

Terminal 117 Cleanup

Port of Seattle and City of Seattle

LONG-TERM MONITORING AND MAINTENANCE PLAN (LTMMP) PHASE 1: Sediment and Upland Cleanup

Lower Duwamish Waterway Superfund Site
Terminal 117 Early Action Area

October 8, 2012



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PREPARED BY:



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Acronyms and Abbreviations

BEHP	bis(2-ethylhexyl)phthalate
City	City of Seattle
COC	contaminant of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbons
dw	dry weight
EAA	Early Action Area
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
ft	feet
kg	kilogram
LDW	Lower Duwamish Waterway
LTMMMP	Long-Term Monitoring and Maintenance Plan
Marina	South Park Marina
mg	milligram
MLLW	mean lower low water
NAD 83	North American Datum of 1983 (horizontal datum)
NTCRA	non-time-critical removal action
oc	organic carbon normalized
PCB	polychlorinated biphenyl
Phase 1	Sediment and Upland Areas
Phase 2	Adjacent Streets and Yards Areas
Port	Port of Seattle
QAPP	Quality Assurance Project Plan
RACR	Removal Action Construction Report
RAO	remedial action objective
RvAL	removal action level
RvAO	removal action objective
Settlement	
Agreement	Administrative Settlement Agreement and Order on Consent
SOW	Statement of Work
T-117	Terminal 117
TEQ	toxicity equivalent
TPH	total petroleum hydrocarbons

1 Introduction and Background

The non-time-critical removal action (NTCRA) for the Terminal 117 (T-117) Sediment and Upland Area (Phase 1) will begin in summer 2013. This Draft Long-Term Monitoring and Maintenance Plan (LTMMP) describes the remedial objectives, approach, and means to confirm achievement of removal action objectives (RvAOs) and evaluate potential sediment recontamination in the Sediment and Upland Areas (Phase 1). It is in draft form and describes anticipated monitoring actions to be conducted by the Port of Seattle (Port). It also briefly describes anticipated actions to be conducted by the City of Seattle (City) to affect the protectiveness of Phase 1 area. A final LTMMP will be prepared within 60 days of U.S. Environmental Protection Agency (EPA) approval of the Removal Action Construction Report (RACR). A separate LTMMP will be issued by the City for the Adjacent Streets and Residential Yards Area (Phase 2).

The T-117 cleanup actions and the associated long-term monitoring and maintenance are being performed in accordance with the Administrative Settlement Agreement and Order on Consent Number CERCLA 10-2011-0089 (Settlement Agreement, including Statement of Work [SOW]; EPA 2011) as an NTCRA.

There are many outstanding issues that impact the content of this LTMMP such as the LDW site-wide monitoring program, the final T-117 site configuration, and the potential presence of a City stormwater outfall. As a result, submission of the Final LTMMP has been deferred until 60 days after EPA approval of the RACR. To capture discussions during the Draft LTMMP process, EPA comments that cannot yet be incorporated into this draft LTMMP and Port responses to those comments are included as Attachment A.

1.1 Project Organization and Personnel

The cleanup will be conducted in two separate but coordinated phases: the Sediment and Upland Areas cleanup (Phase 1) and the Adjacent Streets and Residential Yards Area cleanup (Phase 2). The Port is managing the work associated with the cleanup for the Phase 1 Sediment and Upland Areas while the City is managing work associated with the cleanup for the Phase 2 Adjacent Streets and Residential Yards Area. The EPA has lead responsibility for regulatory oversight. The Port or subcontractors will conduct monitoring and maintenance activities on the Sediment and Upland Areas.

1.2 Description of Removal Action

The scope of this NTCRA includes removal of approximately 8,100¹ cubic yards of sediment from the T-117 Sediment Area to a final elevation ranging from -2 feet mean lower low water (ft MLLW) near the bank to -13 ft MLLW near the South Park Marina (Marina).

¹ These design volumes include dredging or excavation to the design elevations. Additional dredging or excavation may occur if confirmations samples do not meet sediment or soil removal actions levels (RvALs). Additional excavation in the Upland may occur if the Contractor chooses to slope rather than shore excavations.

