay (ML)
			57.9					
GP	S-5	60/54	20	0.0	0.000		ML	(20'-25') Moist to wet, gray, SILT, some coarse to fine gravel, little medium to fine sand, trace clay (TILL)
			52.9					
			25					End of exploration at 25ft bgs

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

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BOREHOLE LOG

SB-LF2-26B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 77.84
Drilling Method/Rig: DPT/Geoprobe 6620DT
Total Depth (ft.): 22
Drillers: J. Emma, J. Haines
Abandonment Method: Backfilled with bentonite chips
Drilling Date: Start: 7/17/2015 **End:** 7/17/2015
Field Screening Instrument: PID, Jerome MVA
Borehole Coordinates:
Logged By: P. Donohue

N 392,397.77 E 900,807.02

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			77.8 0					(0-10') See SB-LF2-26 boring log for lithologic description.
			72.8 5					
			67.8					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled discretely from 21-22' BGS for VOCs, chloropicrin, PCBs, and cadmium. Offset of SB-LF2-26, 1' from original boring location. The Jerome MVA readings indicated represent the highest recorded values in that range.

Reviewed by: E. Ashley **Date:** 10/23/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

BOREHOLE LOG

SB-LF2-26B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			67.8 10 62.8 15 57.8 20					(10-21') See SB-LF2-26 boring log for lithologic description.
GP	S-1	12/12		0.0	0.000		ML	(21-22') Moist, gray-dark gray, SILT, some clay, little coarse-fine angular and rounded gravel, little coarse-fine sand. (ML)
			52.8 25					End of Exploration at 22' BGS.

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BOREHOLE LOG

SB-LF2-28

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 78.8
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 15
Drillers: John Chase, Eric Woodward
Abandonment Method: Bentonite Chips
Drilling Date: Start: 06/18/2015 **End:** 06/18/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: G. Barr, J. Kocis

N 392,444.98 E 900,845.65

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.8					
GP	S-1	60/46	0	0.0	0.000		FILL	(0'-2.5') Dry, brown, SILT, some fine sand, little medium to fine gravel (ML)
							FILL	(2.5'-2.8') Granular black material
							FILL	(2.8'-3.8') Moist, dark brown, medium to fine SAND, trace fine gravel (SW)
							FILL	(3.8'-5') Moist, dark brown, fine SAND and SILT, some medium to fine gravel (ML)
			73.8					
GP	S-2	60/34	5	0.0	0.000		FILL	(5'-6') Moist, dark brown, medium to fine SAND, trace coarse to fine gravel (SP)
							FILL	(6'-10') Moist, yellow-brown, SILT, little fine gravel, little clay (ML) Observed wood debris at 8.5-9 ft and 9.8-10 ft bgs
			68.8					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Reviewed by: G. Barr **Date:** 11/02/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

BOREHOLE LOG

SB-LF2-28

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.8					
GP	S-3	60/29	10	0.0	0.000		FILL	(10'-13') Moist, yellow-brown, SILT, little fine gravel, little clay (ML)
			63.8				FILL	(13'-15') Moist, light gray-brown, SILT and fine SAND, some coarse to fine gravel (ML)
			15					End of exploration at 15 ft bgs.
			58.8 / 20					
			53.8 / 25					

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-28B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 78.77
Drilling Method/Rig: DPT/Geoprobe 6620DT
Total Depth (ft.): 17
Drillers: J. Emma, M. Rash
Abandonment Method: Backfilled with bentonite chips
Drilling Date: Start: 7/20/2015 **End:** 7/20/2015
Field Screening Instrument: PID, Jerome MVA
Borehole Coordinates:
Logged By: P. Donohue

N 392,444.98 E 900,845.65

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.8 0					(0-10') See boring log SB-LF2-28 for lithologic description.
			73.8 5					
			68.8					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled discretely from 16-17' BGS for VOCs, chloropicrin, PCBs, and cadmium. Offset of SB-LF2-28, 1' from original boring location. Due to low recovery, it took 4 offset attempts to collect enough volume for analysis. The Jerome MVA readings indicated represent the highest recorded values in that range.

Reviewed by: E. Ashley **Date:** 10/23/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

BOREHOLE LOG

SB-LF2-28B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.8 10 63.8 15					(10-16') See boring log SB-LF2-28 for lithologic description.
GP	S-1	12/4		0.0	0.000		SM	(16-17') Moist-wet, gray, coarse-fine SAND and SILT, some coarse-fine angular gravel. (SM)
			58.8 20 53.8 25					End of Exploration at 17' BGS.

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BOREHOLE LOG

SB-LF2-32

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 78.7
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 20
Drillers: John Chase, Bobby Orsini
Abandonment Method: Bentonite Chips
Drilling Date: Start: 06/19/2015 **End:** 06/19/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: J. Gillen, J. Kocis

N 392,440.87 E 900,887.25

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.7					
GP	S-1	60/42	0	0.0			FILL	(0'-1') Dry, brown, medium to fine SAND, some silt, trace organics (SM)
							FILL	(1'-2.3') Moist, brown, coarse to fine SAND, some silt, trace medium gravel (SM)
							FILL	(2.3'-5') Moist, brown-gray, medium to fine SAND, little silt, trace fine gravel (SM)
			73.7					
GP	S-2	60/37	5	0.0			FILL	(5'-8.2') Moist, brown-gray, medium to fine SAND, little silt, trace fine gravel (SM)
							FILL	(8.2'-9.75') Moist, brown-gray, SILT, some coarse to fine sand, trace fine gravel (ML) Observed rock at 9.75 ft bgs
			68.7				FILL	(9.75'-10') Moist, brown-gray, coarse to fine SAND, some silt (SM)

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Driller notes increase in tightness at 16' and again at 18'
Till encountered at 13'
Sampling ended at 17'

Reviewed by: J. Gillen **Date:** 11/18/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

BOREHOLE LOG

SB-LF2-32

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.7					
			10				FILL	(10'-11.5') Moist, gray-brown, coarse to fine SAND, little silt, trace fine gravel (SW-SM)
GP	S-3	60/42		0.0			FILL	(11.5'-13') Wet, gray, coarse to fine SAND and SILT, trace fine to medium gravel (SM)
							ML	(13'-15') Wet, brown-gray, SILT and medium to fine SAND, trace fine gravel (TILL) Observed stone at 14.5 ft bgs
			63.7					
			15				ML	(15.'-15.2') Wet, brown-gray, SILT, and medium to fine sand, trace fine gravel (TILL)
							SM	(15.2'-16.3') Wet, gray-brown, coarse to fine SAND, little silt (TILL)
GP	S-4	60/41		0.0			ML	(16.3'-19') Wet, brown-gray, SILT, and coarse to fine sand, trace fine gravel (TILL) Observed rock at 17.4 ft bgs and 19 ft bgs
							ML	(19'-20') Wet, gray-brown, SILT, some coarse to fine sand (TILL)
			58.7					
			20					End of exploration at 20 ft bgs.
			53.7					
			25					

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BOREHOLE LOG

SB-LF2-32B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 78.68
Drilling Method/Rig: DPT/Geoprobe 6620DT
Total Depth (ft.): 17
Drillers: J. Emma, M. Rash
Abandonment Method: Backfilled with bentonite chips
Drilling Date: Start: 7/20/2015 **End:** 7/20/2015
Field Screening Instrument: PID, Jerome MVA
Borehole Coordinates:
Logged By: P. Donohue

N 392,440.87 E 900,887.25

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.7 0					(0-10') See SB-LF2-32 boring log for lithologic descriptions.
			73.7 5					
			68.7					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled discretely from 16-17' BGS for VOCs, chloropicrin, PCBs, and cadmium. Offset of SB-LF2-32, 1' from original boring location. The Jerome MVA readings indicated represent the highest recorded values in that range.

Reviewed by: E. Ashley **Date:** 10/23/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

BOREHOLE LOG

SB-LF2-32B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.7 10 63.7 15					(10-16') See SB-LF2-32 boring log for lithologic descriptions.
GP	S-1	12/12		0.0	0.000		ML	(16-17') Moist, gray-tan, SILT, some coarse-fine angular and rounded gravel, some medium-fine sand, little clay. (ML)
			58.7 20 53.7 25					End of Exploration at 17' BGS.

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

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BOREHOLE LOG

SB-LF2-35

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 75.3
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 25
Drillers: John Chase, Bobby Orsini
Abandonment Method: Bentonite Chips
Drilling Date: Start: 06/17/2015 **End:** 06/17/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: G. Barr, J. Kocis

N 392,486.25 E 900,909.15

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			75.3					
GP	S-1	60/54	0	0.0	0.000		FILL	(0'-0.7') Dry, brown, SILT, little fine sand, trace roots (ML)
							FILL	(0.7'-1.9') Dry, light brown-gray, SILT, little gravel, trace fine sand (ML)
							FILL	(1.9'-4.5') Dry, dark brown, fine SAND, some gravel, little silt, little clay (SP)
			70.3				FILL	(4.5'-5') Moist, dark gray, medium to fine SAND, little gravel, little silt, little clay (SM/SC)
GP	S-2	60/42	5	0.0	0.000		FILL	(5'-6') Moist, dark gray, SILT, some coarse to fine gravel, some clay, little fine sand (ML)
							FILL	(6'-7.3') Moist, dark yellowish brown, SILT, little clay, trace fine gravel (ML)
							FILL	(7.3'-9.2') Moist, light gray-brown, medium to fine SAND, little silt, trace fine gravel (SW/SM)
			65.3				FILL	(9.2'-10') Moist, dark brown, SILT, some clay, trace fine gravel, trace organics (OL)

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

0-5 ft bgs - pressure on Geoprobe
5-10 ft bgs - increased pressure
~12 ft bgs - very high pressure
15-20 ft bgs - very high pressure

Reviewed by: G. Barr **Date:** 11/02/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

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BOREHOLE LOG

SB-LF2-35

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			65.3					
GP	S-3	60/36	10	0.0	0.000		SW	(10'-12.5') Moist-wet, yellowish brown-grayish brown, fine SAND, little silt
							SW	(12.5'-15') Moist-wet, gray-reddish brown, coarse to fine SAND, and coarse to fine gravel, little silt, little clay (TILL)
			60.3					
GP	S-4	60/60	15	0.0	0.000		SW	(15'-18') Moist, dark grayish brown, coarse to fine SAND, some gravel (TILL)
							GW	(18'-20') Wet, dark brown, coarse to fine GRAVEL, some fine sand, little silt, little clay (TILL)
			55.3					
GP	S-5	60/	20	0.0	0.000		GW	(20'-21.2') Wet, dark brown, coarse to fine GRAVEL, some fine sand, little silt, little clay (TILL)
							SC	(21.2'-25') Wet, gray, fine SAND, little clay (TILL)
			50.3					
			25					End of exploration at 25 ft bgs.

CDM Smith Geosyntec consultants

BOREHOLE LOG

SB-LF2-35B

Client: Mallinckrodt US LLC
Project Location: Orrington, Maine
Project Name: Orrington Remediation Site
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Drilling Method/Rig: DPT/Geoprobe 6620DT
Drillers: J. Emma, M. Rash
Drilling Date: Start: 7/20/2015 **End:** 7/20/2015
Borehole Coordinates:
N 392,486.25 E 900,909.15

Surface Elevation (ft.): 75.3
Total Depth (ft.): 16
Abandonment Method: Backfilled with bentonite chips
Field Screening Instrument: PID, Jerome MVA
Logged By: P. Donohue

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			75.3 0					(0-10') See SB-LF2-35 boring log for lithologic descriptions.
			70.3 5					
			65.3					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled discretely from 15-16' BGS for VOCs, chloropicrin, PCBs, and cadmium. The Jerome MVA readings indicated represent the highest recorded values in that range.
Offset of SB-LF1-35, 1' from original boring location.

Reviewed by: E. Ashley **Date:** 10/23/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

BOREHOLE LOG

SB-LF2-35B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			65.3					
			10					(10-15') See LB-LF2-35 boring log for lithologic descriptions.
			60.3					
GP	S-1	12/12	15	0.0	0.000		SWG	(15-16') Wet-saturated, gray, coarse-fine SAND and coarse-fine angular GRAVEL, little silt. (SWG)
								End of Exploration at 16' BGS.
			55.3 / 20					
			50.3 / 25					

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-36

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 78.0
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 20
Drillers: John Chase, Bobby Orsini
Abandonment Method: Bentonite Chips
Drilling Date: Start: 06/25/2015 **End:** 06/25/2015
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: G. Barr, J. Kocis

N 392,452.66 E 900,909.56

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.0					
GP	S-1	60/36	0	0.0	0.000		FILL	(0'-2.3') Moist, brown, SILT, little fine sand, little medium to fine gravel, organics (ML)
							FILL	(2.3'-5') Moist, brown, medium to fine SAND, trace medium to fine gravel, trace silt (SP-SM)
			73.0					
GP	S-2	60/36	5	0.0	0.000		FILL	(5'-7.3') Wet, brown, medium to fine SAND, little medium to fine gravel, little silt (SP-SM)
							FILL	(7.3'-9') Moist, brown, SILT, little clay, trace fine sand (ML)
							FILL	(9'-10') Moist, brown, medium to fine SAND, little fine gravel, trace silt (SP-SM)
			68.0					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

VOCs and Chloropicrin samples collected at 6-7 ft bgs and 7-8 ft bgs
off-set after 5 ft bgs - 1 ft bgs North

Reviewed by: G. Barr **Date:** 11/02/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

BOREHOLE LOG

SB-LF2-36

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.0					
			10				FILL	(10'-12.2') Wet, gray, SILT, trace fine sand (ML)
GP	S-3	60/26.4		0.0	0.000		GM-GC	(12.2'-14.4') Moist, gray-brown, coarse to fine GRAVEL, little fine sand, trace silt, trace clay (TILL)
			63.0				CL	(14.4'-15') Moist, gray, CLAY, trace fine sand, trace silt (TILL)
			15				GM-GC	(15'-19') Wet, gray, medium to fine GRAVEL, little fine sand, trace silt (TILL)
GP	S-3	60/24		0.0	0.000			
			58.0				SP	(19'-20') Moist, brown-gray, fine SAND, trace silt (TILL)
			20				SP	(20'-25') Wet, brown, medium to fine SAND (TILL)
GP	S-4	60/4		0.0	0.000			
			53.0					
			25					End of exploration at 25 ft bgs.

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 11/24/15

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-43

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 71.44
Drilling Method/Rig: DPT/Geoprobe 6620DT
Total Depth (ft.): 20
Drillers: J. Emma, M. Rash
Abandonment Method: Backfilled with bentonite chips
Drilling Date: Start: 7/8/2015 **End:** 7/8/2015
Field Screening Instrument: PID, Jerome MVA
Borehole Coordinates:
Logged By: P. Donohue

N 392,396.76 E 900,667.82

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			71.4					
GP	S-1	60/32	0	0.0	0.000		FILL	(0-1') Moist, reddish brown, fine SAND and SILT, trace clay, trace roots. (SM)
				0.0			FILL	(1-4.5') Moist-wet, gray-olive, SILT, some clay, little fine sand. (ML)
				0.0				
				0.0				
				0.0				
			66.4				FILL	(4.5-5') Moist, gray, coarse-fine SAND, little silt. (SW)
GP	S-2	60/46	5	0.0	0.000		FILL	(5-6') Same as 4.5-5' BGS.
				0.9			FILL	(6-7') Wet, dark gray-black, medium-fine SAND, little silt, trace medium-fine angular gravel. (SP)
				0.5			FILL	(7-9.5') Wet, dark gray-olive gray, SILT, little clay, little medium-fine rounded gravel, little medium-fine sand. (ML)
				0.0				
				0.0				
			61.4				FILL	(9.5-10') Wet, light tan, with orange streaks, SILT, some coarse-fine angular gravel with clay, little medium-fine sand. (ML)

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled continuously for Hg (XRF/DMA) to 20' BGS. The Jerome MVA readings indicated represent the highest recorded values in that range.

Reviewed by: E. Ashley **Date:** 10/23/2015

BOREHOLE LOG

SB-LF2-43

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			61.4					
GP	S-3	60/59	10	0.0	0.000		FILL	(10-12.5') Same as 9.5-10' BGS, wet-saturated. Driller noted tighter drilling conditions at 12' BGS, increasing to 20' BGS.
				0.0				
				0.0			ML	(12.5-15') Wet, gray-light gray, SILT, some clay, little coarse-fine sand, little medium-fine angular gravel. (ML)
				0.0				
				0.0				
			56.4					
GP	S-4	60/40	15	0.0	0.000		ML	(15-20') Same as 12.5-15' BGS.
				0.0				
				0.0				
				0.0				
			51.4					
			20					End of Exploration at 20' BGS.
			46.4					
			25					

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-57

Client: Mallinckrodt US LLC
Project Location: Orrington, Maine
Project Name: Orrington Remediation Site
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Drilling Method/Rig: DPT/Geoprobe 6620DT
Drillers: J. Emma, J. Haines
Drilling Date: Start: 7/17/2015 **End:** 7/17/2015
Borehole Coordinates:
N 392,346.87 E 900,649.73

Surface Elevation (ft.): 75.9
Total Depth (ft.): 15
Abandonment Method: Backfilled with bentonite chips
Field Screening Instrument: PID, Jerome MVA
Logged By: P. Donohue

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.) 75.9	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
GP	S-1	60/24	0	0.0	0.000		FILL	(0-0.5') Dry, dark brown, coarse-fine SAND, trace silt, trace fine sub-angular gravel, trace organics. (SW)
				0.0			FILL	(0.5-4') Dry, brown-light tan, medium-fine SAND, little silt, little medium-fine angular gravel. (SP)
				0.0				
				0.0				
				0.0			FILL	(4-5') Dry-moist, gray-brown, coarse-fine SAND and coarse-fine angular GRAVEL trace silt. (SW)
			70.9					
GP	S-2	60/9	5	0.0	0.000			(5-10') Insufficient Recovery. See SB-LF2-57A for lithologic description details.
				0.0				
				0.0				
				0.0				
			65.9	0.0				

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled continuously for Hg (XRF/DMA) to 15' BGS. The Jerome MVA readings indicated represent the highest recorded values in that range.

Reviewed by: E. Ashley **Date:** 10/23/2015

GEOSYNTEC BL_NO BLOWS PID/JEROME LF2.GPJ CDM_MA.GDT 10/19/15

BOREHOLE LOG

SB-LF2-57

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			65.9					
GP	S-3	60/60	10	0.0	0.000		ML	(10-13.5') Moist, brown-tan, SILT and medium-fine SAND, little coarse-fine angular and sub-angular gravel. Driller noted tighter conditions at 12' BGS. (ML)
				0.0				
				0.0				
				0.0			ML	(13.5-15') Moist, gray, SILT, some coarse-fine sand, some coarse-fine angular gravel, little clay. (ML)
				0.0				
			60.9					
			15					End of Exploration at 15' BGS.
			55.9					
			20					
			50.9					
			25					

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-57A

Client: Mallinckrodt US LLC
Project Location: Orrington, Maine
Project Name: Orrington Remediation Site
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Drilling Method/Rig: DPT/Geoprobe 6620DT
Drillers: J. Emma, J. Haines
Drilling Date: Start: 7/17/2015 **End:** 7/17/2015
Borehole Coordinates:
N 392,346.87 E 900,649.73

Surface Elevation (ft.): 75.9
Total Depth (ft.): 10
Abandonment Method: Backfilled with bentonite chips
Field Screening Instrument: PID, Jerome MVA
Logged By: P. Donohue

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			75.9 0					(0-5') See SB-LF2-57 for lithologic descriptions.
			70.9 5				FILL	(5-6') Moist, brown, coarse-fine SAND, little silt. (SW)
				0.0			FILL	(6-6.5') Wet, black, SILT, some clay, trace coarse-fine sand. (MH)
				0.0			FILL	(6.5-7') Wet, dark gray-brown, medium-fine SAND and SILT, trace fine angular gravel. (SM)
GP	S-1	60/50		0.0	0.000		ML	(7-10') Wet-moist, gray with black and red streaks, SILT and coarse-fine SAND, little clay, little medium-fine angular gravel. (ML)
				0.0				
				0.0				
			65.9 10					End of Exploration at 10' BGS.

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled discretely from 5-10' BGS for Hg (XRF/DMA). Offset of SB-LF2-57, 1' from original boring location. The Jerome MVA readings indicated represent the highest recorded values in that range.

Reviewed by: E. Ashley **Date:** 10/23/2015

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-57B

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: 5000-110260

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 75.9
Drilling Method/Rig: DPT/Geoprobe 6620DT
Total Depth (ft.): 8
Drillers: J. Emma, M. Rash
Abandonment Method: Backfilled with bentonite chips
Drilling Date: Start: 8/10/2015 **End:** 8/10/2015
Field Screening Instrument: PID, Jerome MVA
Borehole Coordinates:
Logged By: P. Donohue

N 392,346.87 E 900,649.73

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			75.9 0					(0-7') No sample collected. See SB-LF2-57 boring logs for lithologic descriptions.
			70.9 5					
GP	S-1	12/12		0.0	0.000		SW	(7-8') Wet, tan-light brown, coarse-fine SAND, little silt, little fine sub-angular gravel, trace clay. (SW)
			65.9					End of Exploration at 8' BGS.

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Sampled discretely from 7-8' BGS for VOCs, chloropicrin, PCBs, and cadmium. Offset of SB-LF2-56, 1' northeast of original boring location. The Jerome MVA readings indicated represent the highest recorded values in that range.

Reviewed by: E. Ashley **Date:** 10/23/2015

ATTACHMENT B-2

Resampling Investigation Logs

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-15D

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 76.2
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 18
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/22/2016 **End:** 04/22/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,374.82 E 900,716.13

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			76.2 0					(0'-13') See SB-LF2-15 and SB-LF2-15B boring logs for lithologic description.
			71.2 5					
			66.2					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

SB-LF2-15D duplicate collected from 13'-14'
Soil boring SB-LF2-15A was not performed.
Soil boring SB-LF2-15C was performed for Hg speciation sampling and log is not presented.

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-15D

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			66.2 10					
GP	S-1	60/36	61.2 15	0.0	0.000		ML	(13'-14') Moist, gray brown, SILT, little fine sand, trace clay, trace fine subangular gravel
							ML	(14'-15.5') Wet, light brown, SILT, some medium to fine sand, little medium to fine subangular gravel
							ML	(15.5'-18') Moist, gray, SILT, little clay, trace medium to fine subangular rounded gravel, trace fine sand
			56.2 20					End of boring at 18 ft bgs
			51.2 25					

GEOSYNTEC BL_NO BLOWS PID/JEROME_ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-23C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 77.4
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 13
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/22/2016 **End:** 04/22/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,384.94 E 900,783.28

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			77.4 0					(0'-8') See SB-LF2-23 and SB-LF2-23B boring logs for lithologic description.
			72.4 5					
							ML	(8'-9.0') Moist, brown-gray, SILT, little clay, little to trace coarse to fine subangular rounded gravel (9.0'-9.1') Cobble (9.1'-9.5') Moist, brown-gray, SILT, little clay, little to trace coarse to fine subangular rounded gravel
			67.4				ML	Moist, brown, SILT, some clay, trace medium to fine rounded gravel, trace fine sand

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

SB-LF2-23C duplicate collected from 8'-9'
Soil boring SB-LF2-23A was not performed.

Reviewed by: R. Rancatti **Date:** 06/03/2016

BOREHOLE LOG

SB-LF2-23C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			67.4 / 10					
GP	S-1	60/42		0.0	0.000			
								End of boring at 13 ft bgs
			62.4 / 15					
			57.4 / 20					
			52.4 / 25					

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-24C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 73.4
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 17
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/21/2016 **End:** 04/21/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,470.45 E 900,808.17

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			73.4 0					(0'-12') See SB-LF2-24 and SB-LF2-24B boring logs for lithologic description.
			68.4 5					
			63.4					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Discrete sample from 12'-17'
Soil boring SB-LF2-24A was performed for VOC sampling and log is not presented.

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-24C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			63.4 10					
GP	S-1	60/43		0.0	0.000		ML	(12'-12.75') Moist, gray, SILT, little clay, trace organics, trace medium to fine subangular gravel, trace fine sand
							SP	(12.75'-15') Wet, gray, fine SAND, trace silt, trace medium subangular gravel (loose)
			58.4 15				SP	(15'-16') Wet, gray, medium to fine, subangular rounded GRAVEL, trace fine sand, trace silt
							SP	(16'-17') Wet, gray, fine SAND
			53.4 20					End of boring at 17 ft bgs
			48.4 25					

BOREHOLE LOG

SB-LF2-25A

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 78.4
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 14
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/21/2016 **End:** 04/21/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,419.77 E 900,799.72

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.4 0					(0'-9') See SB-LF2-25 boring log for lithologic description.
			73.4 5					
							ML	(9'-9.6') Moist, gray, organic SILT, trace fine sand (ML)
			68.4				ML	(9.6'-12.25') Moist, gray brown, SILT, little clay, trace fine sand, trace medium

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

(9'-13') - "reworked native"

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-25A

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.4					
			10					to fine subangular gravel
GP	S-1	60/38		0.0	0.000			
							SP	(12.25'-13.5') Moist, gray, medium to fine SAND
							ML	(13.5'-14') Moist, gray brown, SILT, little medium to fine subangular rounded gravel, trace clay (TILL)
								End of boring at 14 ft bgs
			63.4					
			15					
			58.4					
			20					
			53.4					
			25					

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BOREHOLE LOG

SB-LF2-26C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 77.9
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 23
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/21/2016 **End:** 04/21/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,399.30 E 900,806.92

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			77.9 0					(0'-18') See SB-LF2-26 and SB-LF2-26B boring logs for lithologic description.
			72.9 5					
			67.9					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Soil boring SB-LF2-26A was not performed.

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-26C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			67.9 10					
			62.9 15					
GP	S-1	60/48	57.9 20	0.0	0.000		ML	(18'-23') Moist, gray, SILT, little clay, little medium to fine subangular angular gravel
			52.9 25					End of boring at 23 ft bgs

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BOREHOLE LOG

SB-LF2-28C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 78.8
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 18
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/21/2016 **End:** 04/21/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,444.98 E 900,845.65

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.8 0					(0'-13') See SB-LF2-28 and SB-LF2-28B boring logs for lithologic description.
			73.8 5					
			68.8					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Soil boring SB-LF2-28A was not performed.

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-28C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.8 10					
GP	S-1	60/43	63.8 15	0.0	0.000		ML	(13'-15.5') Moist, gray-brown, SILT, some coarse to fine angular subangular gravel, little medium to fine sand, trace clay
							SP	(15.5'-16.25') Moist to wet, gray, medium to fine SAND
							SP	(16.25'-18') Moist to wet, brown, medium to fine SAND
			58.8 20					End of boring at 18 ft bgs
			53.8 25					

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

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BOREHOLE LOG

SB-LF2-32C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 78.7
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 18
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/21/2016 **End:** 04/21/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,440.87 E 900,887.25

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.7 0					(0'-13') See SB-LF2-32 and SB-LF2-32B boring logs for lithologic description.
			73.7 5					
			68.7					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Soil boring SB-LF2-32A was not performed.

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-32C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.7 10					
GP	S-1	60/48	63.7 15	0.0	0.000		ML	(13'-18') Moist, brown, SILT, little clay, little medium to fine subangular gravel, trace sand
			58.7 20 53.7 25					End of boring at 18 ft bgs

GEOSYNTEC BL_NO BLOWS PID/JEROME_ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

CDM Smith | Geosyntec consultants

BOREHOLE LOG

SB-LF2-35C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 75.3
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 18
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/21/2016 **End:** 04/21/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,486.25 E 900,909.15

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			75.3 0					(0'-13') See SB-LF2-35 and SB-LF2-35B boring logs for lithologic description.
			70.3 5					
			65.3					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Soil boring SB-LF2-35A was not performed.

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-35C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			65.3 10					
							GW	(13'-14') Wet, gray, coarse to fine subangular GRAVEL, trace silt
							ML	(14'-18') Moist, brown gray, SILT, little medium to fine subangular gravel, trace medium to fine sand, trace clay
GP	S-1	60/38	60.3 15	0.0	0.000			
			55.3 20					End of boring at 18 ft bgs
			50.3 25					

BOREHOLE LOG

SB-LF2-36A

Client: Mallinckrodt US LLC
Project Location: Orrington, Maine
Project Name: Orrington Remediation Site
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Drillers: Gio Bovenzi, Pat McClanahan
Drilling Date: Start: 04/21/2016 **End:** 04/21/2016
Borehole Coordinates:
N 392,452.66 E 900,909.56

Surface Elevation (ft.): 78.0
Total Depth (ft.): 13
Abandonment Method: Bentonite Chips
Field Screening Instrument: PID and Jerome meters
Logged By: P. Troy

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			78.0 0					(0'-8') See SB-LF2-36 boring log for lithologic description.
			73.0 5					
							ML	(8'-8.5') Moist, gray, SILT, little clay, trace fine sand
							SP	(8.5'-10') Moist, gray, coarse to fine SAND, trace medium to fine gravel
			68.0					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-36A

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			68.0					
GP	S-1	60/43	10	0.0	0.000		ML	(10'-13') Moist, brown gray, SILT, some clay, trace medium to fine subangular rounded gravel
			63.0 / 15					End of boring at 13 ft bgs
			58.0 / 20					
			53.0 / 25					

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

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BOREHOLE LOG

SB-LF2-43A

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 71.4
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 18
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/21/2016 **End:** 04/21/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,396.76 E 900,667.82

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			71.4 0					(0'-13') See SB-LF2-43 boring log for lithologic description.
			66.4 5					
			61.4					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-43A

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			61.4 10					
GP	S-1	60/40	56.4 15	0.0	0.000		ML	(13'-18') Moist, gray, SILT, some clay, trace medium to fine subangular rounded gravel, trace fine sand (TILL)
			51.4 20					End of boring at 18 ft bgs
			46.4 25					

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

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BOREHOLE LOG

SB-LF2-57C

Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Drilling Contractor: Geosearch, Inc.
Surface Elevation (ft.): 75.9
Drilling Method/Rig: Direct Push/Geoprobe 7822DT
Total Depth (ft.): 13
Drillers: Gio Bovenzi, Pat McClanahan
Abandonment Method: Bentonite Chips
Drilling Date: Start: 04/21/2016 **End:** 04/21/2016
Field Screening Instrument: PID and Jerome meters
Borehole Coordinates:
Logged By: P. Troy

N 392,346.87 E 900,649.73

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			75.9 0					(0'-8') See SB-LF2-57, SB-LF2-57A, and SB-LF2-57B boring logs for lithologic description.
			70.9 5					
							ML	(8'-13') Moist, brown, SILT, little to trace medium to fine sand, trace clay, trace medium to fine subangular gravel (TILL)
			65.9					

EXPLANATION OF ABBREVIATIONS

DRILLING METHODS:
HSA - Hollow Stem Auger
SSA - Solid Stem Auger
HA - Hand Auger
AR - Air Rotary
DTR - Dual Tube Rotary
FR - Foam Rotary
MR - Mud Rotary
RC - Reverse Circulation
CT - Cable Tool
JET - Jetting
D - Driving
DTC - Drill Through Casing

SAMPLING TYPES:
AS - Auger/Grab Sample
CS - California Sampler
BX - 1.5" Rock Core
NX - 2.1" Rock Core
GP - Geoprobe
HP - Hydro Punch
SS - Split Spoon
ST - Shelby Tube
WS - Wash Sample
OTHER:
AGS - Above Ground Surface

REMARKS

Reviewed by: R. Rancatti **Date:** 06/03/2016

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

BOREHOLE LOG

SB-LF2-57C

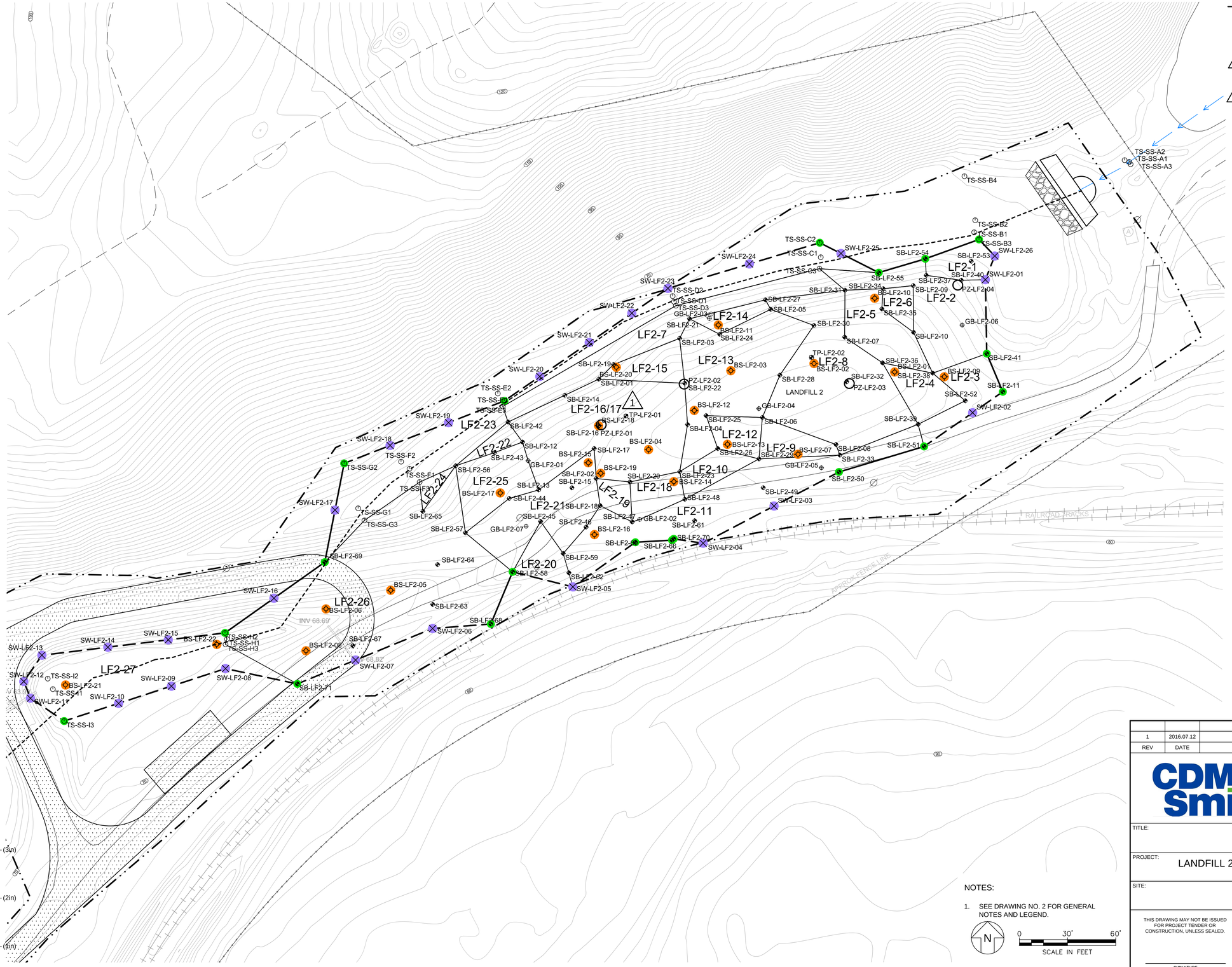
Client: Mallinckrodt US LLC
Project Name: Orrington Remediation Site
Project Location: Orrington, Maine
Project Number: BR0292

Sample Type	Sample Number	Sample Recovery (Inches)	Elev. Depth (ft.)	PID Reading (ppmv)	Jerome Hg Reading (mg/m3)	Graphic Log	Stratum Designation	Material Description
			65.9					
GP	S-1	60/54	10	0.0	0.000			
			60.9 / 15					End of boring at 13 ft bgs
			55.9 / 20					
			50.9 / 25					

GEOSYNTEC BL_NO BLOWS PID/JEROME ORRINGTON TEMPLATE.GPJ CDM_MA.GDT 6/6/16

ATTACHMENT C

Revised Excavation and Confirmation Sampling Plans



LEGEND

- PRE-EXCAVATION SIDEWALL SAMPLE (MERCURY CONCENTRATIONS ARE BELOW THE MPS AT EACH INTERVAL)
- PRE-EXCAVATION BOTTOM SAMPLE
- 1 POST-EXCAVATION BOTTOM SAMPLE
- POST-EXCAVATION SIDE WALL SAMPLE (1 INTERVAL)
- 1 PRE-EXCAVATION PIEZOMETER

BOTTOM SAMPLE AND SIDEWALL SAMPLE SUMMARY TABLE

LOCATION ID	Northing (USSurveyFoot)	Easting (USSurveyFoot)	Elevation (USSurveyFoot)
BS-LF2-01	392446.95	900917.14	68.9
BS-LF2-02	392452.24	900866.91	64.8
BS-LF2-03	392447.78	900815.09	61.3
BS-LF2-04	392398.65	900763.85	55.2
BS-LF2-05	392311.04	900603.25	63.8
BS-LF2-06	392299.44	900562.94	63.8
BS-LF2-07	392395.73	900856.91	68.2
BS-LF2-08	392273.35	900550.47	63.8
BS-LF2-09	392443.96	900948.04	69.9
BS-LF2-10	392492.89	900904.68	66.2
BS-LF2-11	392476.24	900807.29	62.3
BS-LF2-12	392423.01	900792.32	61.3
BS-LF2-13	392401.91	900812.98	66.8
BS-LF2-14	392378.66	900779.6	70.3
BS-LF2-15	392390.45	900726.3	60.3
BS-LF2-16	392345.72	900730.17	70.8
BS-LF2-17	392371.65	900671.48	61.4
BS-LF2-18	392413.497	900732.71	58.3
BS-LF2-19	392383.874	900734.043	58.3
BS-LF2-20	392449.926	900743.763	62.9
BS-LF2-21	392252.109	900400.615	60.7
BS-LF2-22	392277.35	900494.818	60.7
SW-LF2-01	392504.43	900973.62	66-67
SW-LF2-02	392421.62	900965.73	72-73
SW-LF2-03	392363.51	900842.02	74-75
SW-LF2-04	392340.34	900797.84	74-75
SW-LF2-05	392313.16	900716.7	74-75
SW-LF2-06	392287.24	900629.38	64-65
SW-LF2-07	392267.58	900581.35	64-65
SW-LF2-08	392262.29	900500.36	63-64
SW-LF2-09	392251.34	900466.69	63-64
SW-LF2-10	392240.64	900433.78	63-64
SW-LF2-11	392243.85	900378.89	63-64
SW-LF2-12	392254.23	900374.73	63-64
SW-LF2-13	392270.58	900386.01	63-64
SW-LF2-14	392275.59	900427.08	63-64
SW-LF2-15	392280.18	900464.71	63-64
SW-LF2-16	392306.1	900530.53	64-65
SW-LF2-17	392360.96	900568.56	65-66
SW-LF2-18	392401.2	900602.87	65-66
SW-LF2-19	392415.4	900639.27	65-66
SW-LF2-20	392444.15	900696.13	65-66
SW-LF2-21	392465.32	900726.93	65-66
SW-LF2-22	392483.56	900753.45	65-66
SW-LF2-23	392499	900775.9	65-66
SW-LF2-24	392514.26	900826.65	65-66
SW-LF2-25	392520.74	900883.72	65-66

NOTES:

1. SEE DRAWING NO. 2 FOR GENERAL NOTES AND LEGEND.

N

0 30' 60'
SCALE IN FEET

CMI PLAN REV 1

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

REV	DATE	DESCRIPTION	DRN	APP
1	2016.07.12	EXCAVATION PLAN REVISIONS	JHT	CMG

CDM Smith

Geosyntec consultants

TITLE: CONFIRMATION SAMPLING PLAN

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	JJB	DATE:	FEBRUARY 2016
DRAWN BY:	JHT	PROJECT NO.:	BR0292
CHECKED BY:	JJB	FILE:	
REVIEWED BY:	DTD/CMG	DRAWING NO.:	
APPROVED BY:	SML		9 OF 18

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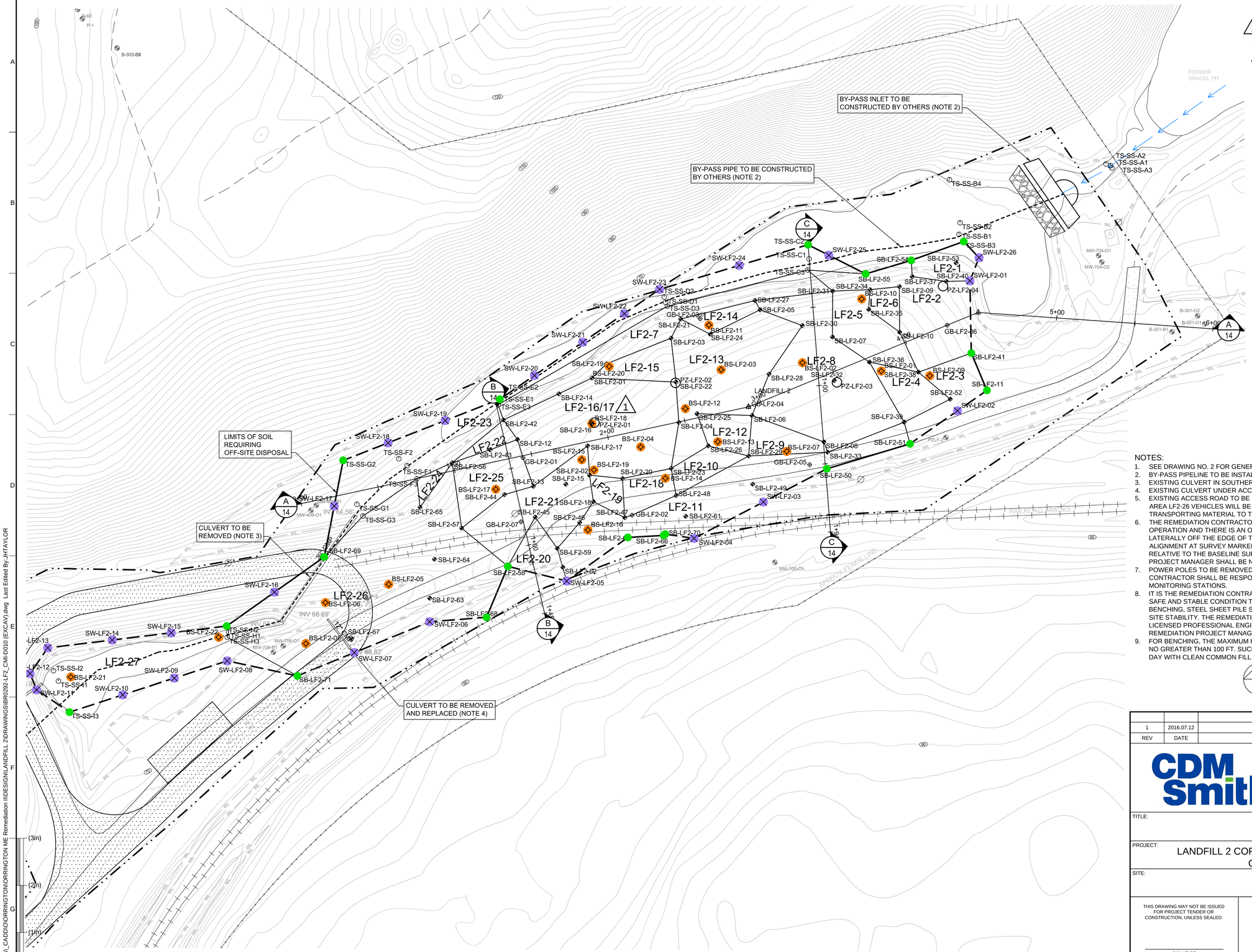

LEGEND

- 1 / LF2-1 — PROPOSED EXCAVATION AREA IDENTIFICATION / BOUNDARY
- PRELIMINARY EXCAVATION BOUNDARY, DEPENDENT ON FINAL CONFIRMATION SAMPLE
- EXCAVATION BOUNDARY

NOTES:

1. SEE DRAWING NO. 2 FOR GENERAL NOTES AND LEGEND.
2. BY-PASS PIPELINE TO BE INSTALLED AS PART OF SCRAP METAL YARD CMI PLAN.
3. EXISTING CULVERT IN SOUTHERLY STREAM TO BE REMOVED AND NOT REPLACED.
4. EXISTING CULVERT UNDER ACCESS ROAD TO BE REMOVED AND REPLACED.
5. EXISTING ACCESS ROAD TO BE REMOVED AS REQUIRED DURING EXCAVATION. WHEN REMOVING EXCAVATION AREA LF2-26 VEHICLES WILL BE REQUIRED TO BACK IN FOR LOADING AND DECONTAMINATION PRIOR TO TRANSPORTING MATERIAL TO TEMPORARY SOIL STOCKPILE AREA.
6. THE REMEDIATION CONTRACTOR SHALL PERFORM DAILY SURVEYS OF THE RAILROAD LINES WHEN THEY ARE IN OPERATION AND THERE IS AN OPEN EXCAVATION WITHIN 5 HORIZONTAL TO 1 VERTICAL PROJECTION LATERALLY OFF THE EDGE OF TRACKS. SURVEYING SHALL BE PERFORMED EVERY 25 FT ALONG THE RAILROAD ALIGNMENT AT SURVEY MARKERS INDICATED. IF GREATER THAN 1/8-IN OF LATERAL MOVEMENT IS OBSERVED RELATIVE TO THE BASELINE SURVEY, NEARBY EXCAVATION WORK SHALL BE STOPPED AND THE REMEDIATION PROJECT MANAGER SHALL BE NOTIFIED.
7. POWER POLES TO BE REMOVED AND REPLACED AS REQUIRED TO SUPPORT EXCAVATION. REMEDIATION CONTRACTOR SHALL BE RESPONSIBLE FOR SUPPLYING AND MAINTAINING POWER TO PERIMETER AIR MONITORING STATIONS.
8. IT IS THE REMEDIATION CONTRACTOR'S RESPONSIBILITY TO MAINTAIN ALL SITE SLOPES AND EXCAVATIONS IN A SAFE AND STABLE CONDITION THROUGHOUT CONSTRUCTION. THE REMEDIATION CONTRACTOR MAY USE BENCHING, STEEL SHEET PILE SHORING, TRENCH BOX SHORING, OR OTHER SUITABLE METHODS TO ACHIEVE SITE STABILITY. THE REMEDIATION CONTRACTOR SHALL SUBMIT A SHORING DESIGN SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF MAINE AND AN INSTALLATION PLAN TO THE REMEDIATION PROJECT MANAGER FOR REVIEW AND APPROVAL PRIOR TO COMMENCING THE WORK.
9. FOR BENCHING, THE MAXIMUM HEIGHT OF A BENCH SHALL BE 4 FT AND THE LENGTH OF THE BENCH SHALL BE NO GREATER THAN 100 FT. SUCH VERTICAL BENCHES SHALL BE BUTTRESSED PRIOR TO THE END OF THE WORK DAY WITH CLEAN COMMON FILL SLOPED AT 2 HORIZONTAL: 1 VERTICAL.

N

0 30' 60'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP
1	2016.07.12	EXCAVATION PLAN REVISIONS	JHT	CMG

CDM Smith

Geosyntec consultants

TITLE: EXCAVATION PLAN

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

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DATE

DESIGN BY:	JSE	DATE:	FEBRUARY 2016
DRAWN BY:	JHT	PROJECT NO.:	BR0292
CHECKED BY:	ZBT	FILE:	
REVIEWED BY:	DTD/CMG	DRAWING NO.:	
APPROVED BY:	SML		10 OF 18

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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BORING SUMMARY TABLE			
LOCATION ID	NORTHING (USSurvey Foot)	EASTING (USSurvey Foot)	GROUND SURFACE ELEVATION (FT)
GB-LF2-01	392391.70	900688.84	74.7
GB-LF2-02	392355.14	900758.30	77.8
GB-LF2-03	392480.28	900801.71	70.6
GB-LF2-04	392424.13	900832.54	78.9
GB-LF2-05	392387.29	900871.47	76.8
GB-LF2-06	392476.18	900959.12	72.9
GB-LF2-07	392350.90	900687.56	76.9
SB-LF2-01	392442.53	900732.85	69.6
SB-LF2-02	392380.65	900731.22	76.6
SB-LF2-03	392467.87	900783.17	71.9
SB-LF2-04	392414.24	900788.14	78.3
SB-LF2-05	392486.00	900839.92	72.2
SB-LF2-06	392418.63	900834.75	78.8
SB-LF2-07	392468.66	900886.01	77.7
SB-LF2-08	392401.79	900880.61	76.3
SB-LF2-09	392500.72	900928.69	72.5
SB-LF2-10	392471.69	900928.87	76.2
SB-LF2-11	392434.66	900984.50	73.8
SB-LF2-12	392403.33	900685.33	72.4
SB-LF2-13	392373.54	900695.46	76.0
SB-LF2-14	392432.45	900711.68	69.0
SB-LF2-15	392374.82	900716.13	76.2
SB-LF2-16	392413.50	900732.71	75.3
SB-LF2-17	392399.30	900730.01	76.4
SB-LF2-18	392363.74	900733.70	77.2
SB-LF2-19	392451.59	900742.04	68.9
SB-LF2-20	392378.50	900752.26	77.0
SB-LF2-21	392480.08	900789.36	69.4
SB-LF2-22	392439.95	900786.33	76.6
SB-LF2-23	392384.94	900783.28	77.4
SB-LF2-24	392470.45	900808.17	73.4
SB-LF2-25	392419.77	900799.72	78.4
SB-LF2-26	392399.30	900806.92	77.9
SB-LF2-27	392491.89	900836.64	70.1
SB-LF2-28	392444.98	900845.65	78.8
SB-LF2-29	392392.86	900832.63	76.9
SB-LF2-30	392475.94	900866.82	75.9
SB-LF2-31	392497.89	900886.17	71.2
SB-LF2-32	392440.87	900887.25	78.7
SB-LF2-33	392395.21	900882.98	76.3
SB-LF2-34	392498.82	900909.98	72.2
SB-LF2-35	392486.25	900909.15	75.3
SB-LF2-36	392452.66	900909.56	78.0
SB-LF2-37	392507.14	900936.86	70.9
SB-LF2-38	392446.24	900940.82	75.9
SB-LF2-39	392414.39	900931.74	75.2
SB-LF2-40	392504.09	900958.63	70.1
SB-LF2-41	392458.39	900974.51	72.1
SB-LF2-42	392415.80	900676.32	67.9
SB-LF2-43	392396.76	900667.82	71.4
SB-LF2-44	392368.21	900677.05	75.4
SB-LF2-45	392353.90	900696.60	77.9
SB-LF2-46	392350.398	900724.937	77.8
SB-LF2-47	392353.574	900753.657	77.9
SB-LF2-48	392367.677	900786.436	77.4
SB-LF2-49	392374.874	900835.258	77.3
SB-LF2-50	392384.699	900882.47	76.6
SB-LF2-51	392400.61	900935.48	75.6
SB-LF2-52	392429.03	900961.10	74.6
SB-LF2-53	392515.86	900964.84	67.7
SB-LF2-54	392517.47	900936.23	67.7
SB-LF2-55	392508.81	900907.22	69.3
SB-LF2-56	392388.53	900643.72	68.9
SB-LF2-57	392346.87	900649.73	75.9
SB-LF2-58	392322.51	900679.18	77.6
SB-LF2-59	392333.96	900710.70	76.9
SB-LF2-60	392340.94	900755.65	77.8
SB-LF2-61	392354.36	900792.53	78.4
SB-LF2-62	392321.90	900714.23	75.7
SB-LF2-63	392302.24	900629.38	73.1
SB-LF2-64	392327.05	900632.43	76.1
SB-LF2-65	392360.15	900623.27	66.8
SB-LF2-66	392342.258	900778.451	78.1
SB-LF2-67	392276.50	900579.71	71.9
SB-LF2-68	392290.05	900665.62	77.0
SB-LF2-69	392328.54	900562.20	75.8
SB-LF2-70	392343.05	900779.53	78.1
SB-LF2-71	392252.74	900545.08	71.3

SOUTHERLY STREAM TRANSECT SAMPLE SUMMARY TABLE			
LOCATION ID	NORTHING (USSurveyFoot)	EASTING (USSurveyFoot)	ELEVATION (USSurveyFoot)
TS-SS-A1	392577.72	901063.21	67.40
TS-SS-A2	392578.83	901060.34	67.65
TS-SS-A3	392576.30	901064.08	67.66
TS-SS-B1	392533.95	900966.65	66.97
TS-SS-B2	392541.41	900967.31	66.86
TS-SS-B3	392529.49	900969.68	66.88
TS-SS-B4	392568.85	900960.57	67.88
TS-SS-C1	392518.36	900871.09	65.83
TS-SS-C2	392527.45	900870.50	66.47
TS-SS-C3	392511.29	900870.29	66.60
TS-SS-D1	392490.67	900779.63	66.12
TS-SS-D2	392494.17	900778.83	66.13
TS-SS-D3	392488.22	900780.84	66.26
TS-SS-E1	392428.99	900674.09	65.45
TS-SS-E2	392433.56	900669.96	66.03
TS-SS-E3	392425.50	900673.05	65.89
TS-SS-F1	392386.65	900614.94	65.33
TS-SS-F2	392391.09	900609.68	65.49
TS-SS-F3	392378.40	900621.24	66.06
TS-SS-G1	392362.06	900582.96	65.11
TS-SS-G2	392390.04	900574.27	65.78
TS-SS-G3	392354.52	900586.85	65.17
TS-SS-H1	392280.67	900501.23	64.86
TS-SS-H2	392284.49	900500.04	65.16
TS-SS-H3	392277.29	900500.36	64.88
TS-SS-I1	392249.44	900392.81	63.76
TS-SS-I2	392256.02	900389.62	64.34
TS-SS-I3	392229.61	900399.86	64.90

EXCAVATION SUMMARY TABLE							
EXCAVATION AREA NAME	AVERAGE ELEV OF GS	AREA	EXCAVATION OF SOIL WITH HG > 2.2 MG/KG		AVERAGE THICKNESS OF SOILS WITH HG > 2.2 MG/KG	TOTAL EXCAVATION DEPTH	APPROX VOLUME
	(FT)	(SF)	TOP, ELEV. (FT)	BOTTOM, ELEV. (FT)	(FT)	(FT)	(CY)
LF2-1	68.5	760.9	68	64.8	3.7	3.7	104
LF2-2	73.5	2996.9	75	64.8	8.7	8.7	966
LF2-3	75	1208.9	75	69.9	5.1	5.1	228
LF2-4	77	927.8	76	68.9	8.1	8.1	278
LF2-5	77	1564.2	78	66.2	10.8	10.8	626
LF2-6	75	401.6	74.5	66.2	8.8	8.8	131
LF2-7	69	2881.1	69.5	62.9	6.1	6.1	651
LF2-8	77	5314.8	78	64.8	12.2	12.2	2402
LF2-9	78	775.9	77	68.2	9.8	9.8	282
LF2-10	78	699.3	77	70.3	7.7	11.2	199
			67.9	66.8	1.2		31
LF2-11	77.5	5045.9	77	70.8	6.7	6.7	1252
LF2-12	78.5	692.6	77	66.8	11.7	11.7	300
LF2-13	77	4266.2	77	61.3	15.7	15.7	2481
LF2-14	71	458.0	72.5	62.3	8.7	8.7	148
LF2-15	73	853.9	75	62.9	10.1	10.1	319
LF2-16/17	75.5	5414.4	76.5	58.3	17.2	17.2	3449
LF2-18	78	703.3	76.5	70.3	7.7	7.7	201
LF2-19	77.5	416.8	75.5	65.6	11.9	11.9	184
LF2-20	77.5	755.8	76	66.9	10.6	10.6	297
LF2-21	77	2741.0	76.5	60.3	16.7	16.7	1695
LF2-22	70.5	332.1	71.5	64.4	6.1	6.1	75
LF2-23	67.5	5864.9	67	64.1	3.4	3.4	739
LF2-24	68	214.7	*	--	*	*	*
LF2-25	74	1588.3	75.5	61.4	12.6	12.6	741
LF2-26	72	11227.1	71.5	68.8	3.2	8.2	1331
			66.1	63.8	2.7		1123
LF2-27	67	4317.5	65	60.7	6.3	6.3	1007
Totals		62423.7					21239

* MERCURY LEVELS WITHIN AREA LF2-24 ARE BELOW 2.2 AT ALL INTERVALS

REV	DATE	DESCRIPTION	DRN	APP
1	2016.07.12	EXCAVATION PLAN REVISIONS	JHT	CMG

CDM Smith

Geosyntec consultants

TITLE: EXCAVATION TABLES

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	JSE	DATE:	FEBRUARY 2016
DRAWN BY:	JHT	PROJECT NO.:	BR0292
CHECKED BY:	ZBT	FILE:	
REVIEWED BY:	DTD/CMG	DRAWING NO.:	11 OF 18
APPROVED BY:	SML		

(3in) (2in) (1in) (1in) (2in) (3in) (4in)

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

CMI PLAN REV 1

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ATTACHMENT D

Revised Soil Use Plan

Soil Use Plan
Revision 1

Orrington Remediation Site
Orrington, Maine

Prepared by:

CDM Smith
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Chelmsford, MA 01824

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Mallinckrodt US LLC

July 2016

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APPENDIX A Reuse Stockpiling and Soil Sampling Plan

Section 1.
Introduction

The purpose of this plan is to provide guidance for selecting and screening soils from off-site and on-site sources that do not exceed the Media Protection Standards (MPS) for potential use as part of the Orrington Remediation Project (Site). Physical requirements (e.g. gradation, hydraulic conductivity, strength, etc.) of the materials to be used as part of the remediation activities are presented in the respective specifications from the CMI Plans.

Soils and materials that exceed the MPS will not be imported for use, and on-site soils exceeding the MPS will be sent off-site for disposal and are not proposed for reuse on-site. Therefore, the soils discussed in this plan are not subject to the 06-096 Code of Maine Regulations Chapter 400, Section 1, which governs contaminated soils from remediation sites that are considered special wastes. The Maine DEP guidance document *Remedial Action Guidelines (RAGs) for Sites Contaminated with Hazardous Substances* (which provides guidance for various soil exposure pathways), will be used for establishing criteria for parameters in which Contaminants of Concern (COCs) do not have a defined MPS criteria.

Section 2.
Media Protection Standards

2.1 Media Protection Standards

Media Protection Standards have been established in the Board of Environmental Protection (BEP) Order (Order) effective April 3, 2014 which incorporates, with modifications, the Compliance Order issued by the Maine Department of Environmental Protection (DEP) dated November 24, 2008. The MPSs for COCs in soil are summarized below in **Table 2-1**.

Table 2-1. Soil Media Protection Standards - Numeric

	Soil
	(mg/kg)
Mercury	2.2
Chloropicrin	0.125
PCBs	1.0
Cadmium	8
Ethylbenzene	13
Xylene	190

NOTES:

Media Protection Standards as presented in the Order (Attachment 2)
mg/kg = milligrams per kilogram
PCBs – polychlorinated biphenyls

2.2 Potential Receptors

Potential Receptors are categorized by duration of exposure and intensity of use at the Site. The receptor categories present at the Site include the following:

Commercial Worker	Outdoor commercial workers are those which are present at the Site for longer durations but with low intensity exposure such as groundskeepers, parking lot attendants and mechanics. This category is also conservatively applied for indoor office workers at the Site.
Residential User	Residential users are characterized by continuous exposure to children and adults over thirty through childhood and into adulthood. The category applies to residences, daycares, eldercare and medical treatment facilities.
Excavation or Construction Worker	Excavation or construction workers are present at the Site for exposure periods of 6-months or less although intensity of use is high, such as during non-routine activities including construction or utility work. Examples include utility and construction contractors and landscapers.

Section 3.
Soil Use Requirements

The soil use requirements for the Site are presented below. The information includes the source of the fill, acceptance criteria for use, areas of use, and testing requirements.

3.1 On-site Soils

Two types of on-site soils are as follows:

- Type 1 on-site - Soils from within a remediation area (e.g. Landfill Ridge, Scrap Metal Yard, Plant Area, Landfill 1, etc.) that do not exceed the MPS criteria; and
- Type 2 on-site - Soils from a proposed on-site borrow source outside a remediation area.

Type 1 on-site soils shall be tested for the following:

- Mercury (USEPA 7471); and
- VOCs (USEPA 8260).

The testing frequency for Type 1 on-site soil shall be a minimum of one test per 2,000 cy of material used. Test results performed as part of the predesign investigation will be used for the assessment of Type 1 on-site soils. Type 1 on-site soils can be used in any remediation area provided the chemical testing indicates parameter concentrations are less than the MPS criteria and less than the Maine RAGs Soil unrestricted use guidelines for parameters for which there is not a MPS criterion. No Type 1 soils containing visual mercury, regardless of concentrations of the parameters listed above, will be used anywhere on site and will be sent offsite to the appropriate disposal facility. Additional testing requirements, including stockpiling and compositing procedures, for material to be reused for excavations is provided in Appendix A.

Type 2 on-site soils shall be tested for the following:

- MPS parameters;
- VOCs (USEPA 8260)
- SVOCs (USEPA 8270);
- Metals (Target Analyte List + Molybdenum/USEPA600/7000 series);
- PCBs (USEPA 8082);
- Pesticides (USEPA 8081); and
- Herbicides (USEPA 8151).

The testing frequency for Type 2 on-site soil shall be 1 test per 2,000 cy of material used. Type 2 soils can be used throughout the Site provided the chemical testing indicates parameter concentrations are less than the MPS criteria and less than the Maine RAGs for unrestricted use for parameters for which there is not a MPS criterion, with the exception of arsenic. Arsenic concentrations shall be in the range of background arsenic levels published in the RAGs, which are greater than the Maine RAGs Residents user guidelines.

3.2 Off-site Soils

Soils obtained from off-site sources shall be tested for the following:

- MPS parameters;
- VOCs (USEPA 8260);
- SVOCs (USEPA 8270);
- Metals (Target Analyte List + Molybdenum USEPA 6000/7000 series);
- PCBs (USEPA 8082);
- Pesticides (USEPA 8081); and
- Herbicides (USEPA 8151).

The minimum testing frequency shall be 1 per virgin borrow pit source. Off-site soils may be used on-site provided the chemical testing indicates parameter concentrations are less than the MPS criteria and less than the Maine RAGs for unrestricted use for those parameters for which there is not a MPS criterion, with the exception of arsenic. Arsenic concentrations must be no greater than background arsenic levels published in the RAGs, which are greater than the Maine RAGs Residents user guidelines.

Section 4.
References

CDM Smith, Inc, 2014b. Quality Assurance Project Plan, Revision 1, Orrington Remediation Site, Orrington, Maine, December 15, 2014.

Maine BEP, 2014. Mallinckrodt US LLC et al. v. Department of Environmental Protection. April 3, 2014.

Maine DEP, 2008. Compliance Order: Designation of Uncontrolled Hazardous Substance Site and Order in the Matter of United States Surgical Corporation, Mallinckrodt LLC Concerning a Chloralkali Manufacturing Facility in Orrington, Penobscot County, Maine Formerly Owned and Operated by Mallinckrodt Inc., Proceeding Under 38 M.R.S.A. § 1365, Uncontrolled Hazardous Substance Sites Law; November 24.

Maine DEP2013. *Remedial Action Guidelines (RAGs) for Sites Contaminated with Hazardous Substances*, 8 May 2013.

06-096 Code of Maine Regulations Chapter 400, Section 1, Nnn.

APPENDIX A

Reuse Stockpiling and Soil Sampling Plan

Appendix A
Reuse Stockpiling and Soil Sampling Plan

As described in Section 4.6 of the Landfill 2 (LF2) CMI Plan, excavated material that does not exceed the MPSs will be stockpiled for reuse. The discussion below presents the stockpiling and sampling methods that will be used to confirm that the soil designated for reuse in the Excavation Plan (**Drawings 10 and 11**) is suitable for re-use at the Site. The methods are as follows:

- Material proposed for re-use will be stockpiled in areas separate from material stockpiled for off-site disposal.
- Reuse layers from LF2 will be separated into in 3 stockpiles of 500 cubic yards (CY) or less as shown in the table below. The stockpiles were developed using the following criteria:
    - 2 excavation areas contain material proposed for re-use;
    - Any excavation areas with greater than 300 CY of material proposed for reuse were not combined with the re-use material from another excavation area; and
    - Areas with greater than 500 CY of material proposed for re-use were split into multiple stockpiles.
- Soil will be transported to the stockpile area in dump trucks which can carry approximately 15 CY of soil.
- Three grab samples of equal volume (greater than or equal to 60 ml) will be taken from different areas in each dump truck load as it is added to the stockpile. Sampling will occur after the truck has unloaded the soil into the stockpile area, but before moving the soil onto the stockpile.
- Each of the grab samples from each dump truck load will be aggregated into three separate composites for each stockpile as the stockpile is built. The composite sample will typically consist of 12 to 96 grab samples (see **Table A-1** below).
- Each of the three stockpile sample composites will be homogenized in the same manner as the pre-design investigation samples. A description of this homogenization procedure is located in the Geosyntec Consultant's Field DMA-80 Laboratory Standard Operating Guideline No. 10, which was previously provided to the Maine DEP on July 22, 2015.
- One sample from each of the three composites will be analyzed for mercury.
- If the mercury in each of the three samples is less than 2.2 mg/kg, the stockpile can be reused. If any of the three samples contains mercury above 2.2 mg/kg, the soil will be disposed offsite.

Table A-1. Landfill 2 Stockpiling and Reuse Sampling Plan

Stockpile #	Excavation Area	Reuse Volume (CY)	Total Reuse Volume (CY)	Number of Pre-Design Samples	Number of Dump Trucks	Post Excavation Grab Samples	Overall Sampling Density (1 Sample/ X CY)
1	LF2-10	60	60	6	4	12	7
2	LF2-26	956	478	10	32	96	37
3	LF2-26		478		32	96	37

Notes:

(1) LF2 Example – Stockpile 2

- Stockpile 2 will be comprised of a portion of the layer intended for reuse from excavation area LF2-26.
- The total anticipated volume for reuse from this excavation area is 956 CY.
- The anticipated volume for stockpile 2 is 478 CY.
- This will require approximately 32 dump truck loads to move the soil to the stockpile area.
- Three grab samples will be taken from each dump truck to create three composite samples. A total of 96 grab samples (32 dump trucks x 3 samples each) will be taken.
- Each of the three composites for Stockpile 2 will be made up of 32 grab samples. These composite samples will be homogenized in a manner similar to the PDI samples.
- Each of the three composites will be analyzed for mercury using the on-site DMA.

(2) Sampling density incorporates PDI samples and 3 post excavation samples per stockpile

ATTACHMENT E

Contractor Work Plans

TRANSMITTAL

July 28, 2016	Job No.:	2-1459
Landfill 2/Northern Drainage Ditch Remediation	**Transmittal No.:**	**T-002B**
Mallinckrodt US, LLC – Orrington Remediation Site	☐ This is a New Transmittal	
Orrington, Maine	☒ This is a Resubmittal of Transmittal No: T-002	

To Construction Manager:	To Construction Manager:	To Owner:
Dean Carter, Project Manager CDM Constructors, Inc. 99 Industrial Way Orrington, ME 04474	Nicole Summa, Project Manager CDM Constructors, Inc. 25 Industrial Drive Chelmsford, MA 01824	
☒By Email carterde@cdmsmith.com ☐By Sharefile Upload	☒By Email summanm@cdmsmith.com ☐By Sharefile Upload	☐By Email Email Address ☐By Sharefile Upload
☐By Other:	☐By Other:	☐By Other:

Submittal Type		
☒ Plan	☐ Manufacturer Data	☐ Material Samples
☐ Shop Drawing	☐ Laboratory Data	☐ Record Documents
☐ Other:		

Copies	Date	Specification Reference	Submittal Description
1	7/28/16	02140	LF2 Construction Water Management Plan Rev 02

Transmitted For:		
☒ For Review and Approval	☐ For Review and Comment	☐ For Your Information
☐ Request for Information	☐ Other:	

Charter Contracting Company, LLC hereby certifies that the equipment, material or design, shown in this submittal, has been reviewed and conforms with the products required, field dimensions, adjacent construction work and coordination of information shown in the Contract Documents, and is transmitted as noted above.

Charter Contracting Company, LLC

Chris Ryan, Project Manager

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Plan Title: **02140 Construction Water Management Plan**

Project Title: Landfill 2 Area
Corrective Measures Implementation
Mallinckrodt US, LLC – Orrington Remediation Site
Orrington, Maine

Prepared For:

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Contract No.: Orrington Remediation-016

Charter No.: 2-1459

Date: 7/28/16

Revision No.: 02

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7/28/16
Date

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7/28/16
Date

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1. INTRODUCTION

This Construction Water Management Plan (CWMP) has been prepared by Lockwood Remediation Technologies, LLC on behalf of Charter Contracting Company, LLC (Charter) for the excavation project at the Landfill 2 Area, 99 Industrial Way, Orrington, Maine (the site). Refer to **Appendix A, Figure 1 – Site Locus Map** for the site location. This Plan relies on data contained in the Landfill 2 Corrective Measures Implementation (CMI) Plan prepared by CDM Smith and Geosyntec Consultants dated January 13, 2016. The Plan also relies on experience in dewatering under similar conditions and in similar soils. This was used to generate a finite difference dewatering model using Visual MODFLOW Version 2012.1.

1.1. PURPOSE AND SCOPE

The purpose of this CWMP is to provide an overview of the anticipated dewatering effort, and additional information regarding the methods to be used; the size, type, and location of pumps; discharge locations; manufacturer's data for mechanical equipment; and anticipated dewatering/pumping rates and management of water at the site.

1.2. KEY ASSUMPTIONS

To estimate pumping rates at the site the following assumptions were used in this study:

- Fill material which is comprised of a loose to dense silty sand and silty or clayey sand to silt or poorly graded sand with traces of medium to fine gravel. Within the Southerly Stream the fill is the deposited material that was transported from upstream or eroded from the surrounding embankments. The material generally is silt with varying amounts of sand and little to a trace gravel. Beneath the fill layer is a peat and organics layer which is comprised of very soft to soft peat with some to trace silt or clay underlain by a clay and silt layer which is comprised of very soft to very stiff silt or silt and clay often with some to trace gravel or sand and a few stratified gravel pockets. Beneath the clay and silt layer is a sand layer which is comprised of very loose to very dense silty sand to poorly graded sand or well graded sand, with some to trace gravel or clay present underlain by a gravel layer which is comprised of medium to dense coarse to fine rounded and angular gravel with some sand and silt. Beneath the gravel layer is till which consists of a very stiff to hard clayey or silty sand with little to trace and, gravel, and cobbles and bedrock. Bedrock was only encountered in boring GB-LF2-03 at 22 feet below ground surface (bgs). For detailed information regarding depth and elevations of the various soil strata encountered at each of the boring locations, refer to the Draft CMI Plan prepared by CDM Smith and Geosyntec Consultants dated January 13, 2016.

- The existing ground surface ranges from elevation El. +56.5' to El. +78' and the bottom of excavation ranges from elevation El. +55' to El. +75.5'.
- Groundwater elevations measured in existing piezometers at the site ranged from El. +69.799' to El. +66.414' in 2016.
- Excavation will be open cut with sheeting in selected areas. See **Appendix A, Figure 2 – Site Excavation Plan** for the location of the excavation cells.
- Dewatering will be conducted by Charter.
- Dewatering effluent will be pre-treated via a temporary on-site water treatment system prior to entering the on-site groundwater treatment plant (GWTP). The anticipated maximum flow rate for construction water sent to the on-site water treatment system is 13.9 gallons per minute. The on-site GWTP will have a maximum capacity for construction water of 20,000 gallons per day (gpd).
- Primary contaminants of concern include total suspended solids (TSS) and mercury.

1.3. DESCRIPTION OF DEWATERING MODEL AND MODEL ASSUMPTIONS

A finite difference model using Visual MODFLOW Version 2012.1 was created for the dewatering estimate. The model consists of two layers; One for the fill layer and a second for the clay layer. For purposes of estimation of pumping rates at the site, the following assumptions were used in this study:

- The model dimensions are 476,250 square feet centering on the site. The model area was divided into a 60 by 40 nodal array.
- The model was run under steady-state conditions. The actual time required to achieve steady-state conditions on a dewatering job varies but for this site it may take several days depending on how fast the water in storage is removed from the overburden and if any significant rainfall occurs.
- The estimated recharge based on annual averages and an estimated degree of surface permeability was input as 2 inches/year.
- The groundwater elevations were simulated at approximate groundwater elevations from piezometer water level readings on June 1, 2016 ranging from El. +66.414' to El. +67.166'.
- The model has two layers with Layer 1 simulating the fill and sand extending from the ground surface to El. +50'. Layer 2 simulates the clay and was assigned an arbitrary thickness of 20 feet to El +30'. Actual elevations of stratigraphic sequences were incorporated into the model based on the geotechnical information provided to LRT.