Upland soil (design volume of 38,000 cubic yards) will be excavated from the site, and the site will be backfilled to about +14 ft MLLW (site completion). Additional excavation, based on confirmation data, may occur to meet cleanup goals. This LTMMP addresses monitoring and maintenance associated with this site completion. There is the potential for the site to undergo restoration or some other construction project at a later time. If that occurs, a revised LTMMP will be developed and submitted to EPA. It will be specific to any unique monitoring or maintenance activities associated with that site configuration. Construction element detail is provided in the Design Report.

Additionally, this LTMMP will collect information that will inform the long-term monitoring objectives of the LDW, which will likely focus on determining progress toward meeting site-wide and area-wide human health remedial action objectives (RAOs), and on determining contributions to the LDW from upstream and lateral sources. Long-term sampling requirements for this site may be revised to help inform the evaluation of the larger cleanup, once the site-wide sampling requirements have been developed.

Because of these potential future adjustments, the LTMMP will remain as a draft document until finalization of the construction project. The Final LTMMP will be submitted 60 days after approval of the RACR.

1.3 Long-Term Monitoring Objectives

The goal of the NTCRA is to reduce the current and future exposure of ecological and human receptors to Contaminants of Concern (COCs). Post-removal conditions in the Phase 1 Sediment and Upland Areas will be monitored to ensure that RvALs have been met, there is compliance with ARARs, and the remedy is sufficiently protective of human health² and the environment. This LTMMP addresses the final site configuration, site uses, and potential redevelopment details. This LTMMP is designed to evaluate the effectiveness of source control measures put in place and to confirm achievement of performance standards.

In accordance with the Engineering Evaluation/Cost Analysis (EE/CA; Windward et al. 2010), elements addressed in this LTMMP include:

- Post-removal action conditions and groundwater monitoring
- Sediment removal area monitoring
- Requirements for future upland subsurface construction, defined as activities disturbing soil after the Phase 1 cleanup is completed, if needed
- Documentation and reporting.

² The removal action will meet these RAOs, with the exception of the RAO for human seafood consumption. Protective levels of some COCs, particularly polychlorinated biphenyls (PCBs), are well below background concentrations, so it will not be possible to completely eliminate any unacceptable risk from this pathway (EPA 2010).

2 Monitoring and Maintenance Plan

2.1 Elements Described in EE/CA

A final Engineering EE/CA was approved by EPA in 2010 (Windward et al. 2010). It described anticipated monitoring and maintenance activities for the NTCRA. The scope of the LTMMP was drafted for the EE/CA prior to the design of the Phase 1 and Phase 2 removal actions, and thus was broader than what's necessary for the Upland and Sediment Areas (Phase 1); therefore, this LTMMP does not follow the outline drafted in the EE/CA. Table 2-1 lists each EE/CA-specified LTMMP element, its relevance to Phase 1 of this NTCRA (as it is currently designed), and where to find more detail in this plan or why it is not included in this plan.

Table 2-1 Monitoring Elements Described in EE/CA and Applicability to this LTMMMP

Subject or Activity	Rationale	Relevance to this Phase 1 LTMMMP		
		Port activity addressed in this LTMMMP	Potential City activity affecting Phase 1, not detailed in this LTMMMP since scope not defined	Port LTMMMP element not required
Post Removal Action Conditions and Facilities				
Site features	Document final locations			Final site features will only include fencing for security purposes and backfill.
On site Stormwater drainage and treatment systems				Upland Area backfill will allow infiltration of precipitation, so no Port drainage infrastructure required.
Informational signage	Document locations and address maintenance			None required. Site will satisfy unrestricted land use criteria
Utility locations	Document final locations	Seattle City Light utility easement including a power pole guy wire anchor will remain as-is. The anchor will be relocated during construction, but may be placed back within the easement after construction is completed.		No Port utilities planned in Upland Area.
Stormwater (if installed by City)				
Stormwater monitoring	Ongoing assessment of recontamination potential		Potential permanent City drainage system across Upland Area to be negotiated with City and approved by EPA.	No stormwater generated from Upland Area; site backfill will allow infiltration, and infiltrated water will be monitored in shoreline groundwater wells.
Stormwater system maintenance	Preventative measure for recontamination, source control			
Stormwater treatment system operation				
Groundwater and Geotechnical Information				
Development of post-removal groundwater monitoring network	Necessary to conduct post-removal action groundwater monitoring and tidal study	Onsite shoreline wells		