- The hydraulic conductivity (permeability) of Layer 1 and Layer 2 are estimated at 5x10-3 cm/s and 1x10-6 cm/s respectively. This site specific hydraulic conductivity is estimated based on geotechnical classification of the stratification at the site by others and using published values for those classification (i.e. Fetter, 1988). The basis for estimating hydraulic conductivities is based on a number of factors including:
    - 1) An analysis of the geotechnical information provided and applying to published studies specifically Fetter et al. (1988) and Domenico and Schwartz (1990) to estimate hydraulic conductivity in similar soils.
    - 2) An analysis of the proposed support of excavation (SOE) or lack thereof.
    - 3) Over 24 years of experience as a hydrogeologist working on hundreds of dewatering projects

- The hydraulic conductivity values are also meant to be a conservative estimate from the standpoint of estimating dewatering flow yields. It is likely that the actual hydraulic conductivities encountered at the site are less permeable than what has been simulated in the model. This provides contingency for estimated flow rate, storage capacity in the proposed fractionation tanks, etc.
- The effective porosity of the subsurface was assumed to be 0.30.
- Any dewatering sumps installed will be completed a minimum of five feet below the bottom of the deepest excavation within each excavated section to maintain groundwater at an elevation of one foot below the bottom of excavation. Refer to **Appendix A, Figure 3 – Dewatering Sump Detail** for typical sump construction detail.

2. EROSION AND SEDIMENT CONTROLS

During construction activities, the use of erosion and sediment controls will be employed to eliminate sediment transport from the active construction site. In addition surface storm water will be diverted around active excavation areas utilizing erosion and sediment controls, including temporary diversion berms and sloping grades, to prevent surface storm water from entering excavations, thus minimizing contact water.

The control practices which are required to minimize impacts during excavation activities must remain functional until all disturbed areas have been stabilized. Erosion control products are to be installed and maintained in accordance with manufacturer's specifications and best management practices. The most important aspect of controlling erosion and sedimentation is limiting the extent of exposed soil and access of untreated runoff to drainage structures. These fundamental principles will be the key factors in Charter’s control of erosion on the site.

Charter will install erosion and sediment controls prior to commencing earth disturbing activities. At a minimum, Charter will install temporary controls as shown on the CMI Plan Drawings and as directed by the Remediation Project Manager. This will include erosion and sediment controls installed around the Decontamination Area and as shown on CMI Plan Drawing 5.

Erosion and sediment controls will meet the requirements of the Maine Erosion and Sediment Control Best Management Practices (BMPs)

Charter acknowledges that the Remediation Project Manager will be monitoring the Erosion and Sediment work as part of their Construction Quality Assurance (CQA) Plan. Charter will also include daily monitoring of site conditions as weather conditions impact the installed control items. Inspections will follow storm events with rainfall in amounts greater than 0.5 inches. Monitoring will be conducted for the duration of the project until final completion and acceptance. Charter will provide immediate repair work as necessary based on internal monitoring and as directed by the Remediation Project Manager. Temporary materials will be removed by Charter at the completion of the project.

Charter will utilize temporary soil berms and swales and other storm water BMPs as needed to control storm water runoff in the remediation area. See work zone figures in Appendix F for the proposed berm locations. This will help control erosion issues with storm water runoff and minimize the amount of contact water in open excavations which will require collection and discharge to the onsite Groundwater Treatment Plant (GWTP) operated by Woodard and Curran. Charter's excavation sequence will limit the exposure of disturbed areas by installing storm water controls around each group of cells being excavated.

Charter's excavation sequence will generally progress from the northeast to the southwest cells. Confirmation sampling/testing will be performed by the Remediation Project Manager. Backfilling will be conducted upon approval of the Remediation Project Manager. The Remediation Contractor will manage storm water/contact water in the interim period after confirmation sampling using the aforementioned E&S controls. Rain runoff will flow down-gradient over clean restored areas limiting the potential for cross contamination to the adjacent areas.

After the excavation and backfill is complete and prior to placement of topsoil and seeding in the Landfill 2 area, silt fence will be installed along the Southerly Stream to minimize sediment flow from stormwater events which cause runoff over the re-established areas into the Southerly Stream while the vegetation is becoming established. The Southerly Stream Bypass will remain in service during and after the Landfill 2 remediation work.

3. NON-CONTACT WATER MANAGEMENT

Non-contact water is the stormwater contacting only non-contaminated surfaces either existing or after stripping and grubbing. Temporary diversion berms will be surrounding the excavation areas

preventing the non-contact water from entering the excavation. Non-contact surface water from rain events will be diverted by gravity flow around the excavations and continue back into the southerly stream. The natural terrain of the areas outside of the Landfill 2 area will also have stormwater events which will have Non-contact water flows that travel down gradient into the Bypassed Southerly Stream bed. In the event of accumulated non-contact surface water, diversion pumps will be installed to route the water to the Southerly Stream.

4. CONTACT WATER

4.1. WATER STORAGE

Contact water generated from excavation activities will be pumped into five (5) 21,000-gallon fractionation tanks prior to pre-treatment, refer to **Appendix A, Figure 4 – Water Treatment System Schematic**.

4.2. SUBMERSIBLE PUMPS

Pumps shall be minimum 2-inch diameter discharge electric submersible pumps, refer to cut sheets in **Appendix C – Dewatering Equipment**.

4.3. COLLECTION SUMPS

Charter will install as many sumps as necessary within the excavation areas to draw down groundwater during excavation. Anticipated minimum pump rates are provided in the section below. The final number and combination of sumps will be determined by Charter based on the sequence of excavation and the actual conditions encountered in the field; however, eleven (11) sumps are currently anticipated. Sumps will be installed to elevations 5’ below the deepest excavation depth in the group of open cells.

4.4. PUMPING RATES

For purposes of estimation of dewatering, a dewatering model was completed in MODFLOW. This model was based on a combination of the site specific information that included the geology reported in soil borings and test pits, piezometer water level summary completed by CDM Smith and Geosyntec, and the proposed excavation plan. Once this information was completed, the model was calibrated to observed non-pumping conditions. A second model was completed simulating pumping conditions. Based on the results of the modeling, steady-state dewatering flow rates are expected to be approximately 1-5 gpm per sump. The pumping simulation was completed 3 times, once for each phase of excavation.

It is anticipated that water will be removed from the excavation via localized collection sumps as needed. Expected flow rates will not exceed the treatment capacity of 13.9 gpm. All excavation areas will not be opened at the same time, thus all eleven (11) proposed sump locations will not be utilized simultaneously. The Excavation and Restoration Plan discusses the sequencing of the excavation. Actual dewatering flow rates will mostly depend on site conditions and on the amount of precipitation that occurs at the time of active dewatering. The figures showing the pumping and non-pumping groundwater condition model results are included in **Appendix B – Dewatering Model.**

4.5. PRE-TREATMENT OF STORED WATER

Charter will provide a water treatment system suitable to meet the discharge criteria of less than 200 mg/L total suspended solids. Based on available data provided for the site, a system that includes frac tanks, bag filtration, and a flow meter/totalizer is proposed. Refer to **Appendix A - Figure 4** for Water Treatment System Schematic, **Appendix D** for Water Treatment System Equipment cut sheets and **Appendix E** for Pre-treatment Design Calculations.

The treatment system is capable of treating water up to 50 gpm and consists of five (5) 21,000-gallon fractionation tanks. From the fractionation tanks, water is pumped via a 2-inch submersible pump within one of the fractionation tanks to two (2) bag filter housings plumbed in parallel. This allows one bag filter vessel to operate while the other remains on standby. Each bag filter housing is included with isolation valves, sample ports and pressure gauges on the influent and effluent piping so that it is clear when a bag filter change out is required. Bag filter housings are stainless steel rated for maximum flow rate of 125 gpm and 125 PSI. Spent bag filters generated as waste will be transported to the Temporary Soil Stockpile Area for disposal off-site. Prior to being transferred to the on-site GWTP, treated water will be monitored with a flow meter/totalizer. Charter will coordinate with the Remediation Project Manager prior to discharge to the on-site GWTP. Flow rates to the on-site GWTP will not exceed the allowable 13.9 gpm.

Discharge lines will run from the submersible pumps within the excavation areas to a pre-treatment system as described above. It is anticipated that a combination of PVC pipe, flexible hose, and quick-connect connections will be used for the discharge lines.

4.6. RECORD KEEPING

During dewatering, Charter will maintain results of monitoring and inspection reports as dictated by the Maine Department of Environmental Protection (MEDEP).

4.7. DEWATERING SYSTEM LAYOUT

The proposed dewatering system layout for this project indicates the anticipated number of sump wells and is included in **Appendix B**. As mentioned, the final number, combination, location and configuration of these components will be determined by the actual conditions encountered in the field.

5. DECONTAMINATION WATER

Vehicles exiting from the exclusion zone will pass through a decontamination pad to remove soil that may exceed the Media Protection Standard (MPS) parameters. The Landfill 2 Area will have a decontamination pad which will include a geomembrane liner to collect water used in the decontamination process. Contact water collected in the decontamination pad will be sent to the pre-treatment system prior to treatment through the on-site GWTP. The volume of decontamination water generated on a daily basis varies on the amount of trucks and equipment requiring power washing and may range in 0 to 300 gallons/day.

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APPENDIX A

Figures

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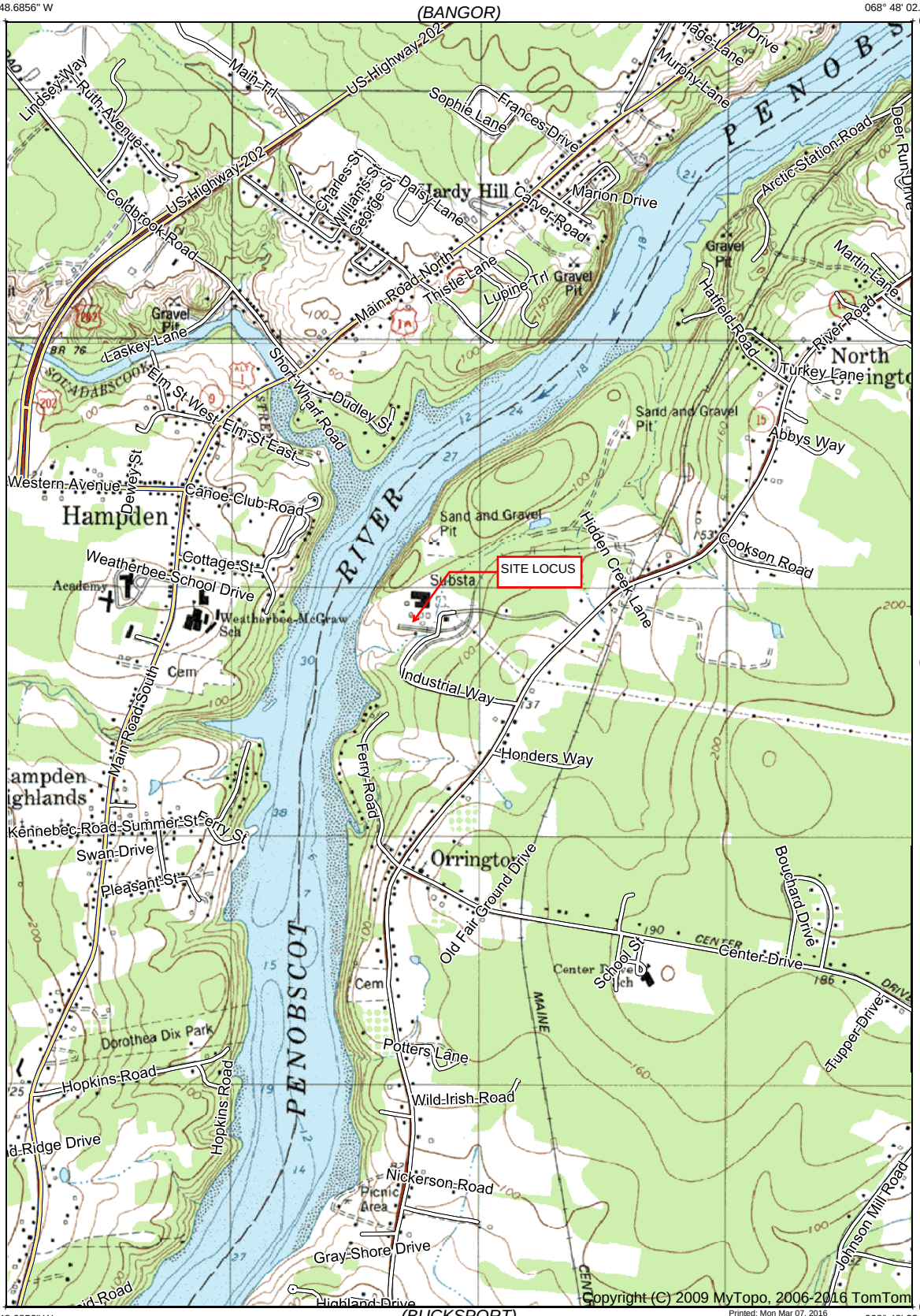
HAMPDEN QUADRANGLE
MAINE
TOPOGRAPHIC SERIES

(HERMON) (BANGOR) (VEAZIE)

068° 50' 48.6856" W
044° 45' 42.2610" N

068° 48' 02.2570" W
044° 45' 42.2610" N

(SNOW MT) (BREWER LAKE)



044° 42' 54.6585" N
068° 50' 48.6856" W

(BUCKSPORT)

044° 42' 54.6585" N
068° 48' 02.2570" W

(MT WALDO) (ORLAND)

SCALE 1:24000

Declination

MN GN

GN 0.12° E
MN 16.32° W

0 1
Mile

0 1000
Yards

0 1
Kilometer

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM 1929

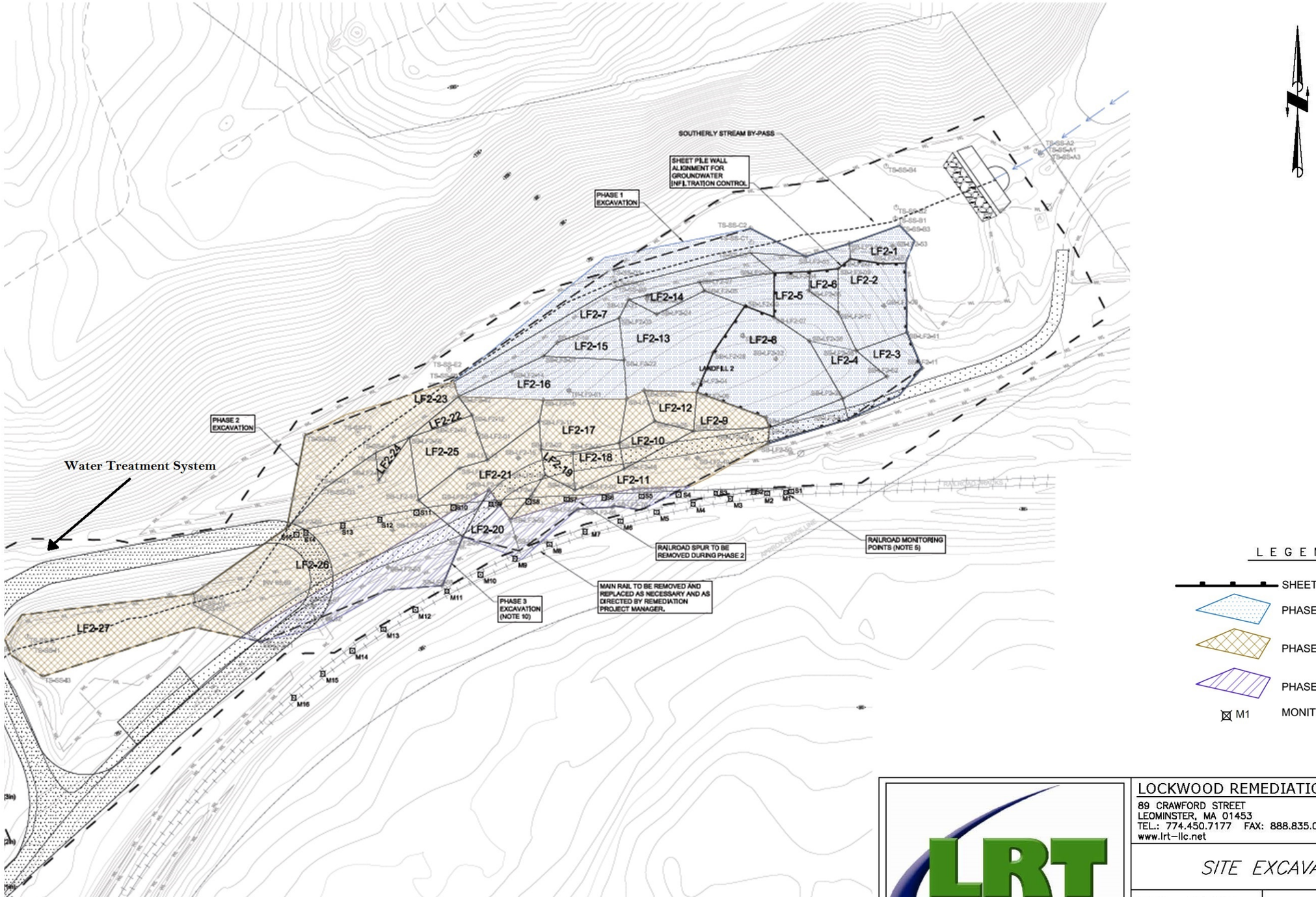
Produced by MyTopo Terrain Navigator
Topography based on USGS 1:24,000 Maps

North American 1983 Datum (NAD83)
Transverse Mercator Projection

To place on the predicted North American 1927 move the projection lines 8M N and 41M E

HAMPDEN, ME 1988

FIGURE-1
SITE LOCUS MAP
99 INDUSTRIAL WAY
ORRINGTON, ME



REFERENCE: PLAN ENTITLED "EXCAVATION SEQUENCE AND MONITORING PLAN PREPARED BY CDM SMITH & GEOSYNTEC CONSULTANTS. PLAN DATED FEBRUARY 2016, DRAWING NO. 12 OF 18.

LOCKWOOD REMEDIATION TECHNOLOGIES LLC
89 CRAWFORD STREET
LEOMINSTER, MA 01453
TEL.: 774.450.7177 FAX: 888.835.0617
www.lrt-llc.net

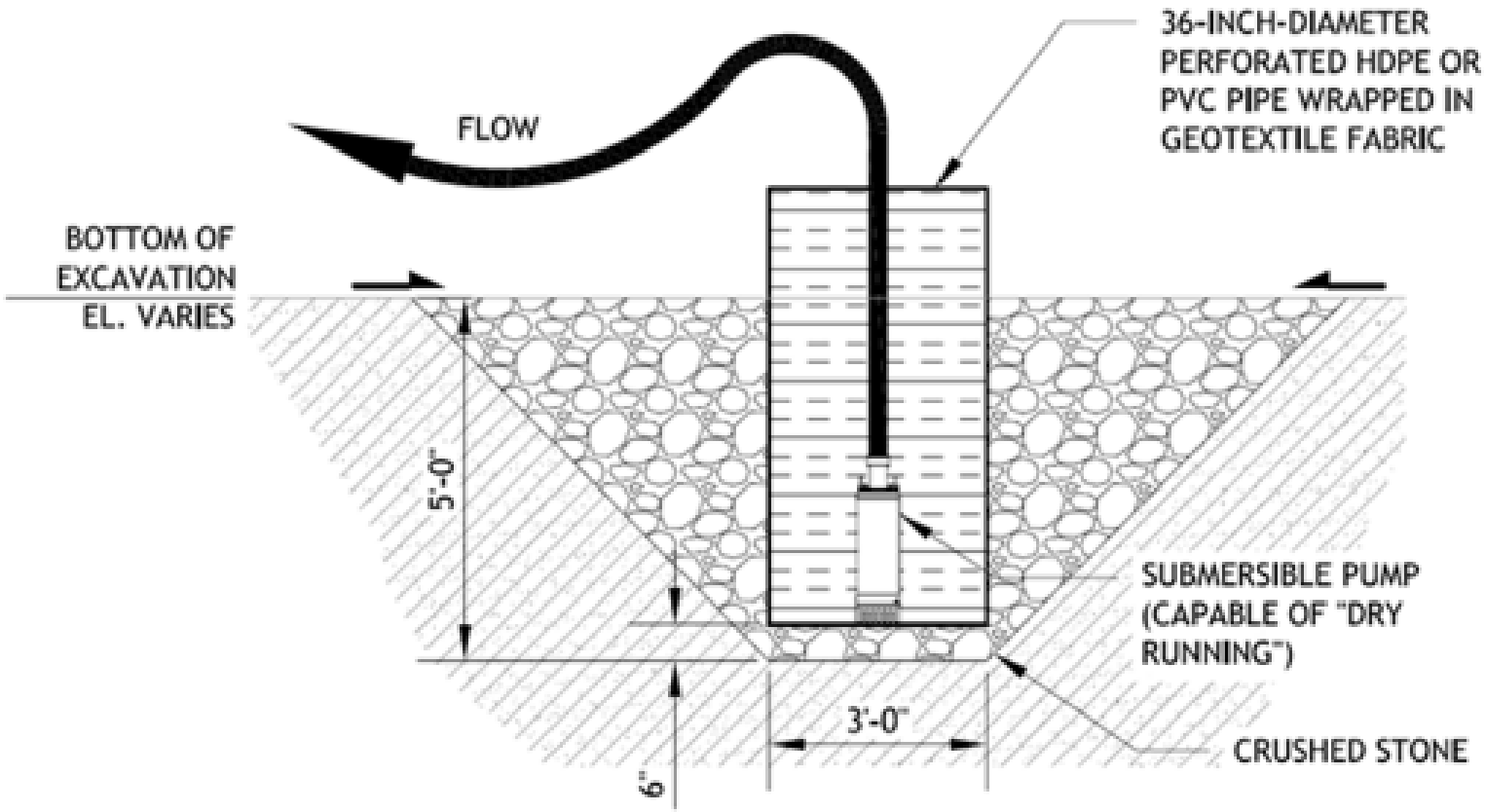
SITE EXCAVATION PLAN

SCALE: AS SHOWN		DR. BY:
DATE:	APP. BY: PL	JOB NO.: 2-1385

Orrington Landfill #2

SITE: 99 INDUSTRIAL WAY ORRINGTON, ME

FIGURE 2



TYPICAL SUMP AND PUMP DETAIL

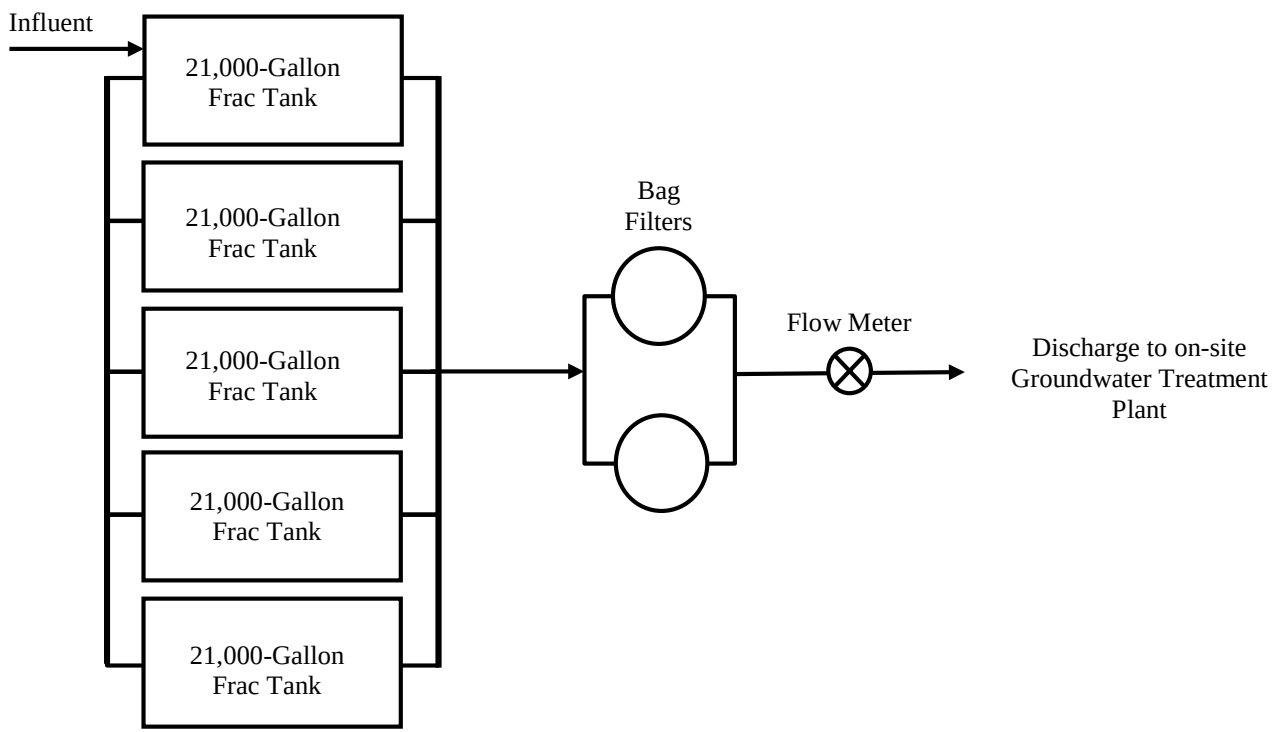
SCALE: ¼" = 1'-0"

Notes:

1.) Figure is not to scale.
2.) Sumps should be packed with ¾" stone.

89 Crawford Street
Leominster, Massachusetts 01453
Tel: 774.450.7177
Fax: 888.835.0617
www.lrt-llc.net

Figure 3 – Dewatering Sump Detail
Orrington Landfill #2
99 Industrial Way
Orrington, ME



Notes:

1. Basic Design Layout
2. Figure Not Drawn to Scale
3. System Rated for 50 GPM

89 Crawford Street
Leominster, Massachusetts 01543
Tel: 774.450.7177
Fax: 888.835.0617
www.lrt-llc.net

Figure 4 - Water Treatment System Schematic
Orrington Landfill #2
99 Industrial Way
Orrington, ME

APPENDIX B

Dewatering Model

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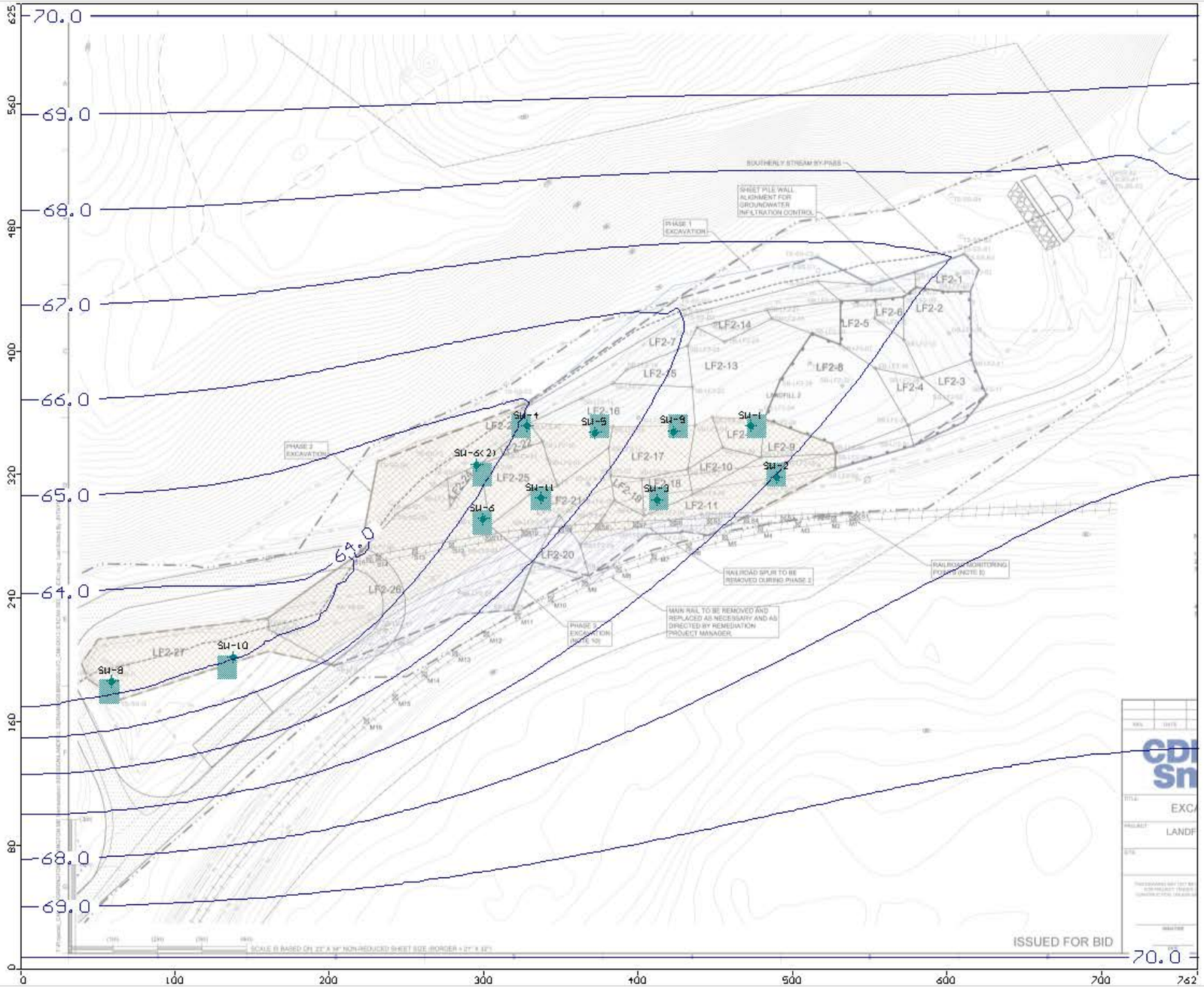
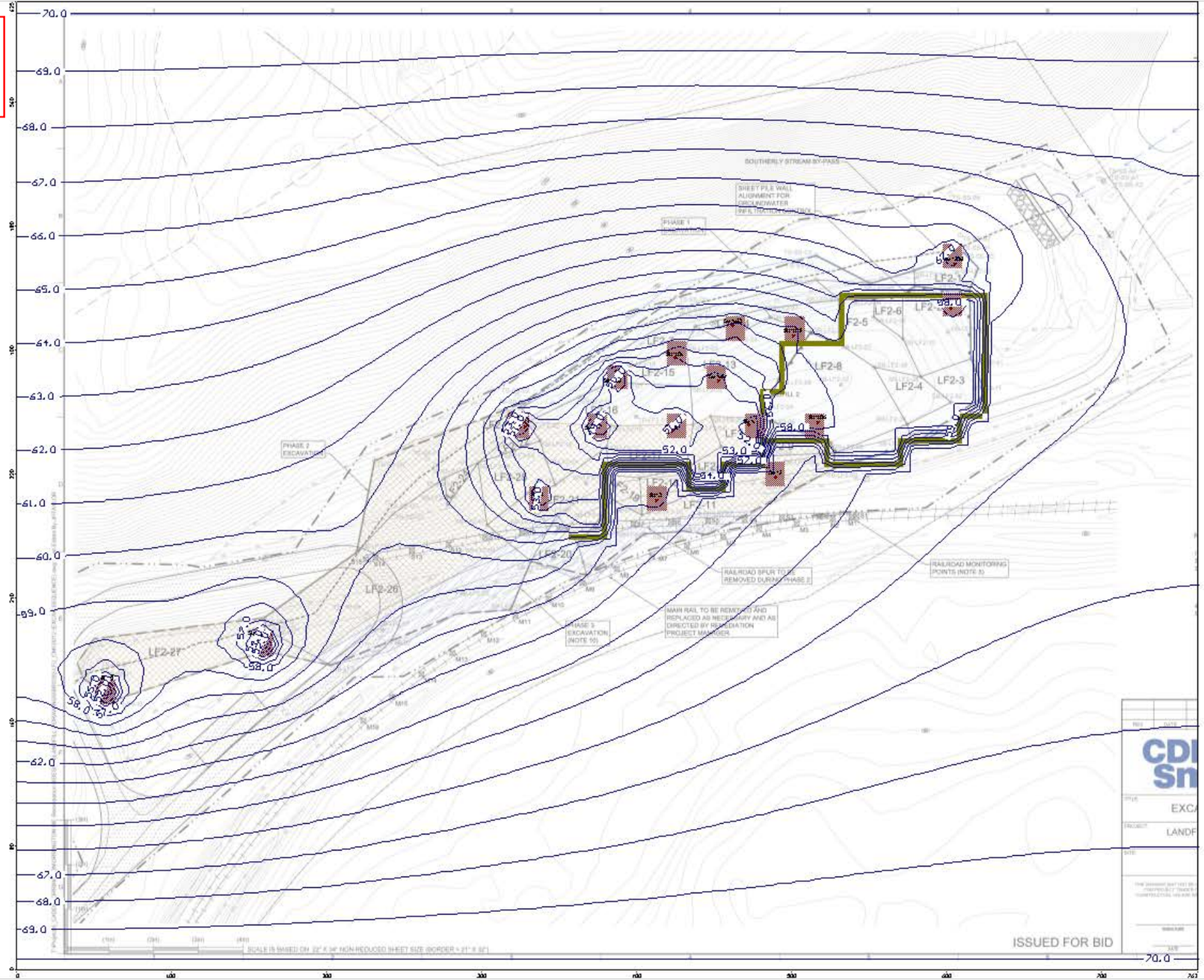
Calibration
-Non-pumping conditions
-Initial head levels based on data measured by others at PZ-LF2-01 through PZ-LF-04.
-Green indicate inactive sumps

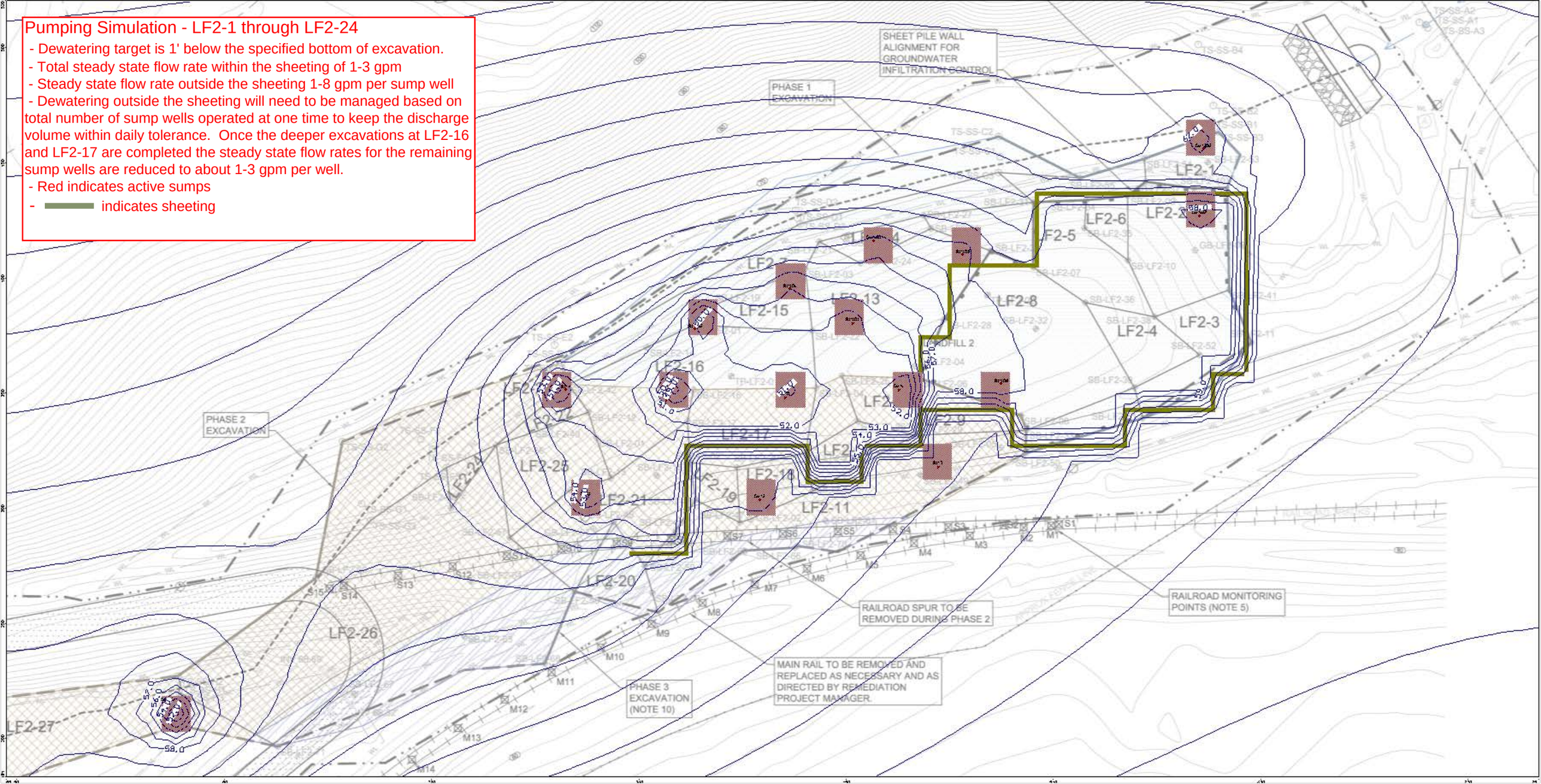


Pumping Simulation - Overall View
Red indicates active sumps
indicates sheeting



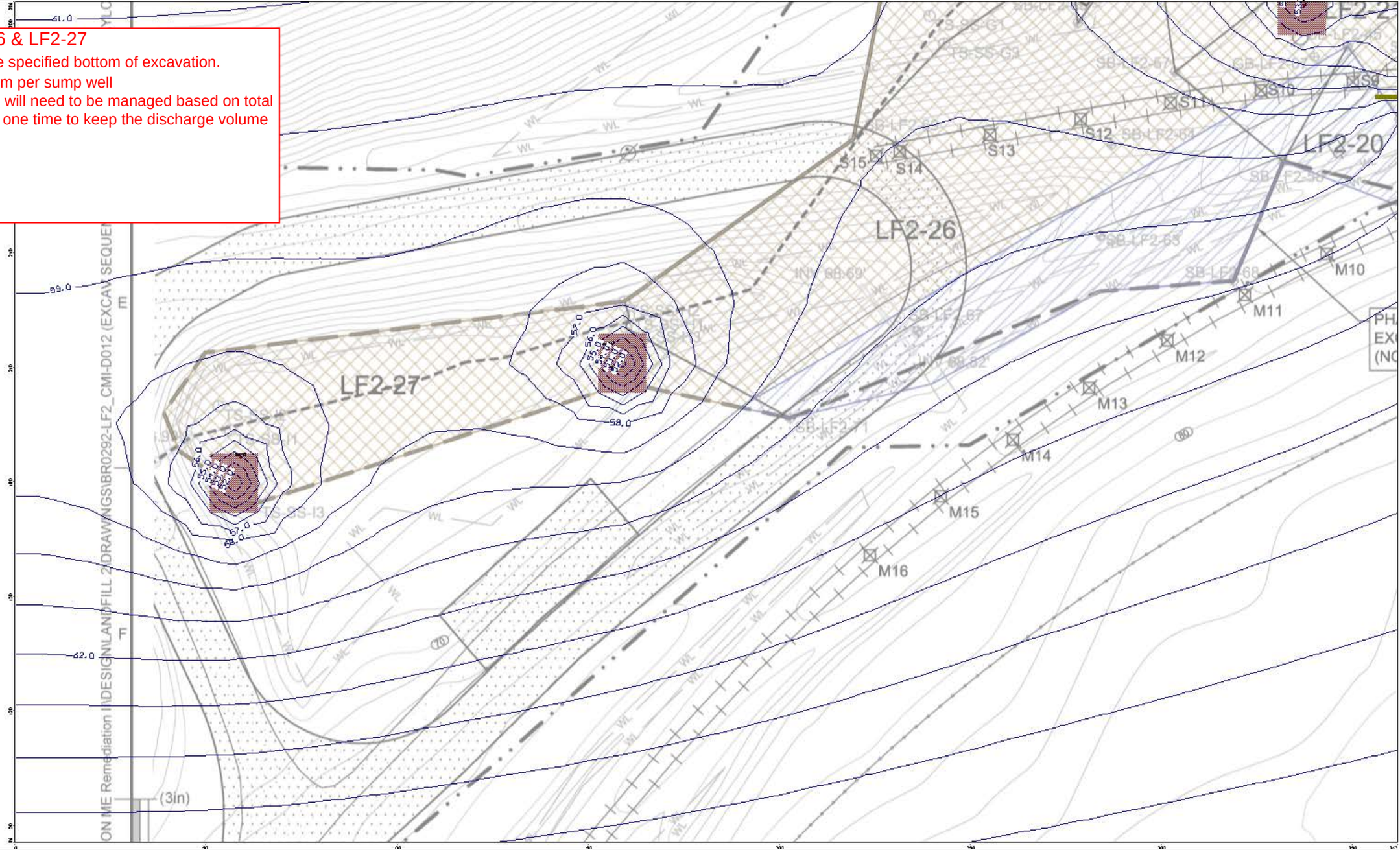
Pumping Simulation - LF2-1 through LF2-24

- Dewatering target is 1' below the specified bottom of excavation.
- Total steady state flow rate within the sheeting of 1-3 gpm
- Steady state flow rate outside the sheeting 1-8 gpm per sump well
- Dewatering outside the sheeting will need to be managed based on total number of sump wells operated at one time to keep the discharge volume within daily tolerance. Once the deeper excavations at LF2-16 and LF2-17 are completed the steady state flow rates for the remaining sump wells are reduced to about 1-3 gpm per well.
- Red indicates active sumps
- indicates sheeting



Pumping Simulation - LF2-26 & LF2-27

- Dewatering target is 1' below the specified bottom of excavation.
- Steady state flow rate is 5-10 gpm per sump well
- Dewatering outside the sheeting will need to be managed based on total number of sump wells operated at one time to keep the discharge volume within daily tolerance.
- Red indicates active sumps
- indicates sheeting



APPENDIX C

Dewatering Equipment

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Documentation

- Pumps-Submersible-Maintenance
- ST-2037-47-47B-38P-40T-rev-3-manual
- ST-2037-47-38P-40T-rev-0-french-manual

Related Media

- Canada - Electric Submersible Pumps Brochure
- Electric Submersible Pumps Brochure
- Pump Selection Handbook

Go Back

ST2047

2 Inch Discharge, 115V 1Ø, 1.0 HP, 87 GPM, 47' Total Head

This lightweight, compact submersible centrifugal pump is ideal for moving water in multiple confined and open area applications. This is a powerful, versatile, low maintenance pump that is perfect for a wide range of operations supporting Contractors, Service Utilities, Municipalities, and Homeowners. Further, the ST2047 incorporates a rugged cast aluminum housing, internal thermal overload protection, dual shaft seals, sealed ball bearings impeller and molded 50' Power Cable with strain relief.

- **1.0HP, 115V/9.8A, 1Ø, UL & CUL Listed Electric Motor.**
- **Built-in Overload Protection.**
- **2" (NPT) Female Discharge Port.**
- **Reliable double mechanical oil-filled seals.**
- **Cast iron/steel motor casing serves as heat conductor.**
- **Pumps Liquid Up To 120° F.**
- **50' of molded power cord w/strain relief**
- **Dewaters Flat Surfaces Up To 1" Levels.**

Performance Data | Options

Unit Specifications

Impeller Type		Neoprene Rubber over Cast-Iron
Impeller Disc Size	2 in	50 mm
Total Head	47 ft	14.3 m
Water Capacity	87 gpm	329 lpm

Dimensions & Weights

Pump Diameter	7.4 in	188 mm
Overall Height	15.4 in	391 mm
Operating Weight	33 lb	15 kg

Electrical Specifications

Power	1 HP	0.75 kW
Phase		Single
Voltage		115 V
Starting Amperage		49 A
Running Amperage		9.8 A
Cable Length	50 ft	15.2 m

APPENDIX D

Water Treatment System Equipment

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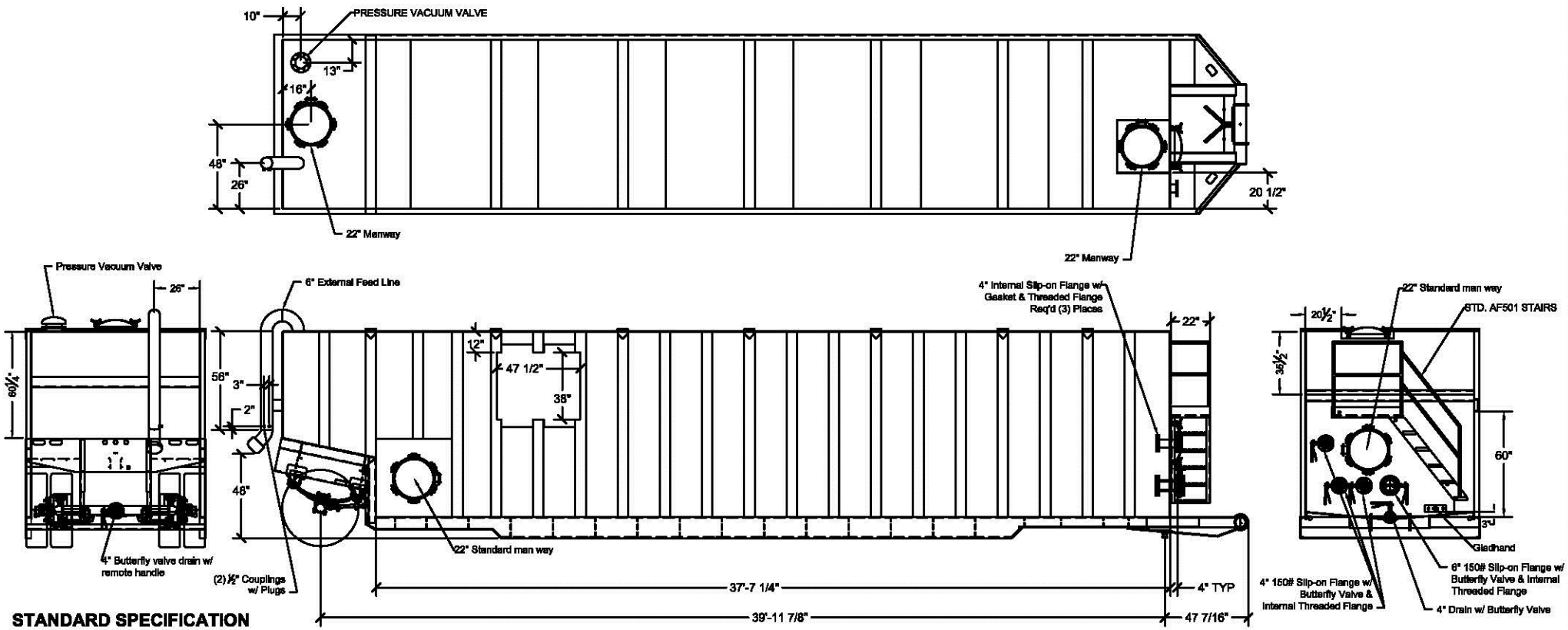

STANDARD SPECIFICATION

CAPACITY: .... 21,000 GALLONS (500 BBL)
SIDE SHEETS: .... 1/4" A36 PLATE
TOP SHEET: .... 1/4" A36 PLATE
FRONT SHEET: .... 1/4" A36 PLATE
REAR SHEET: .... 1/4" A36 PLATE
FLOOR: .... 1/4" A36 PLATE
MAIN FLOOR RAILS: .... 12" x 20.7# STRUCTURAL CHANNEL
FLOOR CROSSMEMBERS: .... 1/4" A36 PLATE
SIDE STAKES: .... ONE PIECE 3/16" A36 PLATE
SUSPENSION: .... 3 LEAF SPRING, 22,500 LBS. CACPACITY
AXLE: .... 77.5" TRACK, 22,500 LBS. CAPACITY
TIRES: 11R22.5
WHEELS: .... 8.25 x 22.5 STEEL
MANWAYS: .... 3 - 22" DIA. FRONT & TOP
1 - 22" DIA. CURB SIDE
VALVES: .... 1 - BLAYLOCK PRESSURE VALVE
4 - 4" BUTTERFLY (FRONT)
1 - 4" BUTTERFLY VALVE (REAR DRAIN)
1 - 6" BUTTERFLY VALVE (FRONT
INLET PIPING: .... 1 - 6" PIPE SYSTEM (REAR)
BLAST: .... (INTERIOR) SSPC-SP-10 (NEAR WHITE)
(EXTERIOR) SSPC-SP-6 (COMMERCIAL BLAST)
PAINT: .... (INTERIOR) EPOXYPHENOLIC 100% SOLID 20.0 MILS D.F.T.
(EXTERIOR) PRIMER COAT EPOXY 3.0 TO 4.0 MILS D.F.T.
(EXTERIOR) FINISH COAT POLURETHANE 3.0 TO 4.0 D.F.T.

NOTE:
This drawing is a representation baseline for this model of tank. Variations between this drawing and the actual equipment do exist, primarily with appurtenance locations, sizes and quantities.

LRT Lockwood Remediation Technologies LLC
89 Crawford Street
Leominster, Massachusetts 01453
Office: 774-450-7177

NOTES:
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.XX ±.030
.XXX ±.010
∠ ± 1°

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DESCRIPTION:
AF 501-MI
STANDARD SPECIFICATIONS
INTERNAL MANIFOLD
—

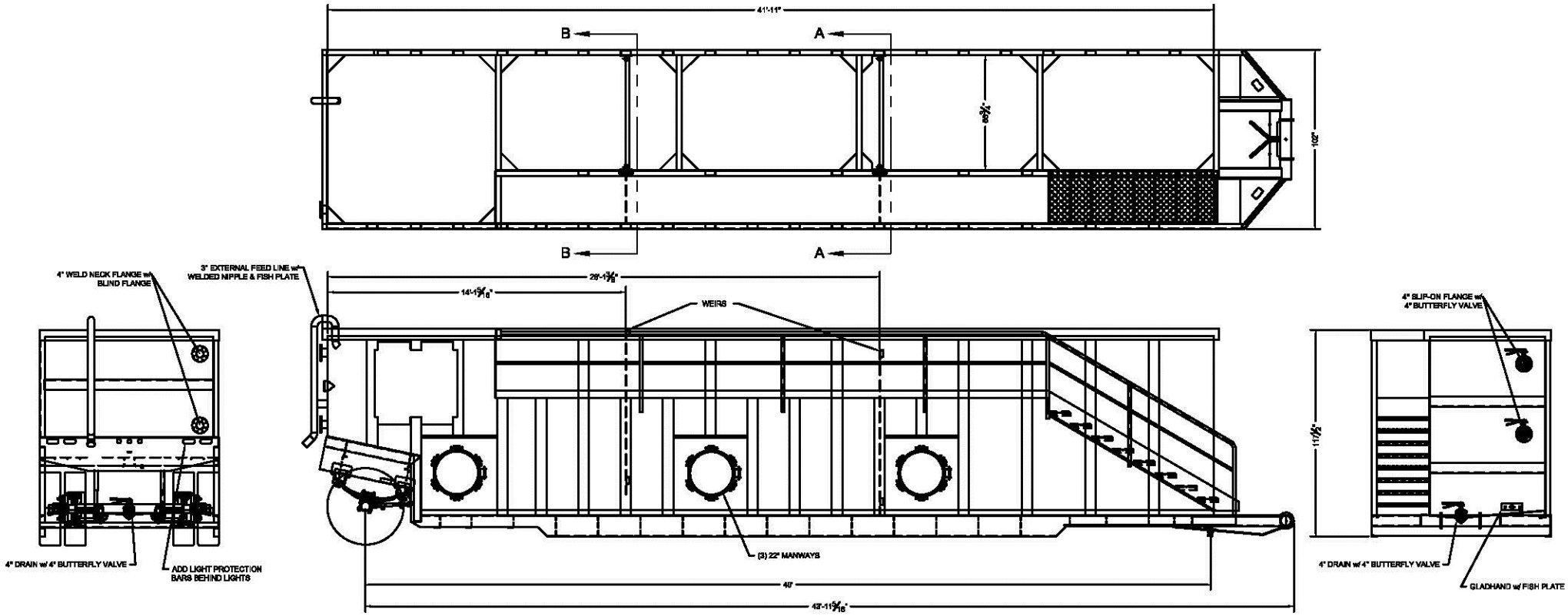
PLASMA / DXF FILE

MATERIAL: —
FIRST USED:
ECN:

REV	CHANGE	ECN	DATE	BY

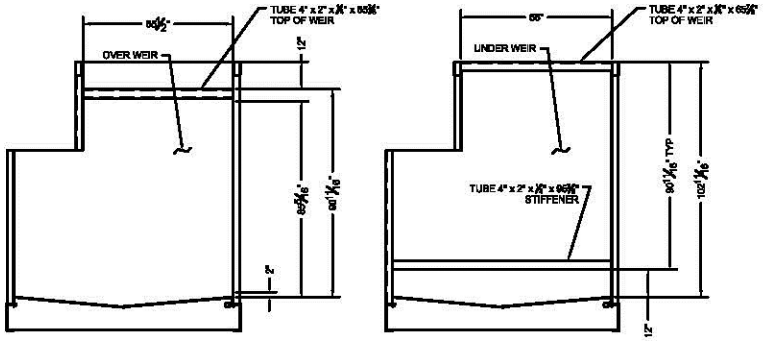
REVISION

DRW: CES
DATE: 06-02-15
SCALE: NTS
BOOK NO.:
SIZE: B
PART NO.:
REV.



STANDARD SPECIFICATION

CAPACITY: .... 18,480 GALLONS (440 BBL)
SIDE SHEETS: .... 1/4" A36 PLATE
FRONT SHEET: .... 1/4" A36 PLATE
REAR SHEET: .... 1/4" A36 PLATE
FLOOR: .... 1/4" A36 PLATE
MAIN FLOOR RAILS: .... 12" x 20.7# STRUCTURAL CHANNEL
FLOOR CROSSMEMBERS: .... 1/4" A36 PLATE
SIDE STAKES: .... ONE PIECE 3/16" A36 PLATE
SUSPENSION: .... 3 LEAF SPRING, 22,500 LBS. CACPACITY
AXLE: .... 77.5" TRACK, 22,500 LBS. CAPACITY
TIRES: .... 11R22.5 RADIAL
WHEELS: .... 8.25 x 22.5 STEEL
MANWAYS: .... 3 - 25" DIA. CURB SIDE
VALVES: .... 2 - 4" BUTTERFLY VALVE (FRONT & REAR)
1 - 4" DRAIN BUTTERFLY VALVE (REAR)
1 - 4" DRAIN BUTTERFLY VALVE (FRONT)
INLET PIPING: .... 1 - 3" PIPE SYSTEM (REAR)
BLAST: .... (INTERIOR) SSPC-SP-10 (NEAR WHITE)
(EXTERIOR) SSPC-SP-6 (COMMERCIAL BLAST)
PAINT: .... (INTERIOR) EPOXYPHENOLIC 100% SOLID 20.0 MILS D.F.T.
(EXTERIOR) FINISH COAT POLURETHANE 4.0 TO 5.0 D.F.T.



SECTION VIEW "A-A"

SECTION VIEW "B-B"

NOTE:
This drawing is a representation baseline for this model of tank. Variations between this drawing and the actual equipment do exist, primarily with appurtenance locations, sizes and quantities.

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89 Crawford Street
Leominster, Massachusetts 01453
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DESCRIPTION:
AL 470-WT
STANDARD SPECIFICATIONS
OPEN TOP WEIR
DOUBLE OVER ADJUSTABLE WEIRS

PLASMA / DXF FILE: —

MATERIAL: —
FIRST USED:
ECN:

REV	CHANGE	ECN	DATE	BY
	REVISION			

DRW: CES	DATE: 03-23-15	SIZE B	PART NO.:
SCALE:	BOOK NO.:		REV.

Documentation

- Pumps-Submersible-Maintenance
- ST-2037-47-47B-38P-40T-rev-3-manual
- ST-2037-47-38P-40T-rev-0-french-manual

Related Media

- Canada - Electric Submersible Pumps Brochure
- Electric Submersible Pumps Brochure
- Pump Selection Handbook

Go Back

ST2047

2 Inch Discharge, 115V 1Ø, 1.0 HP, 87 GPM, 47' Total Head

This lightweight, compact submersible centrifugal pump is ideal for moving water in multiple confined and open area applications. This is a powerful, versatile, low maintenance pump that is perfect for a wide range of operations supporting Contractors, Service Utilities, Municipalities, and Homeowners. Further, the ST2047 incorporates a rugged cast aluminum housing, internal thermal overload protection, dual shaft seals, sealed ball bearings impeller and molded 50' Power Cable with strain relief.

- **1.0HP, 115V/9.8A, 1Ø, UL & CUL Listed Electric Motor.**
- **Built-in Overload Protection.**
- **2" (NPT) Female Discharge Port.**
- **Reliable double mechanical oil-filled seals.**
- **Cast iron/steel motor casing serves as heat conductor.**
- **Pumps Liquid Up To 120° F.**
- **50' of molded power cord w/strain relief**
- **Dewaters Flat Surfaces Up To 1" Levels.**

Performance Data | Options

Unit Specifications

Impeller Type		Neoprene Rubber over Cast-Iron
Impeller Disc Size	2 in	50 mm
Total Head	47 ft	14.3 m
Water Capacity	87 gpm	329 lpm

Dimensions & Weights

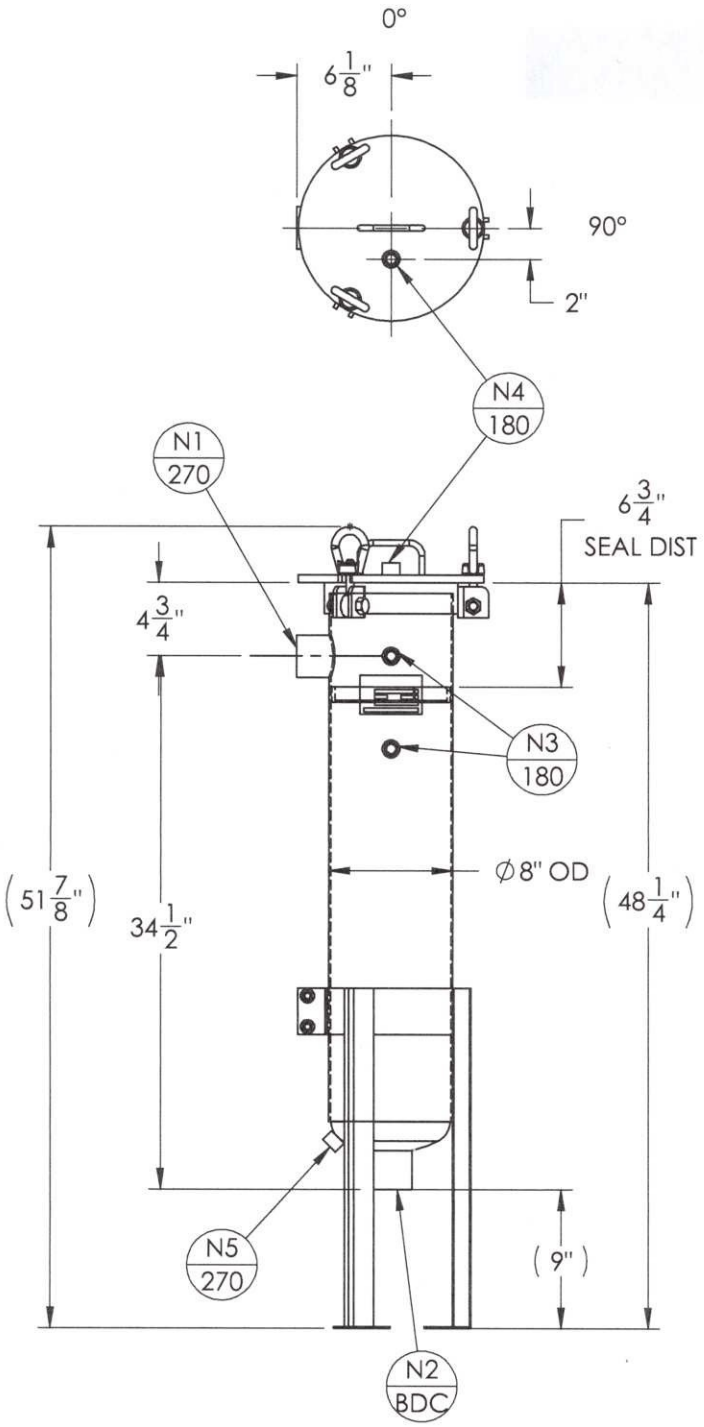
Pump Diameter	7.4 in	188 mm
Overall Height	15.4 in	391 mm
Operating Weight	33 lb	15 kg

Electrical Specifications

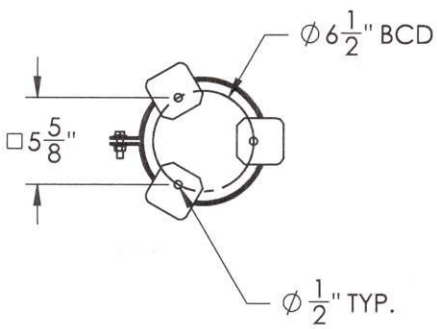
Power	1 HP	0.75 kW
Phase		Single
Voltage		115 V
Starting Amperage		49 A
Running Amperage		9.8 A
Cable Length	50 ft	15.2 m

NOZZLE SCHEDULE			
MARK	QTY	SIZE / RATING	DESCRIPTION
N1	1	2" 150# NPT	INLET
N2	1	2" 150# NPT	OUTLET
N3	2	1/2" 3000# NPT	PRESS GA
N4	1	1/2" 3000# NPT	VENT
N5	1	1/2" 3000# NPT	CLEAN DRAIN
N6	-	-	DIRTY DRAIN

VESSEL DESIGN CONDITIONS			
CODE:	BEST COMMERCIAL PRACTICE		
M.A.W.P.:	150 PSI @ 250°F	M.D.M.T.:	-20° F @ 150 PSI
M.A.E.P.:	15 PSI @ 250°F		
CORROSION ALLOWANCE:	NONE	HYDROTEST PRESS:	195 PSI
STAMP:	'NC'	SERVICE:	NON LETHAL
PWHT:	N/A	RADIOGRAPHY:	N/A
MATERIAL:	SS 304/L	GASKET:	BUNA-N



DRY WEIGHT: 77.62 #'s
FLOODED WEIGHT: 140 #'s
SHIPPING WEIGHT: 100 #'s
VESSEL VOLUME: 1.0 C.F.



NOTES:

- VESSEL WILL HOUSE (QTY=1) DOUBLE LENGTH BASKET.

THIRD ANGLE PROJECTION

TOLERANCES-UNLESS OTHERWISE NOTED
DECIMAL .X =±.1" .XX =±.02" .XXX =±.005"
FRACTIONAL ≤24" =±1/16" >24" =±1/8"
ANGULAR =± 1°
MAX. MACHINED SURFACE FINISH 125

1:1

REV.	DATE	REVISION	DRAWN	APP'D

LRT Lockwood Remediation Technologies LLC
89 Crawford Street
Leominster, MA 01453
Tel: 774.450.7177
Fax: 888.835.0617

LRT Provided Bag Filter Housing

EQUIPMENT:	BAG FILTER HOUSING (EB SERIES)				
MODEL NO:	S4EB112-2P-SW				
CUSTOMER:	-				
PARENT: NONE	DRAWN: CR	DATE: JAN 13 2011	JOB No. V-	DWG. No. 001-0123	REV. No. 0
PAGE: 1 OF 4	CHK'D: JM	SCALE: NTS			

High Performance Liquid Filter Bag – POMF Series

The POMF liquid filter bag is constructed of POLYPROPYLENE melt blown microfibers, allowing for very fine particles capture at high efficiencies. All POMF filter bags are over 90% efficient at their suggested micron rating. The bag construction makes this filter an easy to use, convenient, high performance alternative to filter cartridges.

The POMF liquid filter bag can also absorb unwanted trace of oils that frequently occur in processed fluids. The high amount of surface area due to the polypropylene microfiber construction, results in oil holding capacities from 10 – 20 times the filters own weight

The POMF liquid filter bag is available with a stainless steel ring or plastic ring.

The POMF Series liquid filter bag complies with FDA regulations governing food and beverage contact.

Efficiency:

Product Number	Suggested Application Rating	Efficiency
POMF 1A	1.0 micron	93.00%
POMF 2A	2.5 micron	94.00%
POMF 5A	5 micron	94.00%
POMF 10A	10 micron	94.00%
POMF 25A	25 micron	97.00%

All POMF Series liquid filter bags are over 90% efficient at their suggested application rating. The filters are rated using a challenge of AC Test Dust in water, and controlled flow rate up to 10 GPM. Efficiency data represent initial efficiencies only.

Materials of Construction

Filter Material	All Polypropylene
Converweb Material	All Polypropylene
Handles, Thread	All Polypropylene
Ring Type	Stainless Steel, Plastic
Dimensions	7" x 32" & 7" x 16"
FDA Compliance for food and beverage contact	Yes
Silicone	No

The POMF Series liquid filter bag is available in two sizes with two different ring types. The filters are made from pure polypropylene and are free of potentially damaging silicone oils.

Materials of Construction

Product Number:	POMF 1A	POMF 2A	POMF 5A	POMF 10A	POMF 25A
Dirt Holding Capacity grams of AC Test Dust loaded to 35 psi at 12 GPM	74	150	160	175	195
Oil Holding Capacity grams of mineral oil at saturation	528	657	690	726	798

Recordall® Cold Water Top Load Bronze Disc Meter
Size 2" (DN 50mm)
NSF/ANSI Standard 61 Certified, Annex G

DESCRIPTION

The Lead-Free Alloy (Trade designation: M170-LL) version has been certified to comply with NSF/ANSI Standard 61, Annex G and carries the NSF-61 Mark on the housing. All components of the Lead-Free Alloy meter, i.e., disc, chamber, housing, seals, etc. comprise the certified system.

APPLICATIONS: For use in measurement of potable cold water in residential, commercial and industrial services where flow is in one direction only.

OPERATION: Water flows through the meter's strainer and into the measuring chamber where it causes the disc to nutate. The disc, which moves freely, nutates on its own ball, guided by a thrust roller. A drive magnet transmits the motion of the disc to a follower magnet located within the permanently-sealed register. The follower magnet is connected to the register gear train. The gear train reduces the disc nutations into volume totalization units displayed on the register dial face.

OPERATING PERFORMANCE: The Badger Meter Recordall Disc meters meet or exceed registration accuracy for the low flow rates (95%), normal operating flow rates (100 ± 1.5%), and maximum continuous operation flow rates as specifically stated by AWWA Standard C700.

CONSTRUCTION: Badger Meter Recordall Disc meter construction, which complies with ANSI/AWWA standard C700, consists of three basic components: bronze meter housing, measuring chamber, and permanently, sealed register. A corrosion-resistant engineered polymer material is used for the measuring chamber.

To simplify maintenance, the register, measuring chamber, and strainer can be replaced without removing the meter housing from the installation. No change gears are required for accuracy calibration. Interchangeability of parts among like-sized meters also minimizes spare parts inventory investment. The built-in strainer has an effective straining area of twice the inlet size.

MAGNETIC DRIVE: Direct magnetic drive, through the use of high-strength magnets, provides positive, reliable and dependable register coupling for straight-reading, remote or automatic meter reading options.

SEALED REGISTER: The standard register consists of a straight-reading, odometer-type totalization display, 360° test circle with center sweep hand and flow finder to detect leaks. Register gearing consists of self-lubricating engineered polymer gears to minimize friction and provides long life. Permanently sealed; dirt, moisture, tampering and lens fogging problems are eliminated. Multi-position register simplifies meter installation and reading. Automatic meter reading systems are available for all Recordall Disc meters. All reading options are removable from the meter without disrupting water service.

TAMPER-PROOF FEATURES: Customer removal of the register to obtain free water can be prevented when the optional tamper detection seal wire screw/or Torx® tamper seal resistant screw is added to the meter. Both can be installed at the meter site or at the factory.

MAINTENANCE: Badger Meter Recordall Disc meters are designed and manufactured to provide long-term service with minimal maintenance. When maintenance is required, it can be performed easily either at the meter installation or at any other convenient location. As an alternative to repair by the utility, Badger Meter offers various maintenance and meter component exchange programs to fit the needs of the utility.

CONNECTIONS: Tailpieces/Flanges for installations of meters on various pipe types and sizes, including misaligned pipes, are available as an option.

Model 170 shown with optional 1" Test Plug

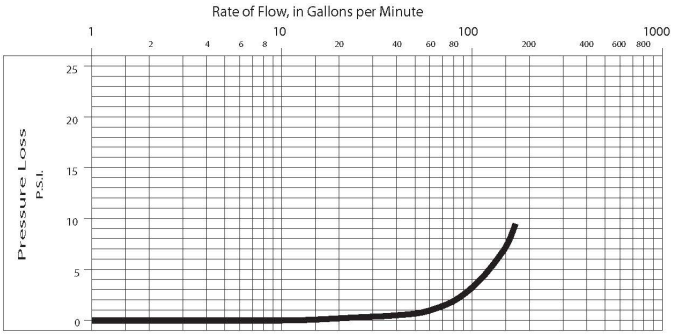
SPECIFICATIONS

Typical Operating Range (100% ± 1.5%)	2 1/2 -170 GPM (.57 to 39 m^3/hr)
Low Flow (Min. 95%)	1 1/2 GPM (.34 m^3/hr)
Maximum Continuous Operation	100 GPM (23 m^3/hr)
Pressure Loss at Maximum Continuous Operation	3.3 PSI at 100 GPM (.23 bar at 23 m^3/hr)
Maximum Operating Temperature	80°F (26°C)
Maximum Operating Pressure	150 PSI (10 bar)
Measuring Element	Nutating disc, positive displacement
Register Type	Straight reading, permanently sealed magnetic drive standard. Remote reading or Automatic Meter Reading units optional.
Registration	100 Gallons, 10 Cubic Feet, 1 m^3
Register Capacity	100,000,000 Gallons, 10,000,000 Cubic Feet, 1,000,000 m^3. 6 odometer wheels.
Meter Connections	2" AWWA two bolt elliptical flange, drilled, or 2" - 11 1/2 NPT internal pipe threads.
Optional Test Plug	1" NPT test plug (TP) available on elliptical long and short versions.