Subject or Activity	Rationale	Relevance to this Phase 1 LTMMP		
		Port activity addressed in this LTMMP	Potential City activity affecting Phase 1, not detailed in this LTMMP since scope not defined	Port LTMMP element not required
Groundwater monitoring	Verify that post-removal groundwater RvALs are being met	Onsite shoreline wells		
Post-removal tidal study	To determine how the removal action alters groundwater flow, particularly at the south end of the Marina			Tidal influence on nearshore wells previously determined.
Sediment Removal Area Monitoring				
Sediment area reconnaissance	Performance monitoring of sediment backfill/cap areas, if necessary			Sediment Area not capped
Sediment sampling	Assessment of recontamination; identify process for corrective action if RvALs are exceeded	Surface sediment sampling		Surface sediment sampling may be required near permanent outfall, if it is installed.
Requirements for Upland Subsurface Construction¹				
Notifications prior to construction	To ensure that post-removal activities conducted as appropriate within the Upland Area	Post construction database will ID which data represent removed soil and which data represent what remains for use by Port construction staff.		
Construction restrictions	To ensure that drainage, backfill areas, and erosion control measures are not compromised			Site will satisfy unrestricted land use criteria so restrictions do not apply. Any additional import of soils in the future will need to comply with site RvALs.
Soil handling, disposal, and backfill procedures	To ensure safe handling and proper disposal			
Site restoration	To ensure future construction area(s) are properly restored			

Subject or Activity	Rationale	Relevance to this Phase 1 LTMMP		
		Port activity addressed in this LTMMP	Potential City activity affecting Phase 1, not detailed in this LTMMP since scope not defined	Port LTMMP element not required
Upland Area Inspections				
Performance of erosion control measures (pavements, backfill, planted areas)	Source control measure for preventing recontamination			Soil to be cleaned to unrestricted land use, and backfill will be clean; site will be graded and armored to prevent erosion. Any future maintenance performed will be conducted by the Port and outside of the requirements of this cleanup order.
Response Actions and Adaptive Management Strategies				
Groundwater	Identify process if post-removal data exceed applicable RvALs	Three newly installed nearshore wells		
Stormwater		Periodic visual inspections to confirm that precipitation is infiltrating	To be determined, if utility installed	
Upland areas	Identify process if post-removal data exceed applicable RvALs			No soil monitoring necessary because no impacted soil to remain onsite unless future site land use changes.
Sediment area		Nearshore sediment sampling locations		

Note: 1. Potential habitat construction coordination not identified in the EE/CA. Any future construction work will be described under a separate plan or in the Final LTMMP, which will lay out appropriate modifications to monitoring and maintenance activities. The final LTMMP will be submitted to EPA for approval within 60 days of EPA approval of the RACR.

2.2 Purpose of Monitoring

2.2.1 Sediment

Long-term chemical monitoring of the Sediment Area will be conducted to assess site integrity and potential recontamination. The Port will monitor chemical quality of the dredged/backfilled sediment near the shoreline to determine if recontamination is occurring and to ensure that RvALs are being met. Three nearshore surface sediment samples will be collected from the locations conceptually shown in Figures 2-1 and 2-2. However, per the EE/CA, preference will be given to areas where seeps develop. Alternatively, samples will be paired with Upland Area monitoring wells to provide a better understanding of the potential groundwater to sediment pathway. Figure 2-1 shows sample locations relevant to the interim site completion (grading to +14 ft MLLW). Figure 2-2 shows sample locations relevant to a potential restoration plan.

The Port will at a minimum collect additional subtidal sediment samples after the completion of the nearby EAA cleanup at Boeing/Jorgensen. The Port may also collect discretionary samples to assess any impacts from storm events or spills in the LDW. These will be determined on an as-needed basis, and will be discussed with EPA. Analytical parameters would likely include all LDW risk drivers, which are the Sediment Management Standard chemicals, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and dioxins/furans.

PLACEHOLDER: Additionally, an LDW-wide long-term monitoring plan will be established as part of the larger cleanup. Port monitoring of T-117 may be revised to complement the goals of that plan.

2.2.2 Upland Soil

The interim site completion includes backfilling of the Upland Area with granular material capable of infiltrating greater than a 100-year storm. The site will be graded such that any runoff that may occur will drain toward the center of the property and infiltrate. Therefore no site stormwater will be conveyed to the LDW. The Upland Area will be seeded with a low-maintenance seed mix (grasses and other herbaceous plants).