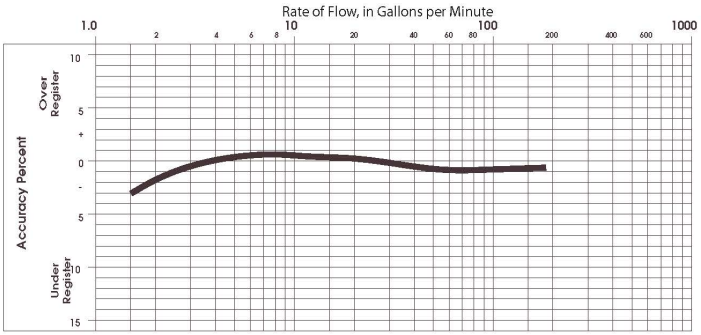
MATERIALS

Meter Housing	Cast Bronze, Lead-Free Alloy
Housing Top Plates	Bronze, Lead-Free Alloy
Measuring Chamber	Engineered Polymer
Disc	Engineered Polymer
Trim	Stainless Steel/Bronze
Strainer	Engineered Polymer
Disc Spindle	Stainless Steel
Magnet	Ceramic
Magnet Spindle	Stainless Steel
Register Lid and Box	Engineered Polymer or Bronze
Generator Housing	Engineered Polymer

PRESSURE LOSS CHART



ACCURACY CHART

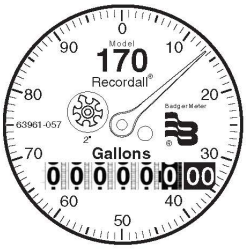


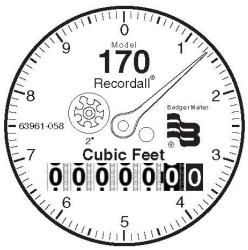
METER SIZE	METER MODEL	A LAYING LENGTH	B HEIGHT REG./RTR	C HEIGHT GEN.	D CENTERLINE BASE	WIDTH	APPROX. SHIPPING WEIGHT
2" (50mm)	170 EL, Hex. 170 EL, TP	$15^{1}/_{4}$" (387mm)	8" (203mm)	$9^{3}/_{8}$" (238mm)	$2^{7}/_{8}$" (73mm)	$9^{1}/_{2}$" (241mm)	30 lb. (13.6kg)
2" (50mm)	170 ELL, 170 ELL, TP	17" (432mm)	8" (203mm)	$9^{3}/_{8}$" (238mm)	$2^{7}/_{8}$" (73mm)	$9^{1}/_{2}$" (241mm)	30 lb. (13.6kg)

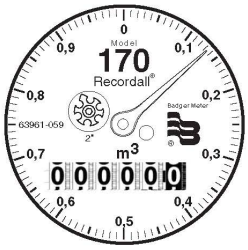
EL = Elliptical ELL = Elliptical Long Hex = Hexagon, 2" - $11^{1}/_{2}$ NPT Thread TP=Test Plug 1"

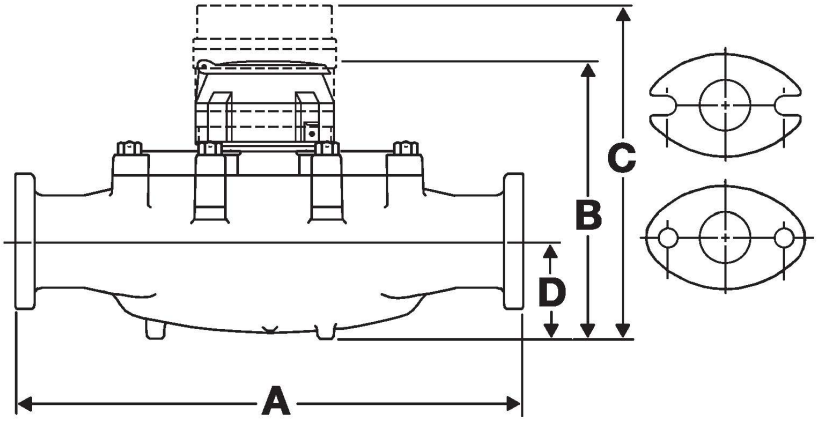
Sweep Hand Registration

MODEL	GALLON	CU.FT.	CU. METER
M170	100	10	1









APPENDIX E

Pre-Treatment System Design Calculations

DESIGN CALCULATIONS

Pre-Treatment System
Landfill 2 Area
Orrington, Maine

Treatment System Description:
System designed to treat groundwater at a maximum flow rate of 50 gallons per minute (gpm). Components include five 21,000-gallon frac tanks, a submersible pump operated with level controls, a single bag filter skid with two bag filters plumbed in parallel and a flow meter. Refer to the Water Treatment System Schematic.

A. Five 21,000-Gallon Frac Tanks

V = 105,000 gallons

Detention Time dt = V/Q = 105,000 gallons/50 gallons per minute = 2,100 minutes or 35 hours
Typical dt >= 1 hour for primary settling/equilization; therefore dt of 35 hours is OK

B. Submersible Pump (Treatment System Pump)

Size = 1.0 HP
Qmax = 50 gpm
TDH max = 40 feet
Q design = 50 gpm

(per Q vs TDH pump curve)
Q = 50 gpm @ TDH = 40 feet

C. Bag Filters

Two single-bag units plumbed in parallel (one on-line, other in stand-by)
Qmax = 125 gpm
Q design = 50 gpm; therefore OK

Bag Filter Capacity = 125 gpm/vessel
Press Drop @ 50 gpm = approx. 0.5 psi = 1.2 feet (w/out bags)
Press Drop @ 50 gpm = approx. 0.5 psi + 0.02 psi = 0.52 psi = 1.2 feet (w/ 5 micron bags)
Note: Bags typically changed out at 5 psi = Therefore, max pressure drop = 5 psi = 11.6 feet.

D. Flow Meter/Totalizer

Size = 2 inch
Qmax = 100 gpm
Qmin = 1.5 gpm
Q design = 50 gpm; since Q design < Qmax; OK
Press Drop @ 50 gpm = 1.0 psi = 2.3 feet

E. System Head Loss

Treatment System Component		*Head Loss (feet)*	
2 inch hose/piping and fittings (at 50 gpm)		5.1	approx.
Bag Filters		11.6	
Flow Meter/Totalizer		2.3	
	Total	19	since 19 < 40 TDH (@ 50 gpm) of 1.0 hp pump; design OK

APPENDIX F

Figures 1 – 3, Zone Layout Drawings

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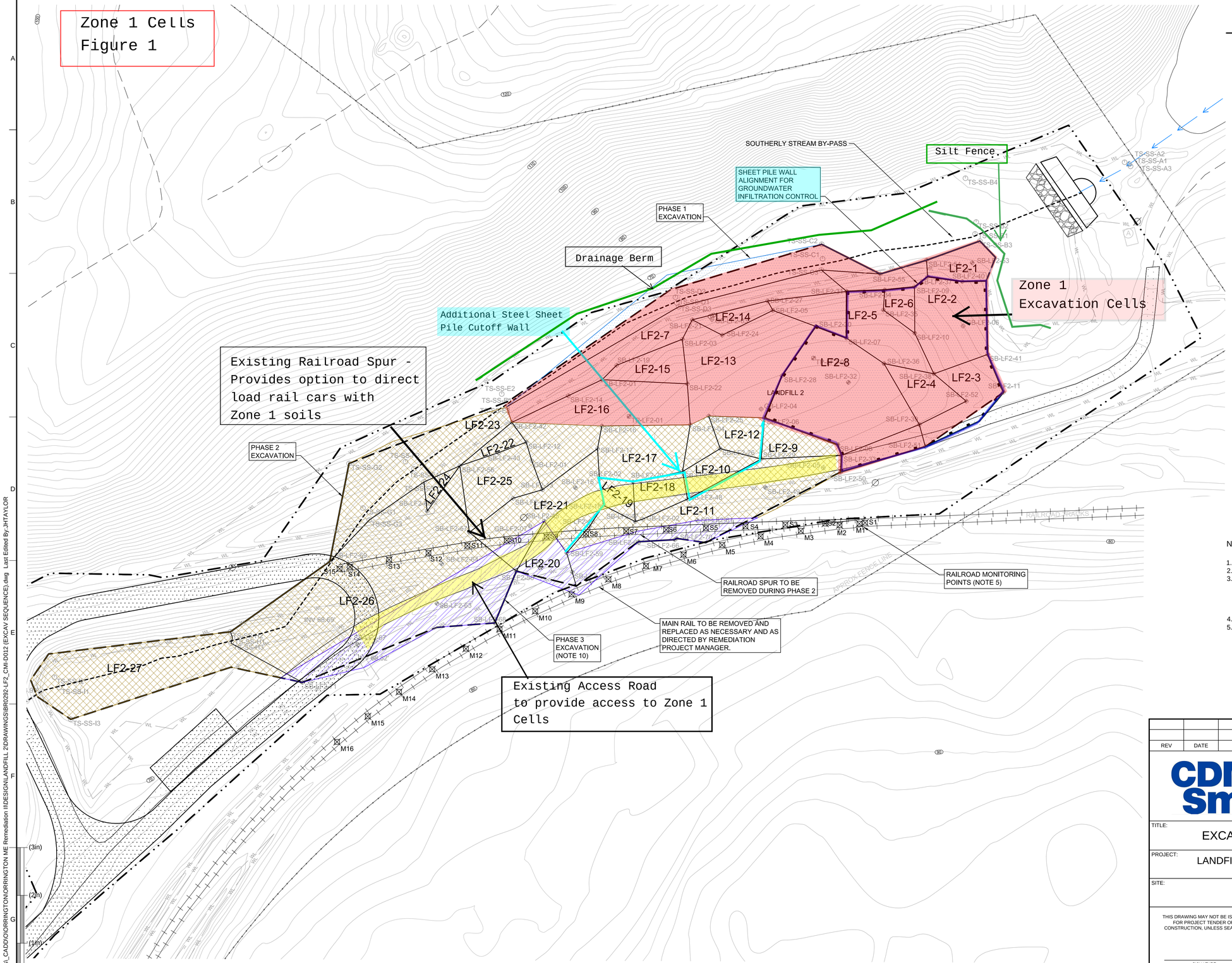


LEGEND

- SHEET PILE ALIGNMENT
- PHASE 1 EXCAVATION AREA
- PHASE 2 EXCAVATION AREA
- PHASE 3 EXCAVATION AREA
- M1 MONITORING POINT

NOTES:

1. SEE DRAWING NO. 2 FOR GENERAL NOTES AND LEGEND.
2. SLOPED EXCAVATIONS SHALL BE NO STEEPER THAN 2.5 HORIZONTAL: 1 VERTICAL.
3. A SHEETPILE WALL IS REQUIRED TO REDUCE SUBSURFACE GROUNDWATER FLOW WITHIN A PERVIOUS GRAVEL UNIT WITHIN THE EXCAVATION AREA. THE SHEETPILE WALL LIMITS SHOWN ON THIS DRAWING ARE APPROXIMATE AND ARE BASED ON LIMITED DATA. STORMWATER ORIGINATING OUTSIDE THE EXCAVATION AREA SHALL BE DIVERTED FROM ACTIVE WORK AREAS USING DIVERSION DIKES, BERMS, OR OTHER FEATURES.
4. NO RAIL TRAFFIC IS PERMITTED WHEN IMPLEMENTING THE PHASE 3 EXCAVATION.
5. REMEDIATION CONTRACTOR SHALL INSTALL MONITORING POINTS AT EVERY 25 LINEAR FEET. TWO POINTS SHALL BE INSTALLED AT EACH LOCATION, ONE ADJACENT TO EACH RAIL.

N

0 30' 60'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

CDM Smith

Geosyntec consultants

TITLE: EXCAVATION SEQUENCE AND MONITORING PLAN

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

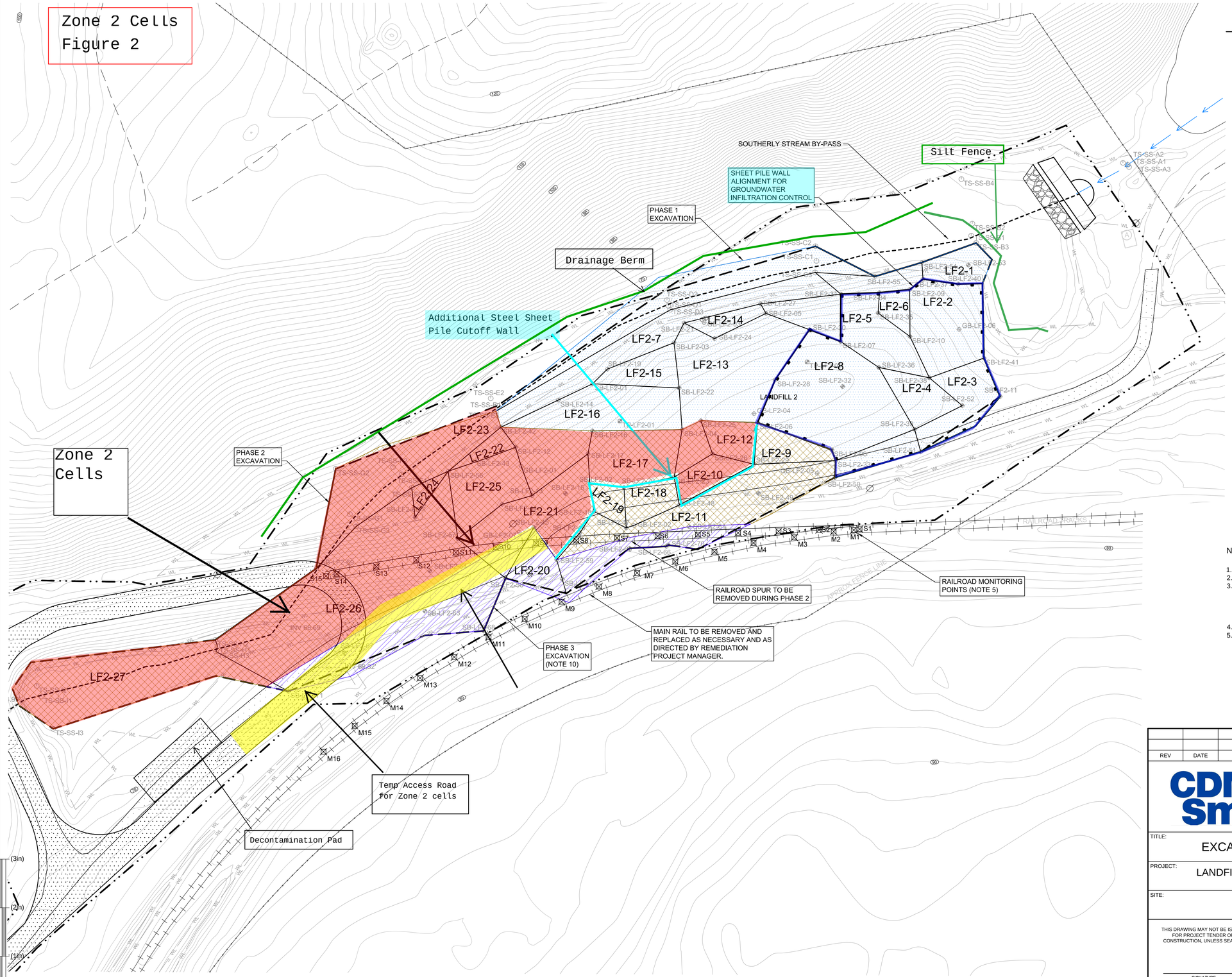
SIGNATURE

DATE

DESIGN BY:	JJB	DATE:	FEBRUARY 2016
DRAWN BY:	JHT	PROJECT NO.:	BR0292
CHECKED BY:	JJB	FILE:	
REVIEWED BY:	DTD/CMG	DRAWING NO.:	12 OF 18
APPROVED BY:	SML		

T:\Projects_CADD\ORRINGTON\ORRINGTON ME Remediation II\DESIGN\LANDFILL 2\DRAWINGS\BR0292-LF2_CMI-D012 (EXCAV SEQUENCE).dwg Last Edited By: JHTAYLOR

Zone 2 Cells
Figure 2



LEGEND

- SHEET PILE ALIGNMENT
- PHASE 1 EXCAVATION AREA
- PHASE 2 EXCAVATION AREA
- PHASE 3 EXCAVATION AREA
- M1 MONITORING POINT

NOTES:

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N

0 30' 60'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

CDM Smith

Geosyntec consultants

TITLE: EXCAVATION SEQUENCE AND MONITORING PLAN

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

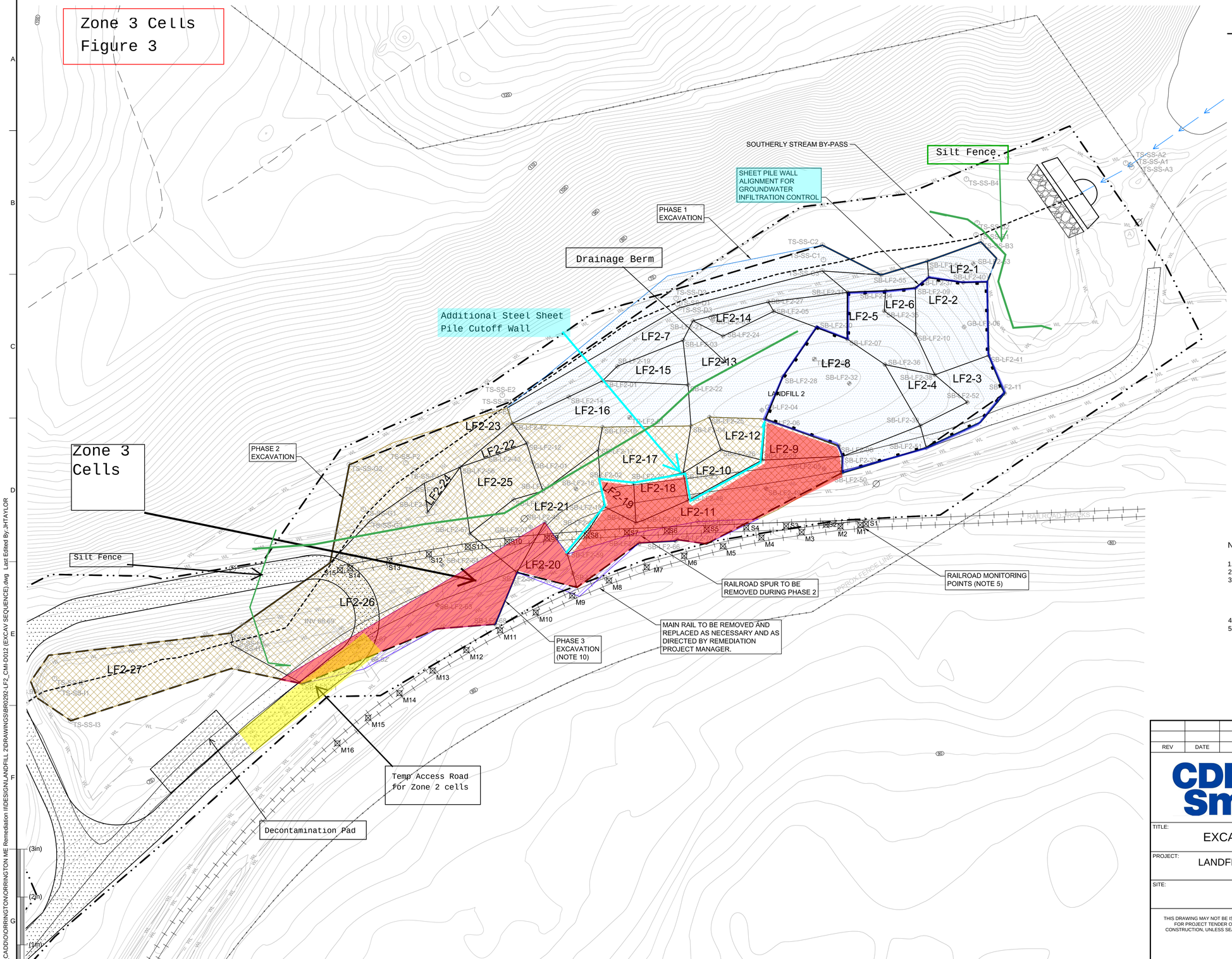
DATE

DESIGN BY:	JJB	DATE:	FEBRUARY 2016
DRAWN BY:	JHT	PROJECT NO.:	BR0292
CHECKED BY:	JJB	FILE:	
REVIEWED BY:	DTD/CMG	DRAWING NO.:	12 OF 18
APPROVED BY:	SML		

ISSUED FOR BID

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

T:\Projects_CADD\OORRINGTON\ORRINGTON ME Remediation II\DESIGN\LANDFILL 2\DRAWINGS\BR0292-LF2_CMI-D012 (EXCAV SEQUENCE).dwg Last Edited By:JHTAYLOR



NOTES:

1. SEE DRAWING NO. 2 FOR GENERAL NOTES AND LEGEND.
2. SLOPED EXCAVATIONS SHALL BE NO STEEPER THAN 2.5 HORIZONTAL: 1 VERTICAL.
3. A SHEETPILE WALL IS REQUIRED TO REDUCE SUBSURFACE GROUNDWATER FLOW WITHIN A PERVIOUS GRAVEL UNIT WITHIN THE EXCAVATION AREA. THE SHEETPILE WALL LIMITS SHOWN ON THIS DRAWING ARE APPROXIMATE AND ARE BASED ON LIMITED DATA. STORMWATER ORIGINATING OUTSIDE THE EXCAVATION AREA SHALL BE DIVERTED FROM ACTIVE WORK AREAS USING DIVERSION DIKES, BERMS, OR OTHER FEATURES.
4. NO RAIL TRAFFIC IS PERMITTED WHEN IMPLEMENTING THE PHASE 3 EXCAVATION.
5. REMEDIATION CONTRACTOR SHALL INSTALL MONITORING POINTS AT EVERY 25 LINEAR FEET. TWO POINTS SHALL BE INSTALLED AT EACH LOCATION, ONE ADJACENT TO EACH RAIL.

REV	DATE	DESCRIPTION	DRN	APP

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TRANSMITTAL

July 27, 2016	Job No.:	2-1459
Landfill 2/Northern Drainage Ditch Remediation	**Transmittal No.:**	**T-001C**
Mallinckrodt US, LLC – Orrington Remediation Site	☐ This is a New Transmittal	
Orrington, Maine	☒ This is a Resubmittal of Transmittal No: T-001A	

To Construction Manager:	To Construction Manager:	To Owner:
Dean Carter, Project Manager CDM Constructors, Inc. 99 Industrial Way Orrington, ME 04474	Nicole Summa, Project Manager CDM Constructors, Inc. 25 Industrial Drive Chelmsford, MA 01824	
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☐By Other:	☐By Other:	☐By Other:

Submittal Type		
☒ Plan	☐ Manufacturer Data	☐ Material Samples
☐ Shop Drawing	☐ Laboratory Data	☐ Record Documents
☐ Other:		

Copies	Date	Specification Reference	Submittal Description
1	6/30/16	13020	Excavation & Restoration Plan Final Draft

Transmitted For:		
☒ For Review and Approval	☐ For Review and Comment	☐ For Your Information
☐ Request for Information	☐ Other:	

Charter Contracting Company, LLC hereby certifies that the equipment, material or design, shown in this submittal, has been reviewed and conforms with the products required, field dimensions, adjacent construction work and coordination of information shown in the Contract Documents, and is transmitted as noted above.

Charter Contracting Company, LLC

Chris Ryan, Project Manager

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Plan Title: **13020 Excavation and Restoration Plan**

Project Title: Landfill 2 Remediation
Corrective Measures Implementation
Mallinckrodt US, LLC – Orrington Remediation Site
Orrington, Maine

Prepared For:

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Contract No.: Orrington Remediation -016

Charter No.: 2-1459

Date: 7/27/16

Revision No.: Final Draft

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6/30/2016
Date

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6/30/2016
Date

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6/30/2016
Date

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1. INTRODUCTION

The Orrington Remediation Site (Site) is a former chloro-alkali facility located at 99 Industrial Way, Orrington, Maine. The plant was constructed in 1967 and operated until 2000. Plant products included sodium hydroxide, sodium hypochlorite, hydrochloric acid, and chloropicrin. Mercury was used in the plant processes to produce chlorine from a brine solution and is the primary contaminant of concern (COC) at the Site. Additional COCs include chloropicrin, polychlorinated biphenyls (PCBs), carbon tetrachloride, cadmium, ethylbenzene, and xylenes. The facility has rail access to a PAN AM Bucksport Branch at the Sobin switch.

The remediation includes excavation and offsite disposal of material from the Landfill 2 Remediation area that are above the Media Protection Standard (MPS) of 2.2 mg/kg of mercury and other soil MPS parameters defined in the Landfill 2 Corrective Measures Implementation (CMI) Plan (January 2016).

The Landfill 2 area is located northeast of the Plant Area and south of the Southerly Stream and is bordered by an unpaved road and the main rail line to the south. The Southerly Stream starts just north of Landfill 2 and flows from north to south across the Site and passes along the northern edge of the Landfill 2 area.

The primary objective of the Landfill 2 CMI Plan is to remove soil within the Landfill 2 and in the adjacent Southerly Stream with contaminants of concern at concentrations greater than the site MPSs (e.g. mercury concentrations > 2.2 mg/kg). The excavated material will be disposed of at an approved offsite disposal facility. Additionally the CMI will establish final grades to shed storm water and re-vegetate the Landfill 2 area such that it blends in with surrounding areas including the Southerly Stream.

This Excavation and Restoration Plan (Plan) will provide details for the Site Preparations, environmental mitigation methods, excavation methodologies and restoration activities.

2. HEALTH & SAFETY PLAN

A Site Health and Safety Plan (HASP) has been prepared by CDM. This plan establishes, in detail, protocols necessary for the recognition, evaluation, and control of hazards associated with work activities performed by Charter and its subcontractors. This plan is Site and Project specific and will provide details addressing the work included in this Plan. Charter will review and sign the Site HASP and conduct operations on site according to the Site HASP and any relevant revisions.

The HASP establishes procedures for planning, controlling, and enforcing site safety. By applying these procedures at the Project Site, Charter prevents accidents, ensures compliance with OSHA

requirements, and protects workers and the environment. Charter will designate a site Health and Safety Officer (HSO) to implement the procedures and requirements for the duration of the project.

3. SITE PREPARATION

Charter will schedule construction activities in the remediation and staging areas in coordination with the Remediation Project Manager to minimize interference with ongoing operations at the Project Site. The work activities described in the following sub-categories will be completed in advance of any remediation work.

Charter will prepare a pre-construction existing conditions survey of the project site. This survey will include digital photographs identifying features of the remediation work site and support areas.

Charter will complete the following Site Preparation activities prior to any remediation work.

- Locate and mark out below grade utilities
- Setup temporary facilities (Office, decontamination, sanitary, phone, internet)
- Setup temporary electrical and lighting as necessary
- Construct Staging Area and Decontamination Pad
- Upgrade existing gravel access roads
- Construct temporary access road
- Install Deformation Monitoring points along the existing railroad sections in/adjacent to work zone
- Provide protection of existing structures and features as necessary

3.1. UTILITY LOCATING

DIGSAFE will be contacted (1-888-340-7233) a minimum of 72 hours prior to any intrusive work activities at the Project Site. Utilities identified through the DIGSAFE review and review of site utilities with the Remediation Project Manager will be incorporated into the work activity planning for those locations. Identified utilities will be clearly marked and protected and if necessary relocated or temporarily disabled during necessary work activities. Any shut downs of utilities will be coordinated with the Remediation Project Manager and GWTP operator to not impact their operations.

Overhead utilities will also be noted during this survey of the Project Site to identify potential conflicts and be included in work plans where equipment (i.e. cranes and excavators) could potentially come in contact. Any overhead utilities that are in conflict with a necessary

construction activity will be either de-energized during the work activity or if that is not a feasible option, will be relocated as necessary.

If an unknown/unidentified utility/drainage structure is discovered during remediation excavation, work will be stopped and the Remediation Project Manager will be immediately notified. The unknown utility will be investigated to determine if it is an active or abandoned utility, and will be addressed as directed by the Remediation Project Manager.

3.2. SITE LAYOUT

The Project Site layout is identified on Drawing Numbers 5, and 6 of the CMI Plan. Any revisions made to these drawings will be part of the final CMI Plan. Included in **Appendix A** are modified versions of these drawings illustrating the site layout in more detail. The following Site Layout items are identified on these drawings.

- The construction office trailer complex
- The Groundwater Treatment Plant
- Limits of Work
- The Landfill 2 Remediation Area
- The Southerly Stream
- Existing Maintenance Building
- The Temporary Soil Stockpile Area
- Rail Loading Area
- Existing Paved and Gravel Access Roads
- Existing Rail Lines
- Construction Staging Area
- Exclusion Zone (EZ)
- Contaminated Reduction Zone (CRZ)
- Support Zone (SZ)

3.3. LAND CLEARING

Land clearing work shall include shrub, tree and stump removal, grubbing, removal of miscellaneous surface debris, and removal of existing railroad ties and tracks. Charter will submit

written notice to the Remediation Project Manager at least 15 days prior to the start of land clearing work in the Landfill 2 Area.

Charter will install erosion and sediment control items identified in the project specifications and drawings prior to the start of land clearing activities. Clearing will be limited to the areas needed to complete the remediation work and any areas needed to construct the temporary access roads.

The clearing and grubbing materials generated will be stockpiled in the designated locations as directed by the Remediation Project Manager. All cleared vegetation materials will be shredded or chipped per Section 4.3.3 of the CMI Plan prior to stockpiling. Materials removed during grubbing activities that are in contact with soils with mercury concentrations > 2.2 mg/kg (stumps, roots and surficial debris) will be transported to the temporary soil stockpile area for disposal as directed by the Remediation Project Manager. Loose soil will be removed to the extent practicable prior to transport to the temporary soil stockpile area.

If weather conditions are unsuitable for clearing, as determined by either Charter or the Remediation Project Manager, Charter will discontinue operation until permission to resume operation is provided by the Remediation Project Manager.

3.4. EROSION AND SEDIMENT CONTROLS

Charter will install erosion and sediment controls prior to commencing earth disturbing activities. At a minimum, Charter will install temporary controls as shown on the CMI Plan Drawings and as directed by the Remediation Project Manager. This will include erosion and sediment controls installed around the Decontamination Pad Area and as shown on CMI Plan Drawing 5.

Erosion and sediment controls will meet the requirements of the Maine Erosion and Sediment Control Best Management Practices (BMPs)

Charter acknowledges that the Remediation Project Manager will be monitoring the Erosion and Sediment work as part of their Construction Quality Assurance (CQA) Plan. Charter will also include daily monitoring of site conditions as weather conditions impact the installed control items. Inspections will follow storm events with rainfall in amounts greater than 0.5 inches. Monitoring will be conducted for the duration of the project until final completion and acceptance. Charter will provide immediate repair work as necessary based on internal monitoring and as directed by the Remediation Project Manager. Temporary materials will be removed by Charter at the completion of the project.

Charter will utilize temporary soil berms and swales and other storm water BMPs as needed to control storm water runoff in the remediation area. This will help control erosion issues with storm water runoff and minimize the amount of contact water in open excavations which will require collection and discharge to the onsite Groundwater Treatment Plant (GWTP) operated by Woodard and Curran. Charter's excavation sequence will limit the exposure of disturbed areas by installing storm water controls around each group of cells being excavated. Please refer to Charter's Construction Water Management Plan.

Charter's excavation sequence will generally progress from the northeast to the southwest cells. Confirmation sampling/testing will be performed by the Remediation Project Manager. Backfilling will be conducted upon approval of the Remediation Project Manager. The Remediation Contractor will manage storm water/contact water in the interim period after sampling/testing area using the aforementioned E&S controls. If sample results show mercury concentrations <2.2 mg/kg, the excavations will then be backfilled. This will allow for restoration and revegetation work to be completed as soon as practical based on the construction activities. Rain runoff will flow down-gradient over clean restored areas limiting the potential for cross contamination to the adjacent areas.

3.5. ACCESS ROADS

Charter will construct new and upgrade existing gravel access roads as shown on CMI Plan Drawings 5 and 6. The existing access roads leaving the staging area and wheel wash/ main entrance area will be reconstructed/upgraded per the specifications and details on Drawing 18. This includes the new access road crossing (Detail 3/18) after the main wheel wash/construction entrance.

The access road will be constructed using structural fill and 1-1/2" crushed stone placed over the existing subgrade. The Access Road will be constructed per Detail 2/5 on CMI Plan Drawing No. 18. The structural fill will be placed in a 6-inch thick lift (compacted) with a second 6-inch lift of 1-1/2" crushed stone. The roadway will have a 1% cross slope. The side slopes of the Access Road will be constructed no steeper than a 2 horizontal to 1 vertical slope. Structural fill will be compacted to a minimum dry density of 95% of the standard proctor value and within +/- 3% of optimum moisture content from the Standard Proctor value (ASTM 698). One-way roadway sections shall be constructed with a width of 15 feet and two-way roadway sections shall be constructed with a width of 25 feet.

The Staging Area to be utilized during the Landfill 2 work was previously constructed under the Scrap Metal Yard CMI.

3.6. ESTABLISHMENT OF EXCLUSION ZONES

The Site Health and Safety Plan (HASP) includes a site control section. The HASP describes the methodology to be used by Charter's Health and Safety Officer (HSO) in determining the modification of work zone designations, and procedures to limit the spread of contamination.

The Exclusion Zone (EZ) will be established by Charter during the initial survey work after the completion of the clearing and grubbing of the Landfill 2 areas. Charter's Registered Land Surveyor (RLS) will conduct an initial existing conditions survey to establish the existing grades in the work zone. The excavation areas in this work plan are also referred to as "cells" with identification tags noted in the CMI Plans. Cells are identified by "LF2-"and an individual identification sequence number.

Along with establishing survey benchmarks and staking out the corners of the cells to be remediated, the boundary of the initial EZ will be staked out. Charter will initially establish the EZ to encompass the areas where remediation excavation work will be conducted. The perimeter of the area will be established with wooden stakes and caution tape to create the visual boundary of the EZ. The EZ will be clearly marked and delineated with signage identifying each individual work zone. When cell excavations are confirmed to have removed impacted soils and have been backfilled, the EZ boundary will be moved to reduce the size of the EZ area.

Equipment, vehicles, and personnel will only be allowed to enter the EZ from the designated location in the Contaminant Reduction Zone (CRZ). Only personnel and equipment necessary to complete the remediation work will be allowed in the EZ. The CRZ will include the Decontamination Pad and Personnel Decontamination Area. The location of the CRZ may be adjusted as needed.

Appendix A includes a drawing which shows the initial location of the EZ and CRZ Zones.

3.7. DECONTAMINATION AREAS

The CRZ will be established by Charter during the initial survey work after the completion of the clearing and grubbing of the Landfill 2 Area. The CRZ area will encompass an area inside of the new access road adjacent to the Landfill 2 Decontamination Pad (Reference Appendix A-Site Layout 1). No equipment or personnel will be allowed to go from the EZ to the Support Zone (SZ) without passing through the CRZ. Decontamination will take place within the CRZ in accordance with the HASP.

Charter will provide personnel decontamination facilities as needed to comply with the HASP. This location will provide employees a location to dispose of used PPE along with the necessary changing facilities. The personnel decontamination facilities will include, at a minimum,

a boot wash for removal of loose soil material and a location for the proper removal of exposed PPE. Appropriate disposal containers for exposed items will be provided in this area.

Charter will construct the Decontamination Pad in the CRZ/Staging Area. The Decontamination Pad will be constructed per detail 1/5 CMI Plan Drawing No. 18. Charter will collect decontamination wash water for transfer to the onsite GWTP. Charter will utilize the long handled shovels, brooms and brushes for the removal of solid materials on tires and tracks and pressurized water sprayers to wash and rinse items. When utilizing the water sprayers, the use of a face shield will be included in the PPE. Additional curtains or enclosures will be included if conditions make it necessary to contain decontamination water/materials. The Decontamination Pad will also include pumps to transfer liquid wash water to the temporary water treatment system as detailed in the Construction Water Management Plan. Shovels and brushes will be used at times when power washing is not necessary to remove light soils especially during dry weather or during freezing weather when power washing is not practicable.

3.8. RAILROAD MONITORING

Charter will have their Registered Land Surveyor (RLS) install and maintain railroad monitoring points at the existing Main Railroad line and the Spur located within the Landfill 2 Remediation area. The monitoring points will be installed at 25 foot intervals along the railroad lines with 2 points installed at each interval location located adjacent to the each rail. Refer to Appendix B, Figures 1 thru 3 for the approximate locations for the monitoring points.

Prior to the start of excavation work in the remediation area the RLS will collect three (3) days of Baseline Values (BVs) for the railroad track monitoring system. After the BVs have been established railroad track monitoring will be conducted per Note 6 on CMI Plan Drawing No. 10. At a Minimum, daily surveys of the railroad line will be conducted during times that the railroad line is in operation and there is an open excavation within a zone if influence which projects diagonally downward at a slope of 5’ horizontal to 1’ vertical projected laterally off the edge of the tracks. Monitoring results will be documented in a daily report and will be provided to the Remediation Project Manager on a daily basis.

Threshold Values (TVs) are defined as “Warning” values for monitoring. The Remediation Project Manager will be notified when the TVs have been exceeded and Charter will indicate what corrective actions are proposed to be implemented reduce the deflection, vibration etc. to levels below the TVs. Corrective actions to reduce deflections, vibrations etc. to levels below the TVs will be reviewed with the Remediation Project Manager. Work will continue with the approved corrective actions upon approval by the Remediation Project Manager. The TVs for horizontal or vertical `deformation of a railroad track monitoring point shall not exceed 0.125-inches of the established BVs.

Limit Values (LVs) are defined as "Stop Work" values for monitoring. If the LVs are exceeded, current work activities shall stop and corrective actions taken to reduce deflection, vibration, etc. to levels below the TVs. Additional measurement of nearby deformation monitoring points shall be performed by Charter to collect survey data to determine the extent of the movement and evaluate whether remedial work is required. Inspections of the railroad may also be required to evaluate whether the railroad tracks have been adversely impacted.

The initial LVs for measured horizontal or vertical deformation of a railroad track monitoring point shall not exceed 0.5-inches of the established BVs. Based on experience gained during the course of the project and the ongoing assessment of the behavior of the subsurface soil conditions with respect to the excavation operation, the LVs indicated herein may be adjusted as determined by the Remediation Project Manager. The Remediation Project Manager will be immediately notified when the LVs have been exceeded and Charter will inform the Remediation Project Manager of what corrective actions are to be conducted to reduce the deflection, vibration, etc. to levels below the TVs.

4. MITIGATION MEASURES FOR DUST AND VAPOR SUPPRESSION

4.1. MITIGATION MEASURES FOR VAPOR SUPPRESSION

Charter will furnish materials, equipment and personnel necessary to complete the remediation work while maintaining perimeter air quality levels below action levels established in the Perimeter Air Monitoring Plan (PAMP) prepared by the Remediation Project Manager. Charter will also supply air monitoring as required to maintain employee safety as defined in the HASP. Work Zone air monitoring will include mercury vapor, dust and VOC's.

Air Quality Levels as defined in the PAMP are as follows:

- Level GREEN: Construction activities may proceed and no specific mitigation measures are necessary.
- Level YELLOW: Construction activities may proceed with caution, mitigation measures shall be deployed and shortened work schedule may be necessary.
- Level RED: Work stopped until levels are down to level YELLOW or GREEN.

Under the direction of the Remediation Project Manager, Charter will utilize the following mitigation measures to suppress vapor levels to bring the perimeter air quality back to level YELLOW or GREEN:

- Windbreaks or barriers will be constructed to reduce wind speeds
- Controlled off road truck speeds to and from the CRZ
- Use of a water truck to control dust
- Use of atomizing water sprays
- Covering of inactive excavations areas to prevent the generation of vapors
- Covering of stockpiles with covers and weights to prevent the generation of vapors
- The use of HgX® by Acton Technologies for the reduction of mercury vapor. Please note that this product will be not be allowed to come in direct contact with ground water or contact water.
- If the above mitigation methods are still not effective to reduce vapor levels at the perimeter then the use of spray foams (i.e. Rusmar foam) will be utilized.

Charter acknowledges that the Remediation Project Manager may direct the delaying or temporary suspension of excavation work if conditions (i.e. excessive wind or temperature) may prohibit the proper implementation and effectiveness of engineering controls.

4.2. MITIGATION MEASURES FOR DUST SUPPRESSION

Under the direction of the Remediation Project Manager, Charter will utilize the following mitigation measures to suppress dust levels to bring the perimeter air quality back to level YELLOW or GREEN:

- Windbreaks or barriers will be constructed to reduce wind speeds and control the generation of dust
- Controlled off-road truck speeds to and from the CRZ to prevent the generation of dust
- Use of a water truck on access roads to control dust generation
- Use of atomizing water sprays at excavation locations
- Covering of inactive excavations areas to prevent the generation of dust
- Covering of stockpiles with covers and weights to prevent the generation of dust

Charter acknowledges that the Remediation Project Manager may direct the delaying or temporary suspension of excavation work if conditions (i.e. excessive wind or temperature) may prohibit the proper implementation and effectiveness of engineering controls.

5. EXCAVATION APPROACH

5.1. EQUIPMENT SPREAD AND CRAFT PERSONNEL

Charter will have the following types of equipment available to complete the remediation work. Charter may also supplement this list with similar rental equipment.

- CAT 420 Loader/backhoe
- CAT D6 or Komatsu D61 Bulldozer equipped with GPS
- CAT 336 or Komatsu PC300 Hydraulic Excavator
- Komatsu WA380 rubber tire loader with 4+/- CY bucket
- CAT 735 or DJB 35 ton Articulated Dump truck
- Water Truck
- Hydraulic Hammer for Excavators
- Double Drum walk behind Vibratory Compactor
- 11+/- Ton single drum Vibratory Roller
- 40 kW Generator
- 3 Inch trash pump
- 4 inch Diesel Dry Prime Pump
- 3000 PSI Pressure washer
- Temporary On-site Water Treatment System (See Construction Water Management Plan)
- Trench Box, Steel Plates, Steel Sheet Piles, Vibratory Hammer w/Power Pack

Charter will staff the project with crew comprised of the following Personnel. Charter work crews will be divided to create separate excavation and backfill crews as needed during the excavation phasing.

- Superintendent
- Health and Safety Officer (HSO)
- Field Engineer
- Heavy Equipment Operators
- Laborers

5.2. VERIFICATION OF EXCAVATION LIMITS

Charter will engage the services of an Independent Registered Land Surveyor (RLS), licensed in the State of Maine with a proven record of performance on projects of similar size and scope. The Surveyor's qualifications will be submitted to the Remediation Project Manager under a separate cover letter at least 15 days prior to the start of site work.

The RLS will be utilized to establish temporary survey control points, provide survey control and layout before and during construction, verify thickness and elevations of clean layers of material, and confirm bottom elevations of excavated cells.

The RLS will conduct a survey of the existing conditions in the Landfill 2 area. This survey will verify the Site's existing topographic map as a base line for construction and Measurement and Payment. This Pre-construction Survey will be submitted to the Remediation Project Manager.

The RLS will establish a minimum of two permanent survey control monuments within 100 feet of the limit of work for the Landfill 2 Remediation. The Survey control monuments will be tied to the North American Datum of 1983 (horizontal) and the North American Vertical Datum of 1988 (Vertical).

The RLS will produce detailed as-built survey and drawings for submission to the Remediation Project Manager. The survey will include the following: Bottom of excavation at each grid corner shown on the CMI Plan Drawings and spot elevations across the bottom of the excavation (25 foot grid); confirmation sample locations; and Post-construction topographic survey with as-constructed contours of disturbed/restored areas. The limits of the as-built Survey will extend a minimum of 50 LF beyond the limits of construction and/or disturbed areas.

The corners of the cells identified for excavation will be staked out/laid out in the field. The control information will also be downloaded into a GPS for additional layout control during the excavations.

Surveyed corner points will be laid out and then marked by stakes offset to the corner points. This will allow for the offsets points to be utilized when the actual corner is excavated and removed. Charter will monitor and establish/reestablish layout control with the use of stakes and marking paint where the use of offset corner points is impractical. The staking of cells will be more of a preliminary layout method. Charter's main survey control method during excavation work will utilize a combination of advanced global positioning software (which will interface with a handheld GPS instrument) and traditional total station survey instruments to conduct pre-excavation layout, verification of subgrade elevations, verification of sample locations, and maintain continuous site survey control throughout the duration of construction activities. The handheld GPS unit can provide location lines and grades with an accuracy of 0.1 foot. This will

allow for the boundaries of the cells to be re-established during the excavation and sloping into adjacent cells.

The following procedures will be followed with respect to confirmation sampling.

- Complete the excavation of the cell to the defined vertical and horizontal boundaries.
- The location and elevation/depth of confirmation samples will be reviewed with the Remediation Project Manager and CQA Engineer at the beginning of each day. For confirmation samples to be collected greater than 4 feet below the existing ground surface, excavations will be benched or appropriate excavation supports installed to allow the CQA Engineer to safely access the confirmation sampling locations. If sidewall samples are to be collected from locations greater than 4 feet above the excavation bottom, benching/excavation supports should be conducted sequentially to allow for safe access to the sampling locations.
- The limits of the excavation will be reviewed in the field with the Remediation Project Manager with assistance from Charter using the handheld GPS.
- Once the limits of the excavation are verified as at or beyond the designed elevation, the sample location will be found and staked by Charter.
- The Remediation Project Manager will obtain confirmation excavation bottom and sidewall samples (as located on CMI Plan Drawing No. 9)
- The sample locations will be staked for the RLS to record during the bottom of excavation as-built survey after verification that the bottom of the cell bottom contains mercury concentrations <2.2 mg/kg.

5.3. MONITORING OF EXCAVATION DEPTHS

Charter will monitor excavation work within the cells utilizing GPS survey instruments, rod and level survey instruments, and laser level controls.

Charter will conduct monitoring of excavation depths in the cells which have layers of On-site Reuse soils which need to be segregated and stockpiled in accordance with the Soil Reuse Plan. These materials will be reused as backfill after testing has confirmed the soil to be acceptable as On-site Reuse soils. Charter will collect survey data with the handheld GPS unit to confirm the top elevation of the On-site Reuse layer of material and will again collect survey data of the excavation to confirm the bottom depth of the On-site Reuse layer of material. This information will be included in the final as-built survey readings. Survey top and bottom elevations of the On-site Reuse soils will be reviewed with the Remediation Project Manager.

5.4. LANDFILL 2 MATERIAL EXCAVATION SEQUENCE

Charter's approach to remediation activities is based on the efficient removal of soils while minimizing over-excavation, limiting contact water, segregating clean material, and meeting production rates. Charter will sequence the remediation work to transfer a daily quantity of 500 to 750 tons of contaminated material to the Temporary Soil Stockpile Area (TSSA) or other location as directed by the Remediation Project Manager. Charter will not overfill transport trucks, this will prevent spillage and thus prevent cross contamination within the transport route from the CRZ to the TSSA. Trucks will be equipped with tailgates and will be inspected on the decontamination pad in the CRZ prior to continuing to the TSSA.

Charter will delineate three separate zones within the overall excavation area. Each zone of cells will be excavated, sampled, and backfilled in succession to allow effective implementation of storm water controls, control of the number of open excavations, and maintain equipment access throughout the site. The excavation sequence is performed in conjunction with sloping/benching and/or sheet pile Support of Excavation (SOE) installation. A more detailed narrative description of this work is included in this Section.

Charter's approach to completing remediation activities for each zone of cells is generally described as follows.

- Delineate each zone and the cells within that zone prior to excavation
- Install storm water controls around the zone to be excavated, including berms and swales.
- Establish excavation support or sloping/benching as necessary to safely reach excavation depths.
- Prepare and operate water management equipment for dewatering, storage, and transfer of liquids to the GWTP including the installation of sumps at low points to dewater nearby cells in the zone. (Refer to the Charter Construction Water Management Plan for more details.)
- Begin excavation of an individual cell within a given zone by removing the first layer of contaminated materials for transfer to the TSSA.
- Excavate to the top elevation of the On-site Reuse soils (if any) and confirm elevation with the Remediation Project Manager. On-site Reuse soils will be excavated to the bottom elevation of the identified On-site Reuse layer and will be stockpiled for backfill. Stockpiles will not exceed 500 CY. Three soil samples will be collected from each truck load as the trucks arrive at the stockpile area. The samples from the individual trucks will be used to generate three composite samples from each stockpile for testing in accordance with the Soil Reuse Plan. The sample collection and testing will be

performed by the Remediation Project Manager. Based on sampling results, this material may be reused as backfill.

- Excavate additional layers of contaminated materials from the cell for transfer to the TSSA.
- Excavate additional layers of On-site Reuse soils (if any) as described above.
- Assist the Remediation Project Manager with confirmation sampling of excavation bottom and sidewalls. Locations and depth/elevation of bottom and sidewall samples will be discussed with the Remediation Project Manager and CQA Engineer at the beginning of each day and excavation activities will be sequenced to ensure that the sampling locations are accessible.
- Begin excavation of the next group of cells while waiting for the results of the confirmation sampling.
- Once confirmation sample results are confirmed to be below the MPS for mercury and the Remediation Project Manager confirms that no further excavation for the cell is required, the RLS will obtain as-built survey information for the cell.
- Backfill will be placed in 12-inch loose lifts. The backfill will consist of approved Common Fill Type I and/or On-site Reuse soils removed from clean layer(s) within cells or excavated from sloping/benching of areas outside of the cell limits, in accordance with the Soil Re-use Plan.
- Complete cells within the given zone and relocate storm water controls, dewatering equipment, and excavation support systems as necessary to begin excavation of the next zone.
- The utilization of sloping /benching will result in excavations extending into the adjacent cells of separate zones. The sequencing is designed to complete a group of cells (zone) and survey/confirmation testing. This will allow Charter to excavate and backfill the cells in an efficient sequence to limit open excavations and restore the zone as quickly as possible.

5.4.1. Preliminary Excavation Boundary

The term Preliminary Excavation Boundary refers to a lateral boundary along an excavation cell which was not completely defined during the pre-design work. Borings with results below the MPS at every sampled interval were not completed due to access issues, timing, or surficial exceedances that can be delineated after excavation. Therefore after such a cell is excavated, these preliminary excavation boundaries will be confirmed with post-excavation sidewall samples, or the boundary will be expanded as necessary to meet MPS criteria. The preliminary excavation boundary along the northeastern cells will be

excavated utilizing sloping/benching techniques. Due to the need for confirmation sidewall samples, steel sheet pile types of support of excavation and trench boxes are not practical. Charter acknowledges the Project's desire to not create additional materials for disposal. Therefore, Charter will conduct excavations with the goal of limiting the excavations beyond the Preliminary Excavation Boundary to only the amounts needed to obtain the sidewall samples.

Sidewall sample locations that require samples at 2 different intervals (upper and lower) will be phased. There will be an initial excavation of material above the top of the On-site Reuse soil layer. The sampling of the upper sidewall sample in these locations will be accessible by vertically benching the cell boundary. After the sidewall sample has been confirmed to have mercury concentrations <2.2 mg/kg, the cell can be further excavated with sloping/benching to the deeper sidewall sample location.

The location and elevation/depth of confirmation samples will be reviewed with the Remediation Project Manager and CQA Engineer at the beginning of each day. For confirmation samples to be collected greater than 4 feet below the existing ground surface, excavations will be benched or appropriate excavation supports installed to allow the CQA Engineer to safely access the confirmation sampling locations. If sidewall samples are to be collected from locations greater than 4 feet above the excavation bottom, benching/excavation supports should be conducted sequentially to allow for safe access to the sampling locations.

Typically the sidewall samples are located near the bottom elevation of the cell. In order to provide safe access to these sample locations, the excavation will need to be sloped both inside the cell boundary and beyond the Preliminary Excavation Boundary. The sloping of the area outside of the Preliminary Excavation Boundary will have a toe of slope at 4 feet above the bottom of excavation. This will create a vertical wall at the sample location. The excavated material from the slope outside of the Preliminary Excavation Boundary will be handled as contaminated soil. This will be limited to only the excavation volumes needed to provide safe access to the sample location.

During the time period that the sidewall samples are being analyzed, the excavation work will continue in cell areas which do not require sloping/benching beyond the Preliminary Excavation Boundary.

5.4.2. Zone 1 (Appendix B – Figure 1)

Charter's Excavation sequence for Zone 1 is based on the phasing detailed in Figure 1 in Appendix B. Zone 1 includes the following cells; LF2-1, LF2-2, LF2-3, LF2-4, LF2-5, LF2-6,

LF2-7, LF2-8, LF2-13, LF2-14, LF2-15, and LF2-16/17. This group of cells does not include any with layers of Reuse Soil.

The Remediation Project Manager's preconstruction soil boring exploration work determined that there is a gravel seam of material located in the northeast cells of Zone 1. This seam of gravel could operate as a conduit for groundwater flow into the deeper excavations in this group of cells. In order to reduce the amount of groundwater infiltration during the excavation of these cells a temporary steel sheet pile wall will be installed in the northeast group of cells. The group of cells to be surrounded by a steel sheet pile wall (SOE) includes cells; LF2-2, LF2-3, LF2-4, LF2-5, LF2-6, and LF2-8. Charter will include in a separate Submittal a shoring wall design package which will include all design calculations and construction drawings showing plan layout, elevation sections and details.

Prior to the installation of the Support of Excavation at Cell LF2-3, a preliminary excavation cut will be made at the boundary. Cell LF2-3 includes a post excavation sidewall sample (SW-LF2-02 at elevation interval 72'-73'). The average existing grade of cell LF2-3 is 75'. The excavation Cell LF2-3 will be held initially benched to elevation 72'-73' along the edge of the boundary. This will be coordinated with the Remediation Project Manager/CQA Engineer to allow for safe access to the sample location. After the Remediation Project Manager provides confirmation the sidewall sample results are below the MPS, the Support of Excavation will be completed.

The soil excavation work in cells LF2-2, LF2-3, LF2-4, LF2-5, LF2-6, and LF2-8 can be completed to the design bottom of excavation as this group of cells does not include any Reuse Soils.

The deeper excavation work in Zone 1 will be limited to the cells within the SOE initially to limit the open excavation needing dewatering. The ground water in these cells will be encountered at the approximate elevation of 68' to 70' and dewatering sumps in the excavation will need to maintain the water level 1-foot below elevation 58.3'. Excavation work in other Zone1 cells could be conducted concurrently with these cells to maintain Charter's daily production rate of 500 to 750 tons of material transported to the TSSA. Post Excavation Bottom Samples (BS-LF2-01, BS-LF2-02, BS-LF2-09, and BS-LF2-10) will be coordinated with the Remediation Project Manager/CQA Engineer. Sample locations will be staked and surveyed for location/elevation.

Cell LF2-1 has two post excavation sidewall samples (SW-LF2-01 and SW-LF2-26). The average existing elevation of the cell is 68.5' and the design excavation bottom elevation is 64.8'. This cell can be excavated with a benched boundary to provide access to the sample interval elevation of 66'-67'. This excavation work will be coordinated with the Remediation Project Manager/CQA Engineer to allow for safety access to the sample

locations. After the Remediation Project Manager provides confirmation the sidewall samples results are below the MPS, the cell will be excavated to elevation 64.8'

Cell LF2-7 includes post excavation sidewall samples (SW-LF2-20, SW-LF2-21, SW-LF2-22, SW-LF2-23, SW-LF2-24 and SW-LF2-25, and a Preliminary Excavation Boundary. The average existing elevation of the cell is 69' and the design excavation bottom elevation is 62.9'. This cell can be excavated with a benched boundary to provide access to the sample interval elevation of 65'-66'. This excavation work will be coordinated with the Remediation Project Manager/CQA Engineer to allow for safety access to the sample locations. After the Remediation Project Manager provides confirmation the sidewall samples are below the MPS, the cell will be excavated to elevation 62.9'. This will require benching/sloping the excavation beyond the Preliminary Boundary. All soils excavated beyond the Preliminary Boundary will be placed in a stockpile as Reuse Soil.

Cells LF2-13, LF2-14, LF2-15 and LF2-16/17 will be excavated along with the boundary cells to an initial elevation of 62.9' +/-. This group of cells has a deeper bottom of excavation elevation and will need to be benched/sloped into the Zone 2 Cells on the southern edge (LF2-12 and the southern half of LF2-16/17). This group of cells includes five Post Excavation Bottom Samples (BS-LF2-03, BS-LF2-11, BS-LF2-12, BS-LF2-18 and BS-LF2-20). Confirmational Sample locations will be coordinated with the Remediation Project Manager before the start and during excavation activities. Safe access to these sample locations will be coordinated with the Remediation Project Manager/CQA Engineer. Sample locations will be staked and surveyed for location/elevation.

Backfilling operations will begin as soon as confirmation sampling results are approved. If any of the confirmation sample results exceed the MPS then additional excavation work will be conducted in accordance with Section 5.9. The cell bottom will then be re-sampled. After the follow-up bottom confirmation samples are shown to meet the MPS and are approved, Charter will have the RLS confirm the elevations/locations of the cell corners and confirmation sampling locations.

Backfill materials shall consist of Common Fill Type I or stockpiled On-site Reuse soils that have been sampled and confirmed for reuse. The open cells will be backfilled in 12-inch loose lifts and compacted to required densities to be confirmed by the CQA Engineer.

The trucks transporting clean materials will be able to access the remediated cells while traveling on the existing access roadway. The trucks will exit the EZ through the Decontamination Pad in the CRZ. Work within this group of cells will progress in a south to north direction maintaining backfill operations on clean material. The Exclusion Zone will be revised as cells are remediated and approved as complete.

Erosion Controls and drainage berms will be installed along the north-northeast edge of the Zone 1 cells to control and direct storm water runoff from the non-remediated cells away from the completed Zone 1 cells. The SOE in this area will also act as a cut off wall for surface runoff as well as ground water infiltration.

5.4.3. Zone 2 (Appendix B – Figure 2)

Charter's Excavation sequence for Zone 2 is based on the phasing detailed in Figure 2 in Appendix B. The excavation of the upper soil layers in Zone 2 will be conducted concurrently with cells in Zone 1 as needed to maintain safe slope/benching of the cells in Zone 1 as the depths increase. Zone 2 includes Cells; LF2-10, LF2-12, LF2-17, LF2-21, LF2-22, LF2-23, LF2-25, LF2-26(partial), and LF2-27.

This group of cells includes two cells (LF2-10, and LF2-26) which contain a single layer of soils identified as Reuse soils (Hg <2.2 mg/kg).

The excavation work in Zone 2 will require the removal of the existing Railroad Spur (See note on CMI Plan Drawing No. 12). The Main Rail will be addressed in Zone 3.

The installation of additional steel sheet piles along the southern cell boundary of cells LF2-10, LF2-12, LF2-17, and LF2-21, is anticipated to limit the groundwater infiltration and required sloping back towards the rail spur alignment. The SOE will be included in the Zone 1 SOE submittal. Please note that the Zone 2 SOE will be included in a separate Submittal. This cut off line of sheet piles will divide the cells with the deepest excavation elevations and will decrease the amount of sloping/benching needed to complete the remediation work. This SOE will also isolate the cells adjacent to the existing Railroad line that boarders the Landfill 2 area.

The excavation work in the perimeter cells (LF2-23, LF2-26 and LF2-27) will be conducted first. These cells have a Preliminary Excavation Boundary and require Post Excavation sidewall sampling.

LF2-23 has an average excavation depth of 3.4' and a maximum depth of 8.0' (Bottom of excavation is 64.1'). The Preliminary Boundary includes 3 sample locations (SW-LF2-17, SW-LF2-18 and SW-LF2-19 at interval elevation 65'-66')). This cell will be excavated with a vertical bench of 4.0' and will only be sloped beyond the boundary in the northwest corner to provide safe access to elevation 65'-66'.

LF2-27 has an average excavation depth of 6.3' The Preliminary Boundary includes 8 sample locations (SW-LF2-08, SW-LF2-09, SW-LF2-10, SW-LF2-11, SW-LF2-12, SW-LF2-13, SW-LF2-14, and SW-LF2-15). The sample interval elevation for this group of sidewall

samples is 63'-64'. This cell will be excavated with a vertical bench of 4.0' and only minimal locations will need to be sloped beyond the boundary. Due to the proximity to the access roads and CRZ Zone this cell boundary will be buttressed prior to receiving confirmational test results.

Cell LF2-27 includes two Post Excavation Bottom Samples (BS-LF2-21, and BS-LF2-22). Safe access to these sample locations will be coordinated with the Remediation Project Manager/CQA Engineer. Sample locations will be staked and surveyed for location/elevation. Once passing confirmation sample results are received and the Remediation Project Manager confirms that no further excavation for the cell is required, the RLS will obtain as-built survey information for the cell.

Based on sampling results, the On-site Reuse soil layers may be reused as backfill. These soils will be excavated to the bottom elevation of the identified On-site Reuse layer and will be stockpiled for backfill. Stockpiles will not exceed 500 CY. Three soil samples will be collected from each truck load as the trucks arrive at the stockpile area. The samples from the individual trucks will be used to generate three composite samples from each stockpile for testing in accordance with the Soil Reuse Plan. The sample collection and testing will be performed by the Remediation Project Manager. Upon confirmation of results below the MPS, the soils in these intervals will be stockpiled for reuse.

LF2-26 will be divided into two Zones of excavation. The zone boundaries are shown in Figures 2 and 3 in Appendix B. This phasing provides access to the Zone 3 cells. LF2-26 has an average excavation depth of 8.2'. The northern cell boundary includes 1 Post Excavation Sidewall sample location in this Zone (SW-LF2-16).

Please note that the southern Boundary of LF2-26 is included in Zone 3. The sidewall samples along this boundary will be obtained during Zone 3 excavation work.

The excavation work in LF2-26 will proceed as follows; excavate to the top elevation of the On-site Reuse soils and confirm elevation with the Remediation Project Manager (LF2-26 top of Re-use Soil = elevation 68.8' which is 3.2' below existing grade).

This cell will be excavated with a vertical bench of 4.0' and will only be sloped beyond the boundary as necessary. The sidewall sample interval elevation is 64'-65' for the sidewall sample along the north cell boundary. The sample elevations average 7' below the existing grade of the cell.

Due to the proximity to the access roads, CRZ Zone, and Railroad line this cell boundary will be buttressed prior to receiving conformation sample results. Work in areas

adjacent to the railroad spur will be coordinated with the Remediation Project Manager prior to any excavation work.

Cell LF2-26 includes three Post Excavation Bottom Samples (BS-LF2-05, BS-LF2-06, and BS-LF2-08). BS-LF2-08 will not be accessible during the Zone 2 phase and will be obtained during the Zone 3 work. Safe access to these sample locations will be coordinated with the Remediation Project Manager/CQA Engineer. Sample locations will be staked and surveyed for location/elevation. Once passing confirmation sample results are received and the Remediation Project Manager confirms that no further excavation for the cell is required, the RLS will obtain as-built survey information for the cell.

See Section 5.9 – Approach in Areas Where Additional Excavation is required for procedures for test results that show soils with Hg>2.2 mg/kg.

Backfilling operations will begin as soon as confirmation sampling results are approved. If any of the test results exceed the MPS then additional excavation work will be conducted in accordance with Section 5.9. The cell bottom will then be re-sampled. After the follow-up bottom confirmation samples are shown to meet the MPS and are approved, Charter will have the RLS confirm the elevations/locations of the cell corners and confirmation sampling locations.

LF2-26 includes the removal of the existing 12” culvert that crosses below the existing access road to allow for excavation. Soil will be removed, exposing the culvert pipe. The culvert pipe will then be removed from the excavation and all loose soil will be removed from the pipe sections. The pipe sections will be transported to a disposal location approved by the Remediation Project Manager. The culvert will be replaced, as detailed in CMI Plan Drawing 10, note 4, upon completion of the excavation.

LF2-24 does not contain any soils with Hg>2.2 mg/kg and will only be excavated as necessary to excavate the adjacent cells. All soil removed from this cell will be stockpiled for Reuse.

The remaining cells (LF2-10, LF2-12, LF2-21, LF2-22, LF2-25, partial LF2-16/17 and LF2-13) will be excavated to the upper elevations of the reuse layer of soils in cell LF2-10 (70.3’).

The initial excavation in LF2-10 will remove soil to the top elevation of the On-site Reuse soils and confirm elevation with the Remediation Project Manager (LF2-10 Top of Re-use = elevation 70.3’ which is 7.7’ below existing grade). This cell borders the support of excavation on the south and west sides and can be excavated down to the bottom of reuse soil elevation with only the north side sloped into cells LF2-12 and LF2-16/17.

Based on sampling results, the On-Site Reuse layer soils may be reused as backfill. These soils will be excavated to the bottom elevation of the identified On-site Reuse layer (LF2-10 bottom elevation of Re-use layer =67.9') and will be stockpiled for backfill. Stockpiles will not exceed 500 CY. Three soil samples will be collected from each truck load as the trucks arrive at the stockpile area. The samples from the individual trucks will be used to generate three composite samples from each stockpile for testing in accordance with the Soil Reuse Plan. The sample collection and testing will be performed by the Remediation Project Manager. Upon confirmation the results are below the MPS, the soils in these intervals will be stockpiled for reuse.

Excavation of the remaining Zone 2 cells will be completed to the bottom of excavation elevations. This group of cells includes five Post Excavation Bottom Samples (BS-LF2-04, BS-LF2-13,BS-LF2-15, BS-LF2-17 and BS-LF2-19). Safe access to these sample locations will be coordinated with the Remediation Project Manager/CQA Engineer. Sample locations will be staked and surveyed for location/elevation. Once passing confirmation sample results are received and the Remediation Project Manager confirms that no further excavation for the cell is required, the RLS will obtain as-built survey information for the cell.

Backfill materials shall consist of the following: approved Common Fill Type I; and/or stockpiled On-site Reuse soils that has been sampled and confirmed for reuse. The open cells will be backfilled in 12-inch loose lifts of Common Fill Type 1 and compacted to required densities to be confirmed by the CQA Engineer.

5.4.4. Zone 3 (Appendix B – Figure 3)

Charter's Excavation sequence for Zone 3 is based on the phasing detailed in Figure 3 in Appendix B. The Zone 3 cells include the following; LF2-9, LF2-11, LF2-18, LF2-19, LF2-20, and the remaining section of LF2-26. These cells are located between the SOE steel sheet pile wall and the main Railroad line to the south of Landfill 2. Cell LF2-26 contains a layer of Reuse soils.

The work in Zone 3 will be performed in accordance with Section 3.8 Railroad Monitoring. Work adjacent to the railroad line will require shutdown of rail service and removal of a portion of Main Rail Line.

The excavation work in the remaining cell LF2-26 (See Appendix B – Figure 3) will proceed as follows; excavate to the top elevation of the On-site Reuse soils and confirm elevation with the Remediation Project Manager (Cell LF2-26 top elevation of Re-use layer = elevation 68.8' which is 3.2' below existing grade).

Based on sampling results, this material may be reused as backfill. On-site Reuse soils will be excavated to the bottom elevation of the identified On-site Reuse layer and will be stockpiled for backfill. Stockpiles will not exceed 500 CY. Three soil samples will be collected from each truck load as the trucks arrive at the stockpile area. The samples from the individual trucks will be used to generate three composite samples from each stockpile for testing in accordance with the Soil Reuse Plan. The sample collection and testing will be performed by the Remediation Project Manager. Upon confirmation the results are below the MPS, the soils in these intervals will be stockpiled for reuse.

LF2-26 has an average excavation depth of 8.2', The southern Preliminary Boundary includes 2 Post Excavation Sidewall sample location in this Zone (SW-LF2-06, and SW-LF2-07). This cell will be excavated with a vertical bench of 4.0' at the bottom of the excavation and will only be sloped beyond the boundary as necessary. The sidewall sample interval elevation is 64'-65' for the 2 samples along the boundary. The sample elevations average 7' below the existing grade of the cell.

Due to the proximity to the access roads, CRZ, and Railroad line this cell boundary will be buttressed prior to receiving conformational test results. Areas adjacent to the railroad spur will be coordinated with the Remediation Project Manager prior to any excavation work.

The Zone 3 section of Cell LF2-26 includes one Post Excavation Bottom Samples (BS-LF2-08). Safe access to these sample locations will be coordinated with the Remediation Project Manager/CQA Engineer. Sample locations will be staked and surveyed for location/elevation. Once passing confirmation sample results are received and the Remediation Project Manager confirms that no further excavation for the cell is required, the RLS will obtain as-built survey information for the cell. During backfilling operations for cell LF2-26 a ramp/access road will be maintained to provide access to the other Zone 3 cells.

See Section 5.9 – Approach in Areas Where Additional Excavation is required for test results that show soils with Hg>2.2 mg/kg.

The remaining cells in Zone 3 do not include any Reuse Soil layers. Cells LF2-9, LF2-11, LF2-18, LF2-19, and LF2-20 will be excavated as a group. Cell LF2-11 has a Preliminary Boundary which includes three Post Excavation Sidewall sample location in this Zone (SW-LF2-03, SW-LF2-04 and SW-LF2-05). The group of cells will be excavated to the sidewall sample interval elevation of 74'-75'. The excavation boundary will initially be a 2.5' vertical bench along the southern perimeter. Safe access to these sample locations will be coordinated with the Remediation Project Manager/CQA Engineer. Sample locations will be staked and surveyed for location/elevation. Once passing confirmation sample results are

received and the Remediation Project Manager confirms that no further excavation for the cell boundary is required, the RLS will obtain as-built survey information for the cell.

Cells LF2-9, LF2-11, and LF2-18 include three Post Excavation Bottom Samples (BS-LF2-07, BS-LF2-14, and BS-LF2-16). Cell LF2-9 has a bottom of excavation elevation of 68.2' (9.8' excavation depth), Cell LF2-11 has a bottom of excavation elevation of 70.8' (6.7' excavation depth), and Cell LF2-18 has a bottom of excavation elevation of 70.3' (7.7' excavation depth). The excavation work to remove soils with Hg>2.2 mg/kg will require a 4' vertical bench at the bottom of the southern boundary and then a sloped excavation outside the cell boundary. This work will be conducted in accordance with Section 3.8 Railroad Monitoring. The excavation work for this Zone of cells will require a shutdown of rail service and removal of a portion of Main Rail line (See note on CMI Plan Drawing No. 12).

Safe access to these sample locations will be coordinated with the Remediation Project Manager/CQA Engineer. Sample locations will be staked and surveyed for location/elevation. Once passing confirmation sample results are received and the Remediation Project Manager confirms that no further excavation for the cell is required, the RLS will obtain as-built survey information for the cell. Backfill operations will begin along the southern boundary of the cells and will work out of the Zone from east to west.

Backfill materials shall consist of the following: approved Common Fill Type I; and/or stockpiled On-site Reuse soils that have been sampled and confirmed for reuse. The open cells will be backfilled in 12-inch loose lifts of Common Type 1 Fill and compacted to required densities to be confirmed by the CQA Engineer.

5.5. TRANSPORTATION OF MATERIALS TO THE CDM SMITH RAIL LOADING AND SOIL STAGING AREA

Charter will transport excavated materials utilizing CAT 735 or DJB – 35 ton Articulated Dump trucks with tailgates or equal equipment. Existing or temporary gravel road ways will be used as truck routes within the EZ and from the EZ to the CRZ. From the CRZ to the TSSA, trucks will follow the prescribed truck route. Trucks will be loaded in the EZ either directly during the excavation work or from a temporary stockpile located in the cells being excavated.

Charter will maintain the transportation route(s) with a water truck to control the generation of dust. Vehicle speeds will be monitored to reduce the generation of dust. Vehicles and equipment leaving the EZ will pass over the Decontamination Pad in the Staging Area prior to delivering materials to the TSSA. Trucks will unload materials only in the designated area provided by the Remediation Project Manager in the TSSA.

Trucks will be inspected at the edge of the EZ to determine how much contaminated material is in the vehicles wheels/tracks. Long handle shovels and brooms will be utilized to remove the bulk material from the truck before it leaves the EZ and drives onto the Decontamination Pad in the CRZ/Staging Area. Trucks will be further decontaminated and inspected at the decontamination pad.

Charter will utilize the following procedures for decontamination of equipment on the decontamination pad: long handled shovels, brooms and brushes for the removal of solid materials on tires and tracks and pressurized water sprayers to wash and rinse items. When utilizing the water sprayer equipment the use of a face shield will be included in the PPE. Additional curtains or enclosures will be included if conditions make it necessary to contain decontamination water/materials.

Charter will construct the Decontamination Pad in the CRZ/Staging Area. The Decontamination Pad will be constructed per detail 1/5 CMI Plan Drawing No. 18. Charter will collect decontamination wash water for transfer to the onsite GWTP.

5.6. DRAINAGE FEATURE CONSTRUCTION

Charter will implement the measures to minimize the generation of contact water during the excavation work in the Remediation area. Charter will use a combination of erosion and sedimentation controls, steel sheet pile SOE systems, excavation sequencing and the construction of soil berms arranged in a manner that will divert storm water to natural discharge points on the site.

Charter will construct temporary earthen swales and diversion berms to minimize storm water runoff from entering excavation areas. Erosion and sediment controls will meet the requirements of the Maine Erosion and Sediment Control Best Management Practices (BMPs). Charter will restore completed areas as the excavation sequence allows. The construction sequence along with rough grading will be performed to keep flows away from the active excavation areas.

Charter will manage the dewatering and drainage of excavation areas by minimizing the open excavations and using sumps to maintain groundwater levels 1’-0” below the bottom of the excavation. Dewatering fluids from open excavations and decontamination wash water will be conveyed to Charter’s water treatment system. Details of this system are included in the Construction Water Management Plan. Water from this system will then be pumped to the Site GWTP at an average rate of 13.9 gal/min (20,000 gal/day).

5.7. TEMPORARY SHORING AND/OR SLOPING

Charter will utilize two methods of temporary excavation support in the remediation area. A temporary steel sheet pile cofferdam will be utilized Zone1 to minimize the need for sloping/benching at the deeper excavations and to provide a cut off wall for the migration of ground water. A second steel sheet pile cut off wall will be installed between the cells along the railroad line and the deeper excavations in Zone 2. A separate Submittal will be transmitted to the RPM for this Support of Excavation (SOE) system with stamped engineer plans and calculations.

Charter will also utilize sloping and benching techniques compliant with OSHA standards (1926, Subpart P App B, Sloping and benching). Charter will characterize the existing soils to be excavated as Type C soils which will utilize a vertical slope of 1-1/2 H : 1 V (34 degrees) for simple excavations less than 20 feet in depth.