A guy wire supporting a City utility pole is currently anchored within the Upland Area. It is located within a Seattle City Light utility easement. It is expected that this anchor will be re-established following the removal and backfill completion.

Site completion is described in the Design Report (Section 4.12). The interim site completion includes:

- A 3:1 slope around the perimeter to match existing grades with a single access ramp

- A 2:1 to 2½:1 riprap armored slope at the bank
- A slightly sloping upland from +15 ft MLLW at the LDW toward Dallas Ave S to direct any stormwater that does not infiltrate
- The existing demarcation between the Upland Area and the Sediment Area (MHHW at 11.3 ft MLLW) will occur in the same location after site completion, such that all material considered soil will remain soil. That is, with this described site completion, no soil will become sediment.

This plan is written for the site completion described above, which is not expected to require any particular monitoring or maintenance beyond periodic inspections and general upkeep for aesthetics and security. Because the site is being cleaned to unrestricted site use, no activities or institutional controls relating to protecting a cap or restricting access are necessary. Any future site development/restoration or construction work (not associated with any Phase 1 cleanup activities) will be described under a separate plan, which will lay out appropriate monitoring and maintenance activities. The Port will work with EPA to determine if any future site work requires modification to the LTMMP, if so; those modifications will be submitted to EPA for approval.

2.2.3 Groundwater

Pre-cleanup groundwater monitoring was conducted from 2008 through 2012. A detailed description of the results of the pre-cleanup monitoring and the groundwater conceptual site model are presented in the Draft Annual Interim Groundwater Monitoring Report (Sealaska and CRETE 2012). This plan includes the groundwater monitoring for the post cleanup conditions. Results from the post cleanup will be compared to pre-cleanup conditions to confirm that groundwater monitoring objectives are being met.

Groundwater monitoring will be conducted by the Port to assess the success of the cleanup in reducing migration of contaminants in groundwater to sediments that may recontaminate the Sediment Area. New groundwater monitoring wells will be installed within the post-NTCRA Upland Area in order to monitor groundwater from the point of discharge to the Sediment Area (Figure 2-1). If a habitat restoration project occurs, in which the location of the shoreline moves landward, shoreline wells will be placed along that revised shoreline (Figure 2-2). The final locations of each monitoring well will be determined when the LTMMP is finalized.

If monitoring data from the new monitoring wells suggest the need to investigate upgradient groundwater, such as detections above RvAls, an appropriate plan will be submitted for EPA approval. Statistical analysis will be performed once the long term sampling is completed, to compare pre and post groundwater sampling results. Statistical methods will likely include the Mann-Kendall trend analysis, or similar.

2.2.4 Potential Permanent City Stormwater Outfall

PLACEHOLDER: The City is evaluating several options for stormwater management. Once the final plan is selected, this LTMMMP will be updated accordingly, if any infrastructure discharges to/near the T-117 Sediment Area.

2.3 Sampling Methodology

This section describes general sampling methods and the long-term monitoring schedule. Detailed information relating to sampling protocols, analytical methods, data validation, sample custody and handling, and laboratory quality assurance are provided in the Quality Assurance Project Plan (QAPP; Attachment B).

2.3.1 Monitoring Methods

2.3.1.1 Sediment

Nearshore sediment samples will be collected by hand (on foot) when the tide is low collected. Offshore sediment samples will be collected from a sampling vessel.

Samples will be collected with a decontaminated spoon, if collected above the tide, or with a Van Veen if collected from a boat, from the top 10 cm of the sediment surface and placed in laboratory-provided sample jars. Visual observations of the sediment, including grain size and the presence of debris or organic material, will be recorded in field forms.

The collected sample will be thoroughly homogenized and distributed to sample containers. Organisms and debris will be removed prior to distribution to sample containers; removed materials will be noted in the field forms.

Washington State Plane North (North American Datum of 1983; NAD 83) will be used for the horizontal datum, and MLLW will be used for the vertical datum. Nearshore sampling location coordinates will be identified using Computer Aided Drafting and will be marked with a stake during low tide by a surveyor to ensure that the same locations are re-occupied during each event.

Sediment samples collected by boat will be surveyed using a Trimble NT300D differential global positioning system (DGPS), or similar. The DGPS system will produce positioning accuracy to within 1 to 2 meters. The coordinates will then be processed in real time and stored at the time of sampling using the positioning data management software package HYPACK®, or similar. Vertical control will be provided by the ship's depth finder and corrected for tidal influence.