5.8. MEANS TO MINIMIZE OVER-EXCAVATION AND PREVENT RECONTAMINATION

Charter will minimize over excavation of soils through the use of survey layout and controlled excavation depths, thus reducing the amount of soils below the MPS transported to the TSSA. The excavation of impacted and On-site Reuse soil layers will be carefully conducted to isolate the soils to be stockpiled and reused onsite as backfill.

Limits of excavation will be controlled through the use of equipment outfitted with GPS controls. Excavation limits and grades will be loaded into GPS-equipped grading equipment to provide the established grades of the soil layers. The GPS equipped grading equipment will be capable of informing equipment operators when the target excavation extents for either the contaminated or On-site Reuse soils have been reached. Charter's field engineer will concurrently check layout to confirm limits and collect as-built elevations, which in turn are used for tracking progress and running volume calculation in Auto CAD. The Project RLS performs final surveys of the ongoing work to provide confirmation that the lines and grades are being met per the CMI Plan documents.

In addition to GPS-equipped grading equipment, a hand-held GPS device (rover) with a data logger will be used to record the progress of excavation and backfilling work on a daily basis. The handheld GPS provides real time line, grade and elevation information during the excavation work. This is important as the excavations will require sloping/benching and re-establishment of boundaries can be remarked as necessary during the actual excavation work. As part of the GPS machine control system, a base station will be setup on-site.

Charter will also utilize a laser level which will allow grades to be checked during excavation work with a grade rod and laser receiver unit.

Charter will utilize the following work practices to prevent recontamination of areas completed within the work zone, and areas outside of the work zone.

- Charter's excavation sequence is designed to have the backfilling operations follow the excavation work from northeast to southwest. This allows for equipment and truck deliveries to remain on areas outside of the EZ.
- Cells that have been backfilled and restored to subgrade will be constructed with temporary earthen berms and swales to keep storm water runoff that may be contaminated from entering clean areas. Contact water within active cells will be removed to prevent cross contamination with completed cells. Contact water will also be controlled to not enter completed cells that are waiting for confirmation test results for acceptable bottom of excavation. This includes cells that have active sumps for controlling ground water but are waiting for approval to start backfilling operations. (Refer to the Construction Water Management Plan for details.)
- Trucks and heavy equipment will be decontaminated prior to working in the clean zones. If necessary excavators can use multiple buckets in order to easily switch between contaminated and clean buckets, while the excavator itself does not need to be decontaminated and remain in the EZ.
- Stockpiles of On-site Reuse materials removed from the cells will be placed on polyethylene sheeting to prevent any possible transfer of contamination when stockpiled within the EZ or outside the EZ. These areas will be identified with signage as "Reuse Soil Stockpile Area". This will prevent cross contamination if On-site Reuse soil material is found to be unsuitable for reuse and stockpiled in a clean area, or if On-site Reuse material is found to be clean and stockpiled in the EZ. Potential stockpile locations will be determined in the field based on construction activities. The location of stockpiles will vary depending on which Zone(s) are being actively remediated. The Remediation Project Manager ultimately must approve stockpile locations.
- Equipment, vehicles, and personnel will only be allowed to enter the EZ from the designated location in the CRZ. Only personnel and equipment necessary to complete the remediation work will be allowed in the EZ. The CRZ will be located in the staging area. This location will include the Decontamination Pad and Personnel Decontamination Area.
- The CRZ will be established by Charter during the initial survey work after the completion of the clearing and grubbing of the Landfill 2 Area. The CRZ area will be located inside of the Staging Area next to the Landfill 2 Decontamination Pad. No equipment or personnel will be allowed to go from the EZ to the Support Zone (SZ) without passing through the CRZ. Decontamination will take place in this zone in accordance with the HASP.

- Trucks transporting contaminated soils will have closed tailgates and will not be overloaded. This will prevent cross contamination to access roads and areas outside of the EZ. Speeds will also be enforced to suppress dust generation.

5.9. APPROACH IN AREAS WHERE ADDITIONAL EXCAVATION IS REQUIRED

Charter will excavate the cell to an elevation where corners of the excavation can be confirmed for location and elevation. At this time the Remediation Project Manager will conduct confirmation sampling at bottom and/or sidewall locations as detailed on CMI Plan Drawing No. 10 – Confirmation Sampling Plan. If the sample results do not meet the MPS criteria (e.g. mercury concentrations <2.2 mg/kg) then additional excavation will be required.

Charter will continue the excavation of the cell as directed by the Remediation Project Manager. The following procedure will be implemented when additional excavation is required based on confirmation sample results.

- Bottom samples - excavate a 20 foot x 20 foot x 1 foot deep square area centered on the confirmation sample point, and then the Remediation Project Manager will re-sample at the same location/new elevation.
- Sidewall samples - excavate horizontally beyond the sidewall sample location at a distance determined by the Remediation Project Manager. The additional excavation will maintain the same bottom of excavation elevation. Typically this horizontal distance will be 10 feet however it may be modified based on Site constraints or restrictions. This additional excavation will extend to the next closest passing sidewall sample in both directions. The Remediation Project Manager will re-sample at the same elevation/new location.
- The above additional excavation approaches may be modified by the Remediation Project Manager as may be warranted by site conditions.

Additional benching may be necessary to allow for deeper and/or wider excavations within a cell. Charter will endeavor to keep the additional soil volumes to as small a quantity as possible. When sampling results indicate MPS criteria has been met (mercury concentrations $\leq$ 2.2 mg/kg), an as-built survey will be conducted and backfilling will be performed.

6. BACKFILLING AND REGRADING

6.1. BACKFILL MATERIALS

Backfill materials shall consist of the following: approved Common Fill Type I or stockpiled On-site Reuse material that has been sampled and confirmed for reuse. The open cells will be backfilled in 12-inch loose lifts of Common Fill-Type 1 and compacted to required densities. Import materials will be submitted to the Remediation Project Manager for approval prior to delivery of the materials to the site.

The cells approved for backfill will be backfilled in 12-inch loose lifts and compacted to required densities utilizing vibratory rollers. Size and production capability of the rollers used for compaction will be as required depending upon size and location of the cells backfilled.

6.2. EQUIPMENT SPREAD AND CRAFT PERSONNEL

Note: Equipment used during backfilling operations will have been decontaminated if utilized in the EZ working on remediation soils. Imported Common Type 1 Fill deliveries will only be allowed to travel across areas outside of the remediation areas or on areas where clean roads are established.

- CAT 420 – Loader/backhoe
- CAT D6 or Komatsu D61 Bulldozer equipped with GPS
- CAT 336 or Komatsu PC300 Hydraulic Excavator
- Komatsu WA380 rubber tire loader with 4 CY bucket
- CAT 735 or DJB – 35 ton Articulated Dump truck
- Double Drum Walk Behind Vibratory Compactor
- 11 Ton single drum Vibratory Roller

Charter will staff the project with crew comprised of the following Personnel. Charter work crews will be divided to create separate excavation and backfill crews as needed during the excavation phasing.

- Superintendent
- Health and Safety Officer (HSO)
- Field Engineer
- (3) Heavy Equipment Operators

- (3) Laborers

6.3. SEQUENCE OF BACKFILL RE-GRADING

Backfilling operations will begin immediately after the approval of confirmation sampling results from the bottom and sidewall locations identified on the CMI Plan Drawings and completion of the sample location surveys. The first areas to be backfilled will be the cells in Zone 1. There are two groups of cells in Zone 1. The first group is located within the closed cofferdam (SOE) and the second group is the cells along the northern boundary. This sequence of backfilling will also benefit the work by allowing for the delivery of import materials to maintain travel on existing/upgraded access roads.

The second area will be Zone 2; this area will be backfilled from a temporary access road connecting the CRZ through the Zone 2 cells to the northern leading edge of the Zone 1.

The third area will be Zone 3; this section will be backfilled from reconstructed access road to the cells along the southern edge of the Landfill 2.

7. RESTORATION

Charter will perform the site restoration activities. Disturbed surfaces impacted by site related activities will be restored as indicated in the design documents. Remediation areas will be backfilled and graded to the subgrade elevations detailed on CMI Plan Drawing No. 13 and 15. Areas will be backfilled with approved Common Fill-Type 1 or stockpiled On-site Reuse material that has been sampled and confirmed for reuse. The open cells will be backfilled in 12-inch loose lifts and compacted to required densities. Imported materials will be submitted to the Remediation Project Manager for approval prior to delivery to the project site.

The Southerly Stream Area adjacent to Landfill 2 will be restored to grades shown on the CMI Plan Drawing but the stream itself will be restored as part of a future CMI Plan at a later date. The erosion control items shown on Drawing No. 15 which runs along the high side of the southerly stream will be installed per Details on CMI Plan Drawings 16 and 17.

The remediation area will have 6 inches of topsoil installed. Topsoil materials will be submitted for approval prior to installation. Restoration areas will be seeded using the specified seed mix, New England Erosion Control/Restoration Mix for Dry Sites. Seeding will be applied between the growing season of April 15th and November 1st at the rate of 35 pounds/acre. Application rate should be tripled if seed is applied between November 2nd and April 14th. Erosion Control Blanket will be installed on sloped areas with grades steeper than 5H:1V per the notes on Drawing 15 of the CMI Plan.

Access roads will be restored as shown on CMI Plan Drawing No. 14 and the details shown on CMI Plan Drawing No. 15. Temporary staging and decontamination areas will be restored to their pre-construction conditions. The decontamination pad, stone and sediment will be transported to the TSSA for off-site disposal.

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APPENDIX A

Site Layout Drawings

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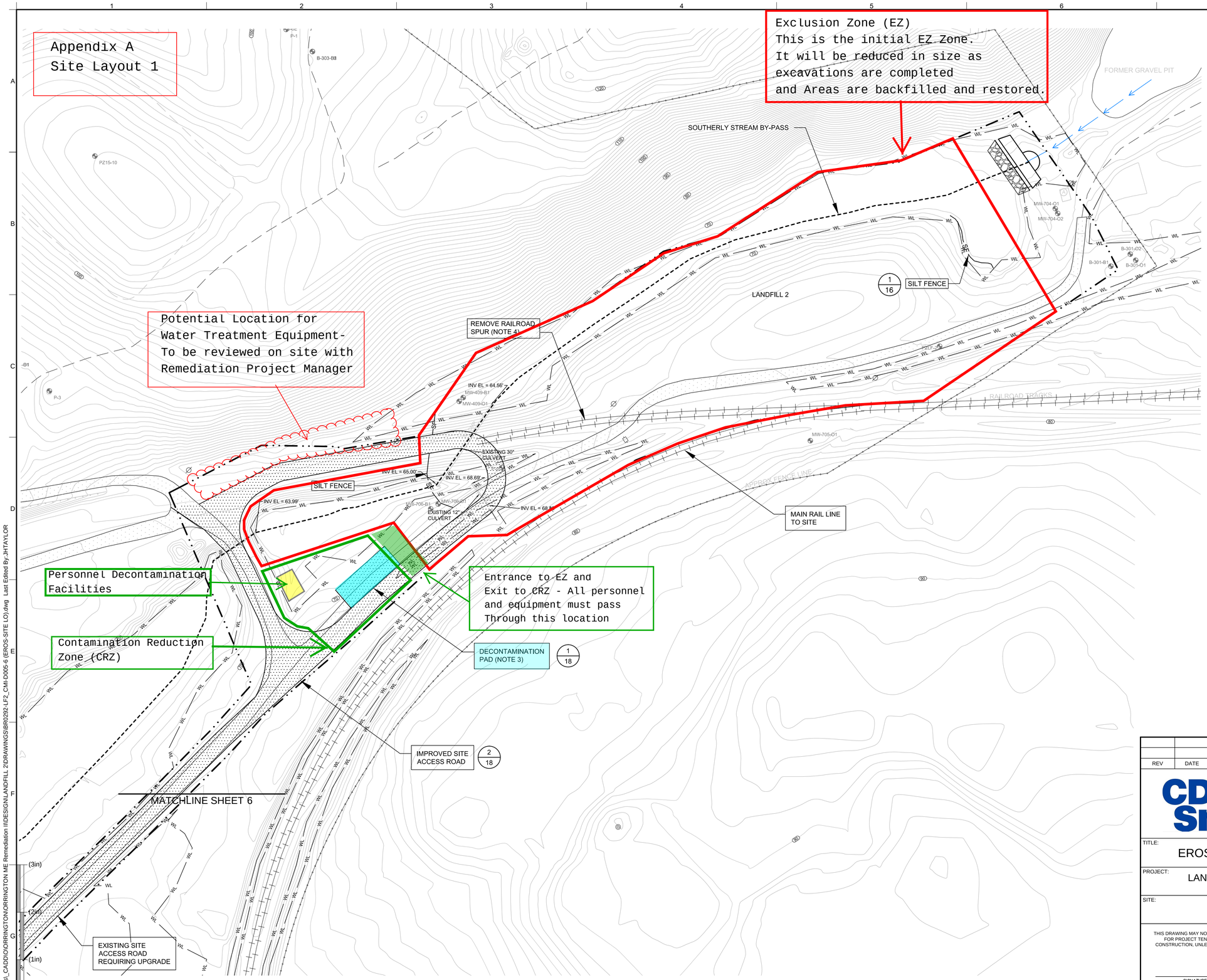

LEGEND

SF — PROPOSED SILT FENCE

IMPROVED SITE ACCESS ROAD/DECONTAMINATION PAD

NOTES:

1. SEE DRAWING NO. 2 FOR GENERAL NOTES AND LEGEND..
2. DURING CONSTRUCTION CONTACT STORMWATER FROM WITHIN THE EXCAVATION AREAS SHALL BE COLLECTED AND STORED TEMPORARILY AND TRANSFERRED TO ON-SITE GROUNDWATER TREATMENT PLANT. CONTRACTOR SHALL CONFIRM SUFFICIENT STORAGE CAPACITY BASED ON DESIGN STORM.
3. LOCATION OF DECONTAMINATION PAD WILL BE DETERMINED BY THE REMEDIATION CONTRACTOR AND AS APPROVED BY THE REMEDIATION PROJECT MANAGER.
4. REMOVE RAILROAD SPUR WITHIN LIMITS OF WORK AS REQUIRED TO SUPPORT CONSTRUCTION OF ACCESS ROAD AND DURING PHASE 2 OF THE EXCAVATION. REMEDIATION CONTRACTOR SHALL LEAVE A MINIMUM OF 150 LF OF RAILROAD SPUR IN PLACE TO SUPPORT DIRECT LOADING OF RAIL CARS DURING THE PHASE 1 EXCAVATION. RAIL ROAD MATERIAL REMOVED SHALL BE PLACED IN THE TEMPORARY STOCKPILE AREA.

N

0 40' 80'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

CDM Smith

Geosyntec consultants

TITLE: EROSION CONTROL AND SITE LAYOUT PLAN - SHEET 1

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	JJB	DATE:	FEBRUARY 2016
DRAWN BY:	JHT	PROJECT NO.:	BR0292
CHECKED BY:	JJB	FILE:	
REVIEWED BY:	DTD/CMG	DRAWING NO.:	5 OF 18
APPROVED BY:	SML		

ISSUED FOR BID

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Appendix A
Site Layout 2

STAGING AREA (NOTE 3)

GRAVEL ACCESS ROAD

MATCHLINE SHEET 5

MAINTENANCE BUILDING

GRAVEL ACCESS ROAD (NOTE 2)

Site Access to the TSSA Area

SOUTHERLY STREAM

EXISTING SITE ACCESS ROAD REQUIRING UPGRADE

ACCESS ROAD CROSSING 3/18

LOW SPOT REQUIRING FILL

WHEEL-WASH/ CONSTRUCTION ENTRANCE

GROUNDWATER TREATMENT PLANT

Support Zone

Charter Site Trailer to be located in SZ as Determined by the RPM

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

ISSUED FOR BID

NOTES:

1. SEE DRAWING NO. 2 FOR GENERAL NOTES AND LEGEND.
2. ACCESS ROAD TO BE CONSTRUCTED AS PART OF SCRAP METAL YARD CMI.
3. EXISTING STAGING AREA TO BE CONSTRUCTED AS PART OF SCRAP METAL YARD CMI.

N

0 40' 80'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

CDM Smith

Geosyntec consultants

TITLE: EROSION CONTROL AND SITE LAYOUT PLAN - SHEET 2

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

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APPROVED BY:	SML		

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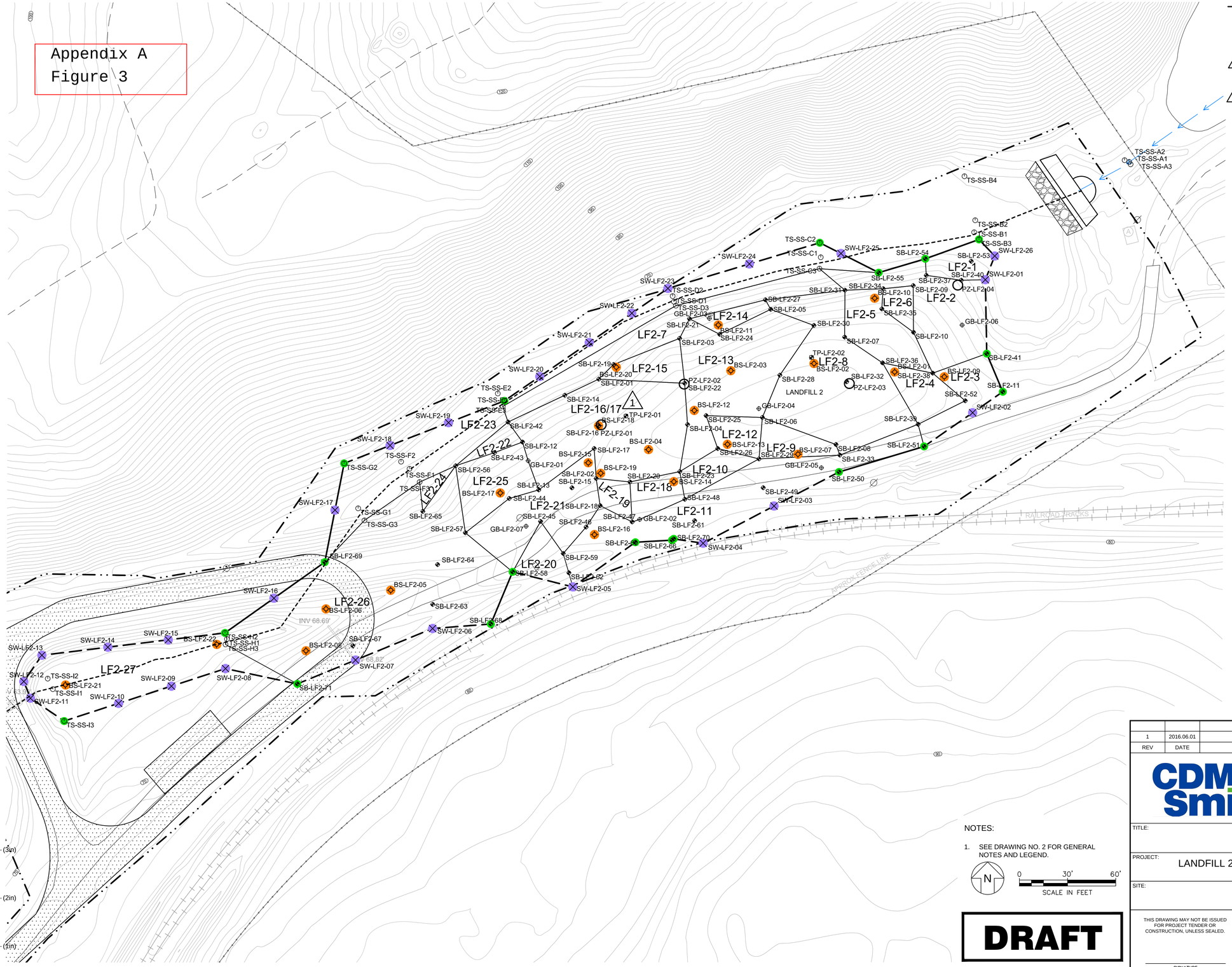
Appendix A
Figure 3



LEGEND

- PRE-EXCAVATION SIDEWALL SAMPLE (MERCURY CONCENTRATIONS ARE BELOW THE MPS AT EACH INTERVAL)
- PRE-EXCAVATION BOTTOM SAMPLE
- 1 POST-EXCAVATION BOTTOM SAMPLE
- POST-EXCAVATION SIDE WALL SAMPLE (1 INTERVAL)
- 1 PRE-EXCAVATION PIEZOMETER

BOTTOM SAMPLE AND SIDEWALL SAMPLE SUMMARY TABLE

LOCATION ID	Northing (USSurveyFoot)	Easting (USSurveyFoot)	Elevation (USSurveyFoot)
BS-LF2-01	392446.95	900917.14	68.9
BS-LF2-02	392452.24	900866.91	64.8
BS-LF2-03	392447.78	900815.09	61.3
BS-LF2-04	392398.65	900763.85	55.2
BS-LF2-05	392311.04	900603.25	63.8
BS-LF2-06	392299.44	900562.94	63.8
BS-LF2-07	392395.73	900856.91	68.2
BS-LF2-08	392273.35	900550.47	63.8
BS-LF2-09	392443.96	900948.04	69.9
BS-LF2-10	392492.89	900904.68	66.2
BS-LF2-11	392476.24	900807.29	62.3
BS-LF2-12	392423.01	900792.32	61.3
BS-LF2-13	392401.91	900812.98	66.8
BS-LF2-14	392378.66	900779.6	70.3
BS-LF2-15	392390.45	900726.3	60.3
BS-LF2-16	392345.72	900730.17	70.8
BS-LF2-17	392371.65	900671.48	61.4
BS-LF2-18	392413.497	900732.71	58.3
BS-LF2-19	392383.874	900734.043	58.3
BS-LF2-20	392449.926	900743.763	62.9
BS-LF2-21	392252.109	900400.615	60.7
BS-LF2-22	392277.35	900494.818	60.7
SW-LF2-01	392504.43	900973.62	66-67
SW-LF2-02	392421.62	900965.73	72-73
SW-LF2-03	392363.51	900842.02	74-75
SW-LF2-04	392340.34	900797.84	74-75
SW-LF2-05	392313.16	900716.7	74-75
SW-LF2-06	392287.24	900629.38	64-65
SW-LF2-07	392267.58	900581.35	64-65
SW-LF2-08	392262.29	900500.36	63-64
SW-LF2-09	392251.34	900466.69	63-64
SW-LF2-10	392240.64	900433.78	63-64
SW-LF2-11	392243.85	900378.89	63-64
SW-LF2-12	392254.23	900374.73	63-64
SW-LF2-13	392270.58	900386.01	63-64
SW-LF2-14	392275.59	900427.08	63-64
SW-LF2-15	392280.18	900464.71	63-64
SW-LF2-16	392306.1	900530.53	64-65
SW-LF2-17	392360.96	900568.56	65-66
SW-LF2-18	392401.2	900602.87	65-66
SW-LF2-19	392415.4	900639.27	65-66
SW-LF2-20	392444.15	900696.13	65-66
SW-LF2-21	392465.32	900726.93	65-66
SW-LF2-22	392483.56	900753.45	65-66
SW-LF2-23	392499	900775.9	65-66
SW-LF2-24	392514.26	900826.65	65-66
SW-LF2-25	392520.74	900883.72	65-66

NOTES:

1. SEE DRAWING NO. 2 FOR GENERAL NOTES AND LEGEND.

N

0 30' 60'
SCALE IN FEET

DRAFT

CMI PLAN REV 1

REV	DATE	DESCRIPTION	DRN	APP
1	2016.06.01	EXCAVATION PLAN REVISIONS	JHT	CMG

CDM Smith

Geosyntec consultants

TITLE: CONFIRMATION SAMPLING PLAN

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

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DATE

DESIGN BY:	JJB	DATE:	FEBRUARY 2016
DRAWN BY:	JHT	PROJECT NO.:	BR0292
CHECKED BY:	JJB	FILE:	
REVIEWED BY:	DTD/CMG	DRAWING NO.:	9 OF 18
APPROVED BY:	SML		

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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APPENDIX B

Figures 1-3 – Zone Layout Drawings

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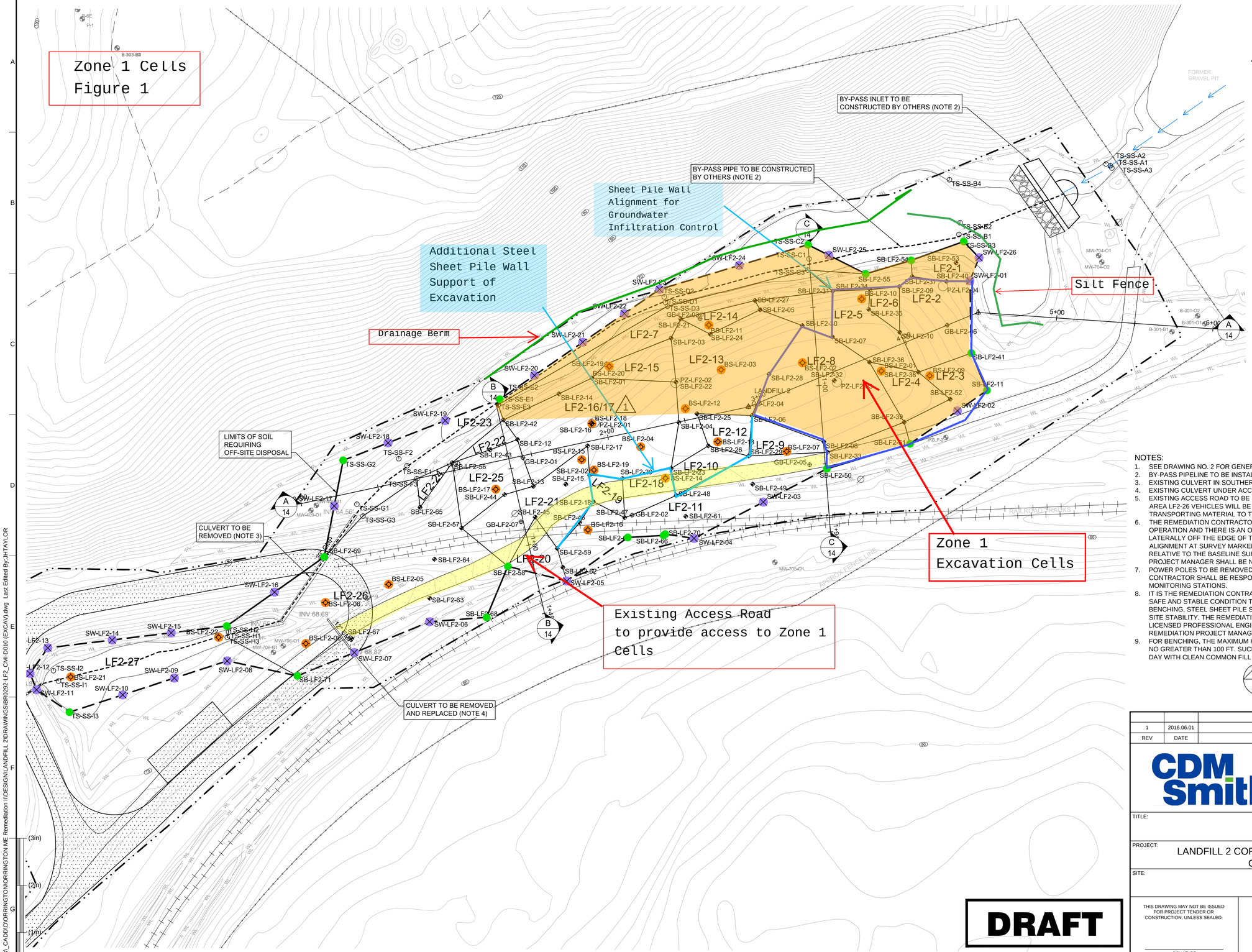

LEGEND

- LF2-1 — PROPOSED EXCAVATION AREA IDENTIFICATION / BOUNDARY
- PRELIMINARY EXCAVATION BOUNDARY, DEPENDENT ON FINAL CONFIRMATION SAMPLE
- EXCAVATION BOUNDARY
- MONITORING POINT

NOTES:

1. SEE DRAWING NO. 2 FOR GENERAL NOTES AND LEGEND.
2. BY-PASS PIPELINE TO BE INSTALLED AS PART OF SCRAP METAL YARD CMI PLAN.
3. EXISTING CULVERT IN SOUTHERLY STREAM TO BE REMOVED AND NOT REPLACED.
4. EXISTING CULVERT UNDER ACCESS ROAD TO BE REMOVED AND REPLACED.
5. EXISTING ACCESS ROAD TO BE REMOVED AS REQUIRED DURING EXCAVATION. WHEN REMOVING EXCAVATION AREA LF2-26 VEHICLES WILL BE REQUIRED TO BACK IN FOR LOADING AND DECONTAMINATION PRIOR TO TRANSPORTING MATERIAL TO TEMPORARY SOIL STOCKPILE AREA.
6. THE REMEDIATION CONTRACTOR SHALL PERFORM DAILY SURVEYS OF THE RAILROAD LINES WHEN THEY ARE IN OPERATION AND THERE IS AN OPEN EXCAVATION WITHIN 5 HORIZONTAL TO 1 VERTICAL PROJECTION LATERALLY OFF THE EDGE OF TRACKS. SURVEYING SHALL BE PERFORMED EVERY 25 FT ALONG THE RAILROAD ALIGNMENT AT SURVEY MARKERS INDICATED. IF GREATER THAN 1/8-IN OF LATERAL MOVEMENT IS OBSERVED RELATIVE TO THE BASELINE SURVEY, NEARBY EXCAVATION WORK SHALL BE STOPPED AND THE REMEDIATION PROJECT MANAGER SHALL BE NOTIFIED.
7. POWER POLES TO BE REMOVED AND REPLACED AS REQUIRED TO SUPPORT EXCAVATION. REMEDIATION CONTRACTOR SHALL BE RESPONSIBLE FOR SUPPLYING AND MAINTAINING POWER TO PERIMETER AIR MONITORING STATIONS.
8. IT IS THE REMEDIATION CONTRACTOR'S RESPONSIBILITY TO MAINTAIN ALL SITE SLOPES AND EXCAVATIONS IN A SAFE AND STABLE CONDITION THROUGHOUT CONSTRUCTION. THE REMEDIATION CONTRACTOR MAY USE BENCHING, STEEL SHEET PILE SHORING, TRENCH BOX SHORING, OR OTHER SUITABLE METHODS TO ACHIEVE SITE STABILITY. THE REMEDIATION CONTRACTOR SHALL SUBMIT A SHORING DESIGN SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF MAINE AND AN INSTALLATION PLAN TO THE REMEDIATION PROJECT MANAGER FOR REVIEW AND APPROVAL PRIOR TO COMMENCING THE WORK.
9. FOR BENCHING, THE MAXIMUM HEIGHT OF A BENCH SHALL BE 4 FT AND THE LENGTH OF THE BENCH SHALL BE NO GREATER THAN 100 FT. SUCH VERTICAL BENCHES SHALL BE BUTTRESSED PRIOR TO THE END OF THE WORK DAY WITH CLEAN COMMON FILL SLOPED AT 2 HORIZONTAL: 1 VERTICAL.