2.3.1.2 Groundwater

During the NTCRA, all Upland Area monitoring wells will be removed. Following site completion, three new wells will be installed along the shoreline and constructed in a similar manner to existing (pre-construction) site wells. It is assumed that post-NTCRA

shoreline groundwater elevations will be similar to those observed before construction because they are largely tidally influenced (Table 2-2). New wells will be constructed with a 3-ft vertical separation between the top of the well casing and the top of the screen. The post-NTCRA near shore ground surface elevation will be between +14 and +15 ft MLLW or above. Wells will be screened appropriately to span the range of groundwater fluctuation that occurs at each location.

Table 2-2 Shoreline Well Groundwater Level Fluctuations

Well	Water Level Elevation Range (ft MLLW)		
	Minimum	Maximum	Average Reported in EE/CA
MW-02	4.6	11.4	7.8
MW-05R	5.0	11.7	n/a
MW-07	3.2	11.8	7.6

Groundwater will be collected using low-flow sampling techniques during low tide events following similar protocols as those established for the pre-construction quarterly monitoring program (AECOM 2009, ENSR 2008).

Figure 2-2 presents potential locations where shoreline wells may be installed if an alternative site restoration is conducted. Figure 2-3 also shows the design excavation elevation coincident with the lithology that the newly installed shoreline monitoring wells will intercept after site completion. It also illustrates the range of groundwater elevations gauged from 2008 to 2011 in existing shoreline wells.

2.3.2 Laboratory Analysis

Groundwater samples will be analyzed for groundwater COCs: arsenic, silver, carcinogenic cPAHs, petroleum hydrocarbons (evaluated as total petroleum hydrocarbons [TPH]), bis(2-ethylhexyl)phthalate (BEHP), and polychlorinated biphenyls (PCBs).

Sediment samples will be analyzed for the following sediment COCs: arsenic, PAHs, phenol, PCBs, and dioxins/furans. TPH is not included for sediment because there is no applicable sediment criterion and because petroleum hydrocarbons are better addressed in sediments through analysis of PAHs. Sediment samples collected following Boeing/Jorgensen actions will be analyzed for the full suite of SMS chemicals.

Table 2-3 Analytes and RvALs

Parameter	Sediment RvAL	Groundwater RvAL
PCBs as Aroclors	12 mg/kg oc	0.01 µg/L
Arsenic	12 mg/kg dw	5 µg/L
Silver	n/a	1.9 µg/L
cPAHs	0.09 µg TEQ/kg dw	0.15 µg/L
Dioxins/Furans	13 ng TEQ/kg dw	n/a
PAHs	Range: 0.25 – 15 mg/kg oc	n/a
BEHP	n/a	1.7 µg/L
TPH (diesel and lube oil range)	n/a	500 µg/L
Total organic carbon	n/a	n/a
Grain size distribution	n/a	n/a
Total solids	n/a	n/a

Note: Other relevant sediment criteria may include the Washington Sediment Quality Standards and any LDW-wide remediation goals and/or removal action levels identified in the Record of Decision.

2.3.3 Sampling Schedule

Sediment samples will be at years 1, 3, and 5. Year 0 is defined as the completion of in-water work (February 2014), and this condition is represented by the chemical quality of the backfill material. Groundwater monitoring will be conducted quarterly during years 1 and 2. Sampling frequency may be revised based on changes to site conditions and sample results, upon approval by EPA.

Data will be compared to pre and post cleanup levels using statistical methods such as the Wilcoxon Rank-Sum Test which compares the median of the two populations. The actual statistical method will be selected based on the distribution of the actual groundwater results. Statistical methods will be discussed and approved by EPA prior to the analysis.

2.3.4 Quality Control and Quality Assurance Procedures

The overall data quality objective for this project is to develop and implement procedures that will ensure the collection of representative data of known, acceptable, and defensible quality. A separate QAPP (Attachment B) will describe quality control procedures.

2.3.5 Data Management

All data will be stored in the Port database. This database is maintained by the Port and includes all historical, post-construction, and LTMMP soil, sediment, and groundwater data. Additionally, the Port will upload data to Ecology's Environmental Information Management System.