N

0 30' 60'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP
1	2016.06.01	EXCAVATION PLAN REVISIONS	JHT	CMG

CDM Smith

Geosyntec consultants

TITLE: EXCAVATION PLAN

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

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DESIGN BY:	JSE	DATE:	FEBRUARY 2016
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REVIEWED BY:	DTD/CMG	DRAWING NO.:	
APPROVED BY:	SML		10 OF 18

DRAFT

CMI PLAN REV 1

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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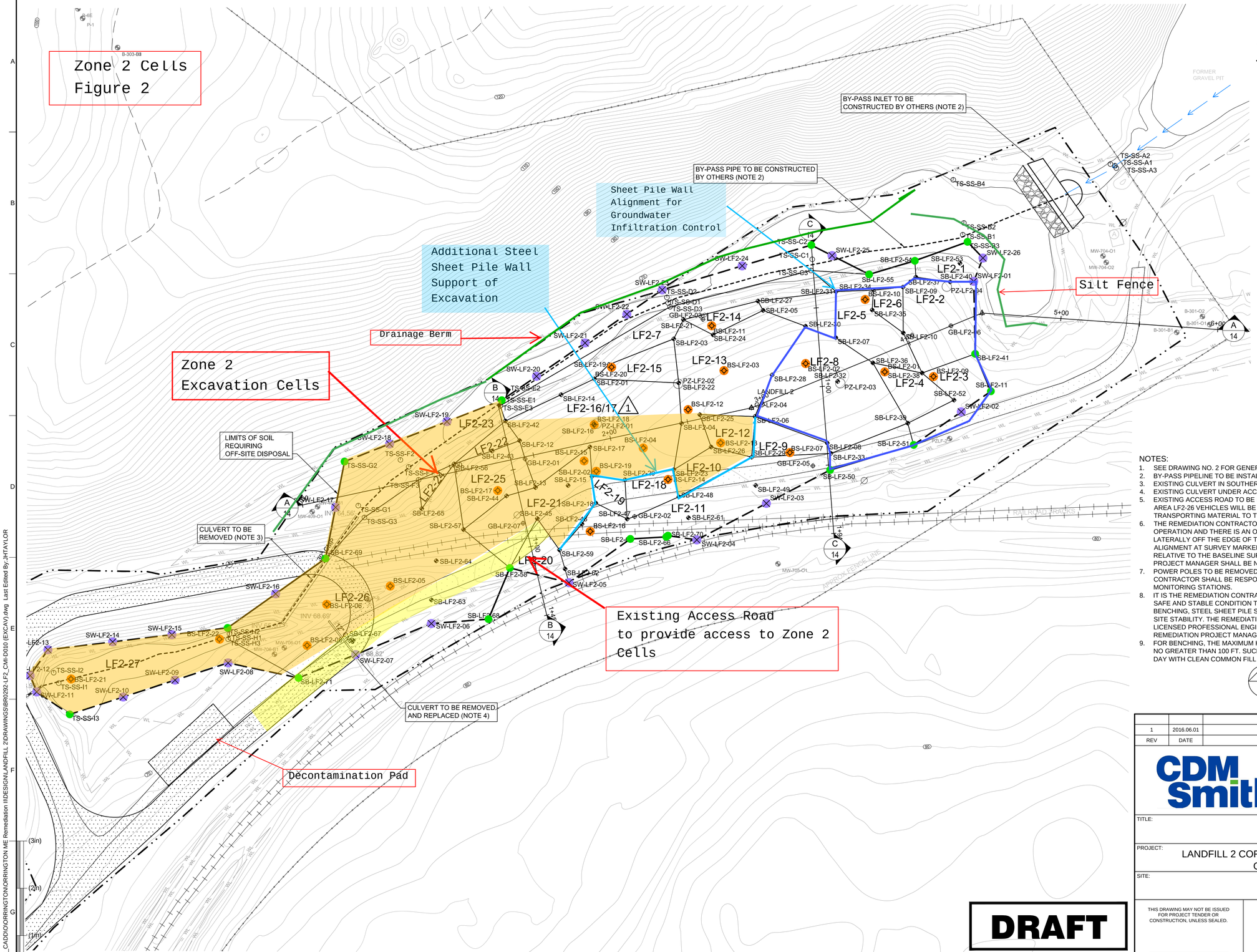

LEGEND

- LF2-1 — PROPOSED EXCAVATION AREA IDENTIFICATION / BOUNDARY
- PRELIMINARY EXCAVATION BOUNDARY, DEPENDENT ON FINAL CONFIRMATION SAMPLE
- EXCAVATION BOUNDARY
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NOTES:

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N

0 30' 60'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP
1	2016.06.01	EXCAVATION PLAN REVISIONS	JHT	CMG

CDM Smith

Geosyntec consultants

TITLE: EXCAVATION PLAN

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

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APPROVED BY:	SML		10 OF 18

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CMI PLAN REV 1

SCALE IS BASED ON 22" X 34" NON-REDUCED SHEET SIZE (BORDER = 21" X 32")

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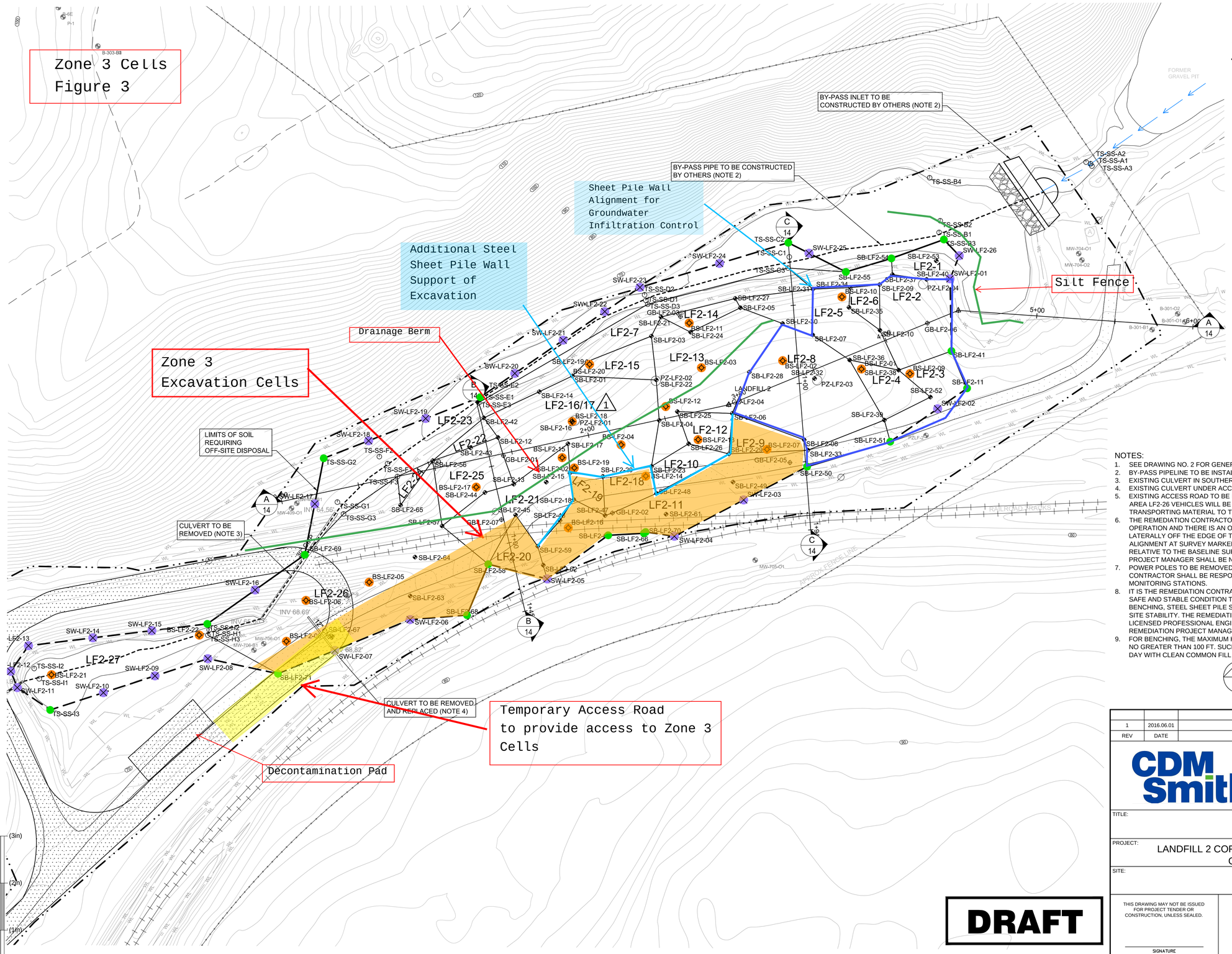

LEGEND

- LF2-1 — PROPOSED EXCAVATION AREA IDENTIFICATION / BOUNDARY
- PRELIMINARY EXCAVATION BOUNDARY, DEPENDENT ON FINAL CONFIRMATION SAMPLE
- EXCAVATION BOUNDARY
- MONITORING POINT

NOTES:

1. SEE DRAWING NO. 2 FOR GENERAL NOTES AND LEGEND.
2. BY-PASS PIPELINE TO BE INSTALLED AS PART OF SCRAP METAL YARD CMI PLAN.
3. EXISTING CULVERT IN SOUTHERLY STREAM TO BE REMOVED AND NOT REPLACED.
4. EXISTING CULVERT UNDER ACCESS ROAD TO BE REMOVED AND REPLACED.
5. EXISTING ACCESS ROAD TO BE REMOVED AS REQUIRED DURING EXCAVATION. WHEN REMOVING EXCAVATION AREA LF2-26 VEHICLES WILL BE REQUIRED TO BACK IN FOR LOADING AND DECONTAMINATION PRIOR TO TRANSPORTING MATERIAL TO TEMPORARY SOIL STOCKPILE AREA.
6. THE REMEDIATION CONTRACTOR SHALL PERFORM DAILY SURVEYS OF THE RAILROAD LINES WHEN THEY ARE IN OPERATION AND THERE IS AN OPEN EXCAVATION WITHIN 5 HORIZONTAL TO 1 VERTICAL PROJECTION LATERALLY OFF THE EDGE OF TRACKS. SURVEYING SHALL BE PERFORMED EVERY 25 FT ALONG THE RAILROAD ALIGNMENT AT SURVEY MARKERS INDICATED. IF GREATER THAN 1/8-IN OF LATERAL MOVEMENT IS OBSERVED RELATIVE TO THE BASELINE SURVEY, NEARBY EXCAVATION WORK SHALL BE STOPPED AND THE REMEDIATION PROJECT MANAGER SHALL BE NOTIFIED.
7. POWER POLES TO BE REMOVED AND REPLACED AS REQUIRED TO SUPPORT EXCAVATION. REMEDIATION CONTRACTOR SHALL BE RESPONSIBLE FOR SUPPLYING AND MAINTAINING POWER TO PERIMETER AIR MONITORING STATIONS.
8. IT IS THE REMEDIATION CONTRACTOR'S RESPONSIBILITY TO MAINTAIN ALL SITE SLOPES AND EXCAVATIONS IN A SAFE AND STABLE CONDITION THROUGHOUT CONSTRUCTION. THE REMEDIATION CONTRACTOR MAY USE BENCHING, STEEL SHEET PILE SHORING, TRENCH BOX SHORING, OR OTHER SUITABLE METHODS TO ACHIEVE SITE STABILITY. THE REMEDIATION CONTRACTOR SHALL SUBMIT A SHORING DESIGN SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF MAINE AND AN INSTALLATION PLAN TO THE REMEDIATION PROJECT MANAGER FOR REVIEW AND APPROVAL PRIOR TO COMMENCING THE WORK.
9. FOR BENCHING, THE MAXIMUM HEIGHT OF A BENCH SHALL BE 4 FT AND THE LENGTH OF THE BENCH SHALL BE NO GREATER THAN 100 FT. SUCH VERTICAL BENCHES SHALL BE BUTTRESSED PRIOR TO THE END OF THE WORK DAY WITH CLEAN COMMON FILL SLOPED AT 2 HORIZONTAL: 1 VERTICAL.

N

0 30' 60'
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP
1	2016.06.01	EXCAVATION PLAN REVISIONS	JHT	CMG

CDM Smith

Geosyntec consultants

TITLE: EXCAVATION PLAN

PROJECT: LANDFILL 2 CORRECTIVE MEASURES IMPLEMENTATION PLAN
ORRINGTON REMEDIATION SITE

SITE: ORRINGTON, MAINE

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	JSE	DATE:	FEBRUARY 2016
DRAWN BY:	JHT	PROJECT NO.:	BR0292
CHECKED BY:	ZBT	FILE:	
REVIEWED BY:	DTD/CMG	DRAWING NO.:	
APPROVED BY:	SML	10 OF 18	

DRAFT

CMI PLAN REV 1

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ATTACHMENT F

Revised Specifications

SECTION 02220
ACCESS ROADS

PART 1 – GENERAL

1.01 SCOPE

A. This Section covers the construction of the Access Roads including placement of Geotextile, and Dense Graded Gravel as shown on the Drawings.

1.02 RELATED SECTIONS

A. Section 01200 – Health and Safety

B. Section 01300 – Submittals

C. Section 02100 – Surveying

D. Section 02120 – Erosion and Sedimentation Control

E. Section 02130 – Clearing, Grubbing, and Stripping

F. Section 02200 – Earthwork

G. Section 02710 – Geotextile

1.03 REFERENCES

A. Latest version of American Society for Testing and Materials (ASTM) standards:

1. ASTM C 535 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
2. ASTM D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
3. ASTM D 6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

B. Maine Department of Transportation (MDOT) Standard Specifications

C. Construction Quality Assurance (CQA) Plan submitted as Appendix H of the Landfill 2 CMI Plan dated January 2016

1.04 SUBMITTALS

A. At least 20 days prior to the start of access road construction, the Remediation Contractor shall submit the following items for each soil/aggregate type proposed for use to the Remediation Project Manager:

1. the location of the proposed soil material source(s);
2. one 50-lb sample of the soil material from each proposed source; and
3. a submittal including the test results for those tests specified in Section 02200.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. Construction of the access road components of the project will be monitored by the Remediation Project Manager as outlined in the CQA Plan.

B. The Remediation Contractor shall be aware of the activities set forth in the CQA Plan and shall account for these activities in the construction schedule.

C. The Remediation Contractor shall assist the Remediation Project Manager in every manner necessary for the proper performance of activities set forth in the CQA plan.

D. CQA testing or inspections performed by the Remediation Project Manager in no manner relieves the Remediation Contractor of the responsibility to construct all work to conform the Drawings and the project Specifications.

E. If quality control or quality assurance tests indicate work does not meet specified requirements, the Remediation Contractor shall remove work, replace, and retest at a cost borne solely by the Remediation Contractor.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Dense Graded Road Base material shall meet the requirements specified in Section 02200.

B. Structural Fill shall meet the requirements specified in Section 02200.

C. Topsoil to be installed on adjacent areas disturbed during access road construction shall meet the requirements of the Topsoil specified in Section 02200.

2.02 EQUIPMENT

A. The Remediation Contractor shall furnish, operate, and maintain grading equipment as necessary to produce uniform layers, sections, and smoothness of grade for compaction and drainage.

B. The Remediation Contractor shall furnish, operate, and maintain compaction equipment required for the work.

C. The Remediation Contractor shall furnish, operate, and maintain tank trucks, pressure distributors, or other equipment designed to apply water uniformly and in controlled quantities to variable surface widths as needed to perform the work.

PART 3 – EXECUTION

3.01 EROSION AND SEDIMENT CONTROL

A. Prior to implementing any of the work described in this Section, the Remediation Contractor shall install all erosion and sediment controls as described in Section 02120, in the relevant area(s) of construction.

3.02 PREPARATION OF SUBGRADE

A. The Access Road alignment shall be cleared, grubbed, and stripped of topsoil as specified in Section 02130.

B. Existing subgrade shall be compacted with a minimum of two passes of a soil compactor, vibratory roller or other compaction method approved by the Remediation Project Manager. Unstable areas and areas requiring additional compaction, as identified by and at the sole discretion of the Remediation Project Manager, shall be corrected by the Remediation Contractor at a cost born solely by the Remediation Contractor.

3.03 PLACEMENT OF STRUCTURAL FILL

A. Structural fill shall be placed on the existing subgrade, as needed, to achieve the maximum road slopes of 8%.

B. Structural fill shall be placed with sideslopes no steeper than 2 Horizontal: 1 Vertical.

C. Structural fill shall be placed and compacted with completed lifts no thicker than 12 inches. Structural fill shall be spread, shaped, and compacted the same day it is placed.

D. Structural fill shall be compacted to a minimum dry density of 95% with a corresponding water content of +/- ~~1~~3% of the standard proctor value.

3.04 GEOTEXTILE INSTALLATION

A. Geotextile shall be installed as shown in the Drawings and specified in Section 02710.

3.05 PLACEMENT OF DENSE GRADED GRAVEL INSTALLATION

A. Dense Graded Gravel shall be placed and compacted to thicknesses shown on the drawings in completed lifts up to 12 inches thick. The road base shall be spread, shaped, and compacted the same day it is placed.

B. Dense Graded Gravel shall be compacted to a minimum dry density of 95% with a corresponding water content +/- 1% of the standard proctor value.

C. Unstable areas and areas requiring additional compaction, as identified by and at the sole discretion of the Remediation Project Manager, shall be corrected by the Remediation Contractor at a cost borne solely by the Remediation Contractor.

3.06 SURVEYING

A. All surveying shall be performed in accordance with Section 02100.

3.07 PROTECTION OF WORK

A. The Remediation Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. The Remediation Contractor shall maintain the access roads throughout construction where ruts or appear. Access roads with ruts or undulations deeper than 3 inches shall be repaired by regrading, resurfacing, recompacting, or other means approved by the Remediation Project Manager.

C. In the event of damage to the work of this Section or all other Sections of the project Specifications, the Remediation Contractor shall immediately make all repairs and replacements necessary at a cost borne solely by the Remediation Contractor.

END OF SECTION

SECTION 13020
EXCAVATION AND SOIL HANDLING

PART 1 – GENERAL

1.01 SCOPE

A. This Section covers, but is not limited to, excavation of soils exceeding the media protection standards (MPS) in the Landfill 2 Area

B. The work shall include, but is not necessarily limited to: temporary stockpiling of soils within the excavation area; transport of soils to the Temporary Soil Stockpile Area; and direct loading of material into rail cars. Materials stockpiled in the Temporary Soil Stockpile Area will be managed and loaded into rail cars by the Remediation Project Manager.

C. Design, construct, and maintain temporary excavation support structures as required to complete the excavations in the dry and in a controlled safe manner.

D. Excavate to the lines and grades shown on the Drawings without over-excavation per the limits defined in Part 3.04 of this Section.

E. All excavation, trenching, sheeting, bracing, etc. shall comply with the requirements of OSHA excavation safety standards (29 CFR PART 1926 Subpart P).

F. The Remediation Contractor shall furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals necessary to complete the work specified herein and indicated on the Drawings.

1.02 RELATED SECTIONS

A. Section 01200 – Health and Safety

B. Section 02050 – Air Monitoring

C. Section 02100 – Surveying

D. Section 02120 – Erosion and Sedimentation Control

E. Section 02130 – Clearing, Grubbing, and Stripping

F. Section 02140 – Construction Water Management

G. Section 02200 – Earthwork

H. Section 02920 – Revegetation

I. Section 13030 – Steel Sheet Pile Shoring

1.03 REFERENCES

A. Maine Department of Transportation (Maine DOT) Standard Specifications

B. United States Environmental Protection Agency (USEPA) Publication SW-846, “Test Methods for Evaluating Solid Waste Physical/Chemical Methods”

C. USEPA Test Method 9095B, “Paint Filter Liquids Test”

D. Construction Quality Assurance (CQA) Plan submitted as Appendix H of the Landfill 2 Area CMI Plan dated January 2016

E. 29 Code of Federal Regulations (CFR) Part 1926 Subpart P – Safety and Health Regulations for Construction / Excavation

F. 29 CFR Part 1926 Subpart C – Safety and Health Regulations for Construction / General Safety and Health Provisions

G. Soil Use Plan submitted as Appendix J of the Landfill 2 Area CMI Plan dated January 2016

1.04 SUBMITTALS

A. The Remediation Contractor shall submit required plans outlined in the scope of work to the Remediation Project Manager within the required timeframes outlined in the scope of work. Plans shall describe the Remediation Contractor's specific means and methods for obtaining access to the designated areas, surface and groundwater control (including pre-treatment and storage requirements), excavating, relocating excavated materials, direct loading of material into rail cars, and decontamination procedures for all vehicles and equipment associated with this work.

1.05 CONSTRUCTION QUALITY ASSURANCE

A. Contaminated soil, debris, and sediment excavation and relocation activities will be monitored by the Remediation Project Manager as outlined in the CQA Plan and project Specifications.

B. The Remediation Contractor shall be aware of the activities set forth in the CQA Plan and shall account for these activities in the construction schedule.

C. The Remediation Contractor shall assist the Remediation Project Manager in every manner necessary for the proper performance of CQA activities set forth in the CQA Plan.

D. CQA testing or inspections performed by the Remediation Project Manager in no manner relieves the Remediation Contractor of the responsibility to construct all work to conform to the Contract Documents.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Backfill materials shall meet the requirements set forth in the Section 02200.

2.02 EQUIPMENT

A. The Remediation Contractor shall furnish all tools, transportation, installation equipment, and incidentals necessary to complete the work specified herein and indicated on the Drawings.

PART 3 – EXECUTION

3.01 EROSION AND SEDIMENT CONTROL

A. Prior to implementing any of the work described in this Section, the Remediation Contractor shall install all erosion and sediment control measures in the relevant area(s) of construction.

B. Standard details and requirements representing the minimum erosion and sediment control standards that shall be met by the Remediation Contractor during construction are provided on the Drawings and in Section 02120. However, regardless of any minimum standards, the Remediation Contractor is solely responsible for implementing, and maintaining proper and fully adequate erosion and sediment controls at all times.

3.02 PREPARATION

A. Temporary dewatering and drainage systems for Contact and Non-Contact storm water removal shall be in place in accordance with Section 02140 prior to excavation.

B. The Site shall be cleared, stripped, and grubbed in accordance with Section 02130.

C. Prior to implementing any of the work described in this Section, the Remediation Contractor shall install all erosion and sediment controls in the relevant area(s) of construction.

D. Construct access/haul roads, as necessary, to get the excavated soil to a soil stockpile and/or load out area.

3.03 LAYOUT

A. General

1. Areas intended for excavation shall be staked by the Remediation Contractor at the soil boring locations indicated on the excavation plans in the Drawings.

2. Locations of the stakes shall be made using surveying instruments and located in reference to established Site survey controls.

3. The Remediation Project Manager reserves the right to make adjustments or revisions in lines or grades, should these be necessary as the work progresses due to: unexpected Site conditions; discrepancies on the Drawings; or in order to obtain satisfactory construction scheduling and/or conditions.

3.04 EXCAVATION

A. General

1. The Remediation Contractor shall perform all excavation, removal and backfilling activities in conformance with the Drawings and the Site-Specific Health and Safety Plan (HASP).

2. During excavation the Remediation Contractor shall:

   a. Establish and maintain appropriate exclusion zones.

b. Minimize personnel exposure by keeping non-essential personnel away from the area and upwind from the excavation site.

c. Perform all excavation, removal, and backfilling activities in a manner as required to allow for completion of the Work as specified in the Drawings.

d. Continually have a Competent Person as defined by 29 CFR 1926.32 (f) observe the excavation area for the signs of stability issues, potential contaminants, debris and potential hazards.

e. Perform work and employ mitigation measures in a manner to ensure that the perimeter air quality achieves the requirements in Section 02050. The Remediation Contractor shall be prepared at all times to immediately employ mitigations measures specified within Section 02050 for the Air Quality Action Levels (Level Green, Yellow or Red). The application of mitigation measures may need to be concurrent with ongoing excavation work to maintain air quality. Additionally, the Remediation Contractor shall anticipate that excavation and soil handling work may have to be curtailed, delayed, or rescheduled until more favorable weather conditions (lower temperatures, lower humidity, wind direction shift, etc.) exist that enable work to proceed within the specified Air Quality Action Levels at a cost solely borne by the Remediation Contractor.

f. The Remediation Contractor shall design excavation sloping and shoring systems for each excavation area per local, state, and federal regulations.

g. Perform excavations in a manner to minimize storm water inflow into excavation areas. Where necessary, the Remediation Contractor shall employ the use of sandbags and/or create diversion swales to redirect storm water flow away from excavations. Sheet piles may extend above the adjacent exterior ground surface to prevent runoff from entering excavations.

h. At all times during construction, the Remediation Contractor shall provide and maintain proper equipment and facilities to remove all water entering the excavation area so as to obtain and maintain satisfactory working conditions.

i. The Remediation Contractor shall be responsible for maintaining the water level in the excavation area at least 1 foot below the excavation surface as determined at the sole discretion of the Remediation Project Manager.

3. Materials posed for re-use as backfill shall be stockpiled on clean, bare ground or as directed by the Remediation Project Manager. Re-used material shall be used as in accordance with the Soil Use Plan.

4. Temporary soil stockpiles (materials for reuse) shall be constructed in such a way as to be stable against collapse and provide for infiltration of drainage water and runoff into the surrounding soil. Stockpiles shall be equipped with perimeter and surficial erosion control measures as presented in the Construction Documents and as required by, local, state and federal regulations.

5. Temporary soil stockpiles (contaminated materials for disposal) shall be constructed in such a way as to be stable against collapse and provide measures for shedding or

collecting stormwater runoff. Stockpiles shall be equipped with perimeter and surficial erosion control measures as presented in the Construction Documents and as required by, local, state and federal regulations. Temporary stockpiles shall not be located in areas already excavated.

6. Soils being excavated shall be visually inspected for the presence of elemental mercury or drum carcasses. If any elemental mercury or drum carcasses are observed during excavation or handling, the Remediation Project Manager shall be notified immediately, and the materials segregated and handled as follows:

    a. Excavated soils visually observed to contain elemental mercury or soils excavated from areas delineated on the Drawings to contain elemental mercury shall be stockpiled separately from other soils exceeding 2.2 mg/kg mercury for disposal purposes.

7. Upon completion of each day's excavation or completion of each subarea, the excavated area shall be measured and recorded by the Surveyor for development of As-Built Drawings and volume measurements.

8. The Remediation Contractor shall coordinate the submission of as-built survey information with the Remediation Project Manager for review and confirmation of final excavation bottom elevations prior to any placement of backfill. The Remediation Contractor shall notify the Remediation Project Manager at least one full working day prior to work of backfilling in an area or subarea.

B. Excavation and Backfilling

1. Excavate and backfill areas to the lines and grades as shown on the Drawings.

    a. Soils with mercury concentrations of less than 2.2 mg/kg of mercury are to remain on-site for reuse and shall be stockpiled in locations approved by the Remediation Project Manager.

    b. Excavated soils with mercury concentrations of 2.2 mg/kg or greater will be transported for direct loading into gondola cars or to the Temporary Soil Stockpile Area for offsite disposal or loading into disposal trucks. The Remediation Contractor shall prevent contamination of previously excavated areas in the Landfill 2 Area when transporting material to the Temporary Soil Stockpile Area.

    c. The Remediation Contractor shall avoid dropping clumps of contaminated soil and/or debris from the haul trucks when travelling between the excavation areas and temporary storage areas. Material spilled during movement shall be immediately collected and transported to the appropriate storage area.

2. The Remediation Contractor shall excavate and manage excavated soils on site such that they shall meet the Paint Filter Liquids Test (USEPA Test Method 9095B) at the disposal site without loss of liquids in transit. Remediation Contractor shall generally maintain excavation areas with sheet piling where necessary, dewatering, and/or staging such that excavated materials meet the paint filter liquids test prior to removal from the excavation area.

3. The intent of the work is to excavate the subareas shown on the Drawings without over-excavation. The Remediation Contractor shall execute the work to minimize over-excavation beyond the limits shown on the drawings. The Remediation Contractor shall execute the excavations in a manner that shall assure that the surveyed bottoms of the excavations shall be at the excavation bottom elevations shown on the drawings or lower, and within the vertical excavation tolerances presented in Section 02100.

4. The Remediation Contractor may install temporary shoring or cut slopes of the excavation subareas such that the total quantity excavated does not exceed the quantity shown on the Drawings.

5. The excavation horizontal limits (defined as the edge of cut soil face or innermost exposed sheet pile face) shall be between the horizontal coordinates shown on the Drawings within the tolerances presented in Section 02100. The Remediation Contractor shall determine if using a template for the sheet pile installation will be required to achieve this accuracy.

6. Backfill the Landfill 2 Area with Common Fill Type I per Section 02200 and the last 6 inches shall be backfilled with Topsoil (as detailed in Section 02200) material as shown on the Drawings.

3.05 HANDLING OF WASTE FOR LOAD OUT AND TRANSPORT

A. Off-site transport and disposal shall be performed by the Remediation Project Manager's transportation and disposal subcontractor. The Remediation Contractor is responsible for the handling and pretreatment of waste materials (i.e., dewatering and loading) for off-site disposal.

B. Soils to be removed from the Site shall be direct loaded by the Remediation Contractor into containers provided by the transportation and disposal subcontractor, as permitted by the appropriate local, state and federal authorities, and as required by the operations of the approved disposal facility.

C. Each container load shall be shipped with its own specific Chain of Custody Form which shall accompany the container from the time that it is loaded, en-route to its destination and when it arrives and is accepted by the receiving facility for disposal. The Remediation Project Manager will be acting as agent for the Owner and sign the Chain of Custody Form. The Remediation Contractor and the transportation and disposal subcontractor shall coordinate loading and shipping each container with the Remediation Project Manager to ensure that each container is shipped with a Chain of Custody.

D. The Remediation Contractor shall ensure that free water is removed from waste materials prior to transport. Solidifying agents (i.e. lime, Portland cement, etc.) shall not be added to the material prior to off-site disposal unless approved by the Remediation Project Manager.

E. The Remediation Project Manager will manage the container interior liner and/or tarp covering system while on site to ensure the liners are in place prior to loading and that each container is properly covered with the supplied tarp or other cover system to secure

the contents of the container during transport. The Remediation Project Manager will supply the tarps.

F. The Remediation Project Manager will provide labor required for maintaining and operating scales to weigh each loaded gondola or truck prior to exiting the Site. The scales will be provided by the Remediation Project Manager.

G. The Remediation Contractor shall load containers arriving at the Site so that waste materials are removed from the Site in an approved manner as quickly as possible, taking account of project scheduling restraints, on-site temporary storage capacity. The Remediation Contractor shall be responsible for having at least 750 tons per day of stockpiled soil ready for transport at the start of each Work Day morning. The containers shall be loaded within two hours of the scheduled load time determined by the Remediation Project Manager. If a scheduled intermodal is not loaded within the 2 hour time period, the Remediation Contractor will be responsible for demurrage charge.

H. If rail cars are not available for direct loading the Remediation Project Manager will direct the Remediation Contractor to place the material in the Temporary Soil Stockpile Area. The Remediation Project Manager will be responsible for managing soils within the Temporary Soil Stockpile Area and loading material from the Temporary Soil Stockpile Area into the rail cars.

3.06 DECONTAMINATION

A. All equipment and materials used during excavation and handling of the site materials with greater than 2.2 mg/kg mercury shall be decontaminated per Section and other Contract Documents prior to leaving the site or used in work in non-contaminated areas or other areas with less than or equal to 2.2 mg/kg mercury contamination on the Site.

3.07 SURVEYING

A. The Remediation Contractor shall coordinate as-built survey of the excavation extents with the Surveyor. All surveying shall be performed in accordance with Section 02100.

3.08 DEFORMATION MONITORING

A. The Remediation Contractor shall install a railroad track monitoring system attached to the rail and/or ties as indicated on the Drawings.

B. The railroad track monitoring system shall be surveyed daily basis and results documented in a daily report.

C. Prior to beginning excavation work the Remediation Contractor shall collect three (3) days of Baseline Values (BVs) for the railroad track monitoring system.

D. Threshold Values (TVs) are defined as “Warning” values for monitoring that if they are exceeded current work operations shall momentarily cease and corrective actions taken to reduce deflections, vibrations etc. to levels below the TVs.

1. Measured horizontal or vertical deformation of a railroad track monitoring point shall not exceed 0.125-inches of the established BVs.

2. The Remediation Project Manager shall be notified when the TVs have been exceeded and the Remediation Contrator shall indicate what corrective actions were taken to reduce the deflection, vibration, etc. to levels below the TVs.

E. Limit Values (LVs) are defined as "**Stop Work**" values for monitoring that if they are exceeded, current work operations shall stop and corrective actions taken to reduce deflection, vibration, etc. to levels below the TVs. Additional measurement of nearby deformation monitoring points shall be performed by the Remediation Contractor to collect data required to access the extent of the movement and evaluate whether remedial work is required. Inspections of the railroad may also be required to evaluate whether LV exceedance has adversely impacted the railroad tracks. Based on experience gained during the course of the project and ongoing assessment of the behavior of the subsurface soil conditions with respect to the excavation operations, the Limit Values indicated herein may be adjusted as conditions dictate.

1. Measured horizontal or vertical deformation of a railroad track monitoring point shall not exceed 0.5-inches of the established BVs.

2. The Remediation Project Manager shall be notified immediately when the LVs have been exceeded and the Remediation Contractor shall indicate what corrective actions are to be taken to reduce the deflection, vibration, etc. to levels below the TVs.

3.09 PROTECTION OF WORK

A. The Remediation Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage to the work of this Section or all other Sections of the project Specifications, the Remediation Contractor shall immediately make all repairs and replacements necessary at a cost borne solely by the Remediation Contractor.

END OF SECTION

SECTION 13030
STEEL SHEET PILE SHORING

PART 1 – GENERAL

1.01 SCOPE

A. This Section covers the design and installation of temporary steel sheet pile shoring wall (shoring wall) for the purpose of earth retention within the excavation area for Landfill 2.

B. The work shall include, but is not necessarily limited to: design, construct, and maintain temporary excavation support structures as required to complete the excavation in a controlled safe manner.

C. The Remediation Contractor shall furnish all labor, materials, tools, supervision, transportation, installation equipment, and incidentals necessary to complete the work specified herein and indicated on the Drawings.

D. The Remediation Contractor shall provide the Remediation Project Manager with all required submittals two weeks prior to the start of work.

1.02 RELATED SECTIONS

A. Section 01001 – Definition of Terms

B. Section 01200 – Health and Safety

C. Section 01300 - Submittals

D. Section 02050 – Air Monitoring

E. Section 02100 – Surveying

F. Section 02120 – Erosion and Sediment Control

G. Section 02140 – Construction Water Management

H. Section 02200 – Earthwork

I. Section 13020 – Excavation and Soil Handling

1.03 REFERENCES

A. Maine Department of Transportation (Maine DOT) Standard Specifications

B. Construction Quality Assurance (CQA) Plan submitted as Appendix H of the Landfill 2 Area CMI Plan dated January 2016

C. 29 Code of Federal Regulations (CFR) Part 1926 Subpart P – Safety and Health Regulations for Construction / Excavation

D. 29 CFR Part 1926 Subpart C – Safety and Health Regulations for Construction / General Safety and Health Provisions

E. Drawings, entitled Landfill 2 Corrective Measures Implementation Plan, dated January 2016.

F. American Society for Testing and Materials (ASTM) standards:

1. ASTM A 36 Standard Specification for A36 Carbon Structural Steel
2. ASTM A 572 Standard Specification for A572 High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

1.04 SUBMITTALS

A. The Remediation Contractor shall submit a shoring wall design package to the Remediation Project Manager for review a minimum four weeks prior to the start of work. The design package shall include calculations including: geotechnical parameters for wall design, earth pressure diagrams, calculations for wall shear forces, bending moments, calculated wall deflection, and required embedment for all load cases. Provide computer output and/or hand calculations.

B. The Remediation Contractor shall submit the design shoring wall drawings (shoring wall drawings) to the Remediation Project Manager for review a minimum two weeks prior to the start of work. The shoring wall drawings shall include plan, elevation, and section views of the wall, with details to illustrate the work.

C. No work or ordering of materials for the shoring wall shall be done until the submittals have been approved.

1.05 EXISTING CONDITIONS

A. Prior to beginning work, the Remediation Contractor shall become familiar with the Site, including railway and utility locations. The Remediation Contractor is responsible for contacting a utility location service to verify the location of underground utilities before starting work.

B. The remediation Contractor shall review all available subsurface data as provided in the CMI Plan.

1.06 CONSTRUCTION QUALITY ASSURANCE

A. The Remediation Contractor shall be aware of the activities set forth in the CQA Plan for the Project and shall account for these activities in the construction schedule.

B. CQA testing or inspections performed by the Remediation Project Manager in no manner relieves the Remediation Contractor of the responsibility to construct all work to conform to the Contract Documents.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Backfill materials shall meet the requirements set forth in the Section 02200.

B. Steel sheet piles shall conform to ASTM A572 Grade 50 steel.

C. Steel plates and miscellaneous shapes shall be new, hot-rolled plates and shapes conforming to ASTM A36 and ASTM A572, as required by application.

D. Welding, if required, shall use E70XX electrodes.

2.02 EQUIPMENT

A. The Remediation Contractor shall furnish all tools, transportation, installation equipment, and incidentals necessary to complete the work specified herein and indicated on the shoring wall drawings.

PART 3 – DESIGN CRITERIA

3.01 GENERAL

A. The Remediation Contractor shall provide a design of the shoring wall, prepared and sealed by a professional engineer licensed to work in the state of Maine.

B. The shoring wall shall be constructed from interlocking steel sheet piles.

C. The design shall follow local, state, and federal regulations.

3.02 DESIGN LOADINGS REQUIREMENTS

A. The shoring wall shall be designed to resist maximum anticipated loadings calculated for the effects of earth pressures, water pressures, railway loading, and live load and dead loads from construction equipment or materials. Railway loading shall be Cooper E80 loading.

3.03 DESIGN CRITERIA

A. The design target factor of safety for global stability of the wall is 1.3. The target factor of safety for wall embedment is 1.5.

B. The maximum allowable lateral deflection of the wall is 0.5 inches for a shoring wall constructed along a railroad alignment. Remediation Contractor shall survey monitoring points throughout construction to confirm design.

C. The structural design for the sheet pile shall incorporate a FS value of 1.5 for allowable stresses in the sheet pile.

PART 4 – EXECUTION

4.01 PREPARATION

A. Temporary dewatering and drainage systems for Contact and Non-Contact storm water removal shall be in place in accordance with Section 02140 prior to excavation.

B. The Site shall be cleared, stripped, and grubbed in accordance with Section 02130.

C. Prior to implementing any of the work described in this Section, the Remediation Contractor shall install all erosion and sediment controls in the relevant area(s) of construction in accordance with Section 02120.

D. Construct access/haul roads, as necessary, for pile driving and other equipment and any necessary material or equipment storage areas.

4.02 LAYOUT

A. The shoring wall alignment shall be staked by the Remediation Contractor per the shoring wall drawings.

B. Locations of the stakes shall be made using surveying instruments and located in reference to established Site survey controls.

C. The Remediation Project Manager reserves the right to make adjustments or revisions in lines or grades, should these be necessary as the work progresses due to: unexpected Site conditions; discrepancies on the Drawings; or in order to obtain satisfactory construction scheduling and/or conditions.

4.03 SHORING WALL INSTALLATION

A. The shoring wall shall consist of continuous interlocking sheet piles driven in place. The sheet piles shall be placed at the locations shown on the shoring wall drawings and shall not deviate more than 1 ft along the horizontal alignment of the wall.

B. The sheet piles shall be embedded a minimum of 4 feet into the till layer as recommended in the stability analysis included as Appendix I-3 of the CMI Plan.

C. The sheet piles shall be advanced to the specified minimum tip elevation shown on the shoring wall drawings. The Remediation Contractor shall select a sheet pile section that satisfies all design criteria and does not become damaged during installation. The Remediation Contractor shall select a driving method and pile driving ancillary equipment consistent with the expected ground conditions at the site. The interlocks between adjacent sheet piles shall not be damaged. Equipment shall be used to permit the impact energy to be distributed over the tops of the sheet pile.

D. The Remediation Contractor shall provide any corrective measures for any wall that does not meet the tolerance requirements described in this specification. Any proposed corrective measures must be approved by the Remediation Project Manager in writing.

4.04 DECONTAMINATION

A. All equipment and materials used during construction of the shoring wall that may have come into contact with site materials with greater than 2.2 mg/kg mercury shall be decontaminated per Section and other Contract Documents prior to leaving the site or used in work in non-contaminated areas or other areas with less than or equal to 2.2 mg/kg mercury contamination on the Site.

4.05 SURVEYING

A. The Remediation Contractor shall coordinate as-built survey of the alignment of the shoring wall with the Surveyor. All surveying shall be performed in accordance with Section 02100.

B. For a shoring walls within 50 ft of a railroad, the Remediation Contractor shall install a vertical alignment of survey markers every 50 ft along the shoring wall alignment at the top of the wall to monitor displacements. The Remediation Contractor shall perform daily surveys of the survey markers. If the surveyed displacement of the shoring wall

equals or exceeds 0.5 inches at any survey markers, the Remediation Contractor shall stop all nearby excavation work and notify the Remediation Project Manager.

4.06 PROTECTION OF WORK

A. The Remediation Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage to the work of this Section or all other Sections of the project Specifications, the Remediation Contractor shall immediately make all repairs and replacements necessary at a cost borne solely by the Remediation Contractor.

END OF SECTION