2.4 Maintenance and Notifications

Following removal completion, the Upland Area will be backfilled with clean material capable of infiltrating precipitation from up to a 100-year storm. The site will be graded, such that any runoff would drain to the center of the site. The completed site has the capacity to infiltrate more than twice the flow of the design storm (50-year, 24-hour storm). No stormwater is expected to be generated from the Upland Area, and thus no discharge to the Sediment Area is anticipated. The Upland Area will be fenced on three sides. Other than general upkeep for security and aesthetics, no maintenance activities will be necessary.

The Port cleanup team is responsible for coordinating communication with other Port design teams, including the restoration design team. In addition, as part of internal construction coordination meetings, the Port cleanup team will provide construction teams with any soil data that characterize post-removal conditions (including historical data collected below the soil excavation prism, post-excavation confirmation sampling data, and backfill chemical quality data). Based on unrestricted site cleanup, it is not anticipated that any protective measures will be required by construction workers; rather, data is provided for information purposes only. Any maintenance performed on the site will be conducted outside the requirements of this cleanup order.

3 Potential Response Actions

Sediment recontamination could occur from groundwater migration from the upland, from deposition of upstream-source (Green/Duwamish River) or storm drain-source suspended solids, or from redeposition of nearby scoured bed sediments. For example, adjacent cleanup projects being conducted after the T-117 NTCRA could be sources. If RvAL exceedances are detected in sediment samples, data from the nearby monitoring wells will be reviewed to evaluate groundwater as a potential source of recontamination.

If an exceedance is detected in either a validated sediment or groundwater sample, EPA will be notified (prior to issuance of the data report), and the need for corrective actions or additional data collection will be assessed. Potential sources, and data that could help identify them, could include:

- Upland soil or groundwater: both sediment and shoreline groundwater data exceed criteria.
- Upstream-source deposited sediment: upstream sediment data have higher concentrations than downstream locations.
- Other LDW cleanup actions: concentrations are increasing in offshore sediment samples, but not in nearshore samples. Increasing concentrations in analytes other than T-117 COCs can also provide evidence.
- Atmospheric deposition: regional or local air deposition studies, such as those conducted by King County.

If a surface sediment exceedance is detected, all available data collected in the vicinity of the surface sediment exceedance will be reviewed. In addition to the paired shoreline data, these relevant data could include storm drain solids or whole water data from possible storm drain outfall(s), if included as an element of the City's planned drainage improvements for the adjacent residential streets, navigation channel suitability determination cores collected by the Army Corps, and sediment data collected within the LDW by any other parties.

4 Monitoring and Maintenance Documentation and Reporting

The Port will prepare reports documenting the results/findings of monitoring and maintenance activities, in accordance with the schedule in Table 4-1. The reports will provide detail of Port-led activities: shoreline well and sediment monitoring and any corrective actions, if needed. They may also summarize any activities conducted by other parties that have the potential to impact, or generate data relevant to, the Upland and Sediment Areas. These summaries will include particular consideration of recontamination potential. Sampling frequency may be revised based on changes to site condition; any revisions must be approved by EPA.

Annual reports will provide analytical data summaries and comparisons to T-117 RvALs or to any relevant LDW-wide remediation goals (as documented in the Record of Decision), laboratory reports, data validation reports, any deviations from the work plan, and any necessary corrective actions.

Table 4-1 Monitoring and Maintenance Reporting Schedule

Year	Sediment Sampling ¹	Quarterly Groundwater Sampling ¹	LTMMP Report ²
1 (2015)	X	X	X
2		X	X
3	X		X
4			
5	X		X

Notes:

1. Sampling frequency may be revised based on changes to site conditions or sample results; any revisions must be approved by EPA.
2. Report provided to EPA 60 days after receipt of final laboratory analytical reports.

4.1 Report Outline

Each report will generally follow this outline:

1. Introduction/Background
2. Activities Performed
 - a. Monitoring
 - i. Port Activities
 - ii. City Activities Potentially Affecting Upland and Sediment Areas
 - b. Maintenance Activities/Inspections
 - c.
 - d. Deviations from Work Plan
3. Data Collected
 - a. Observations from Inspections (if conducted)
 - b. Summary of Analytical Data Collected
 - c. Comparison of Data to Other Event Data
 - d. Comparison to RvALs or to Other Relevant Criteria
4. Next Steps
 - a. Corrective Actions
 - b. Next Monitoring/Maintenance Event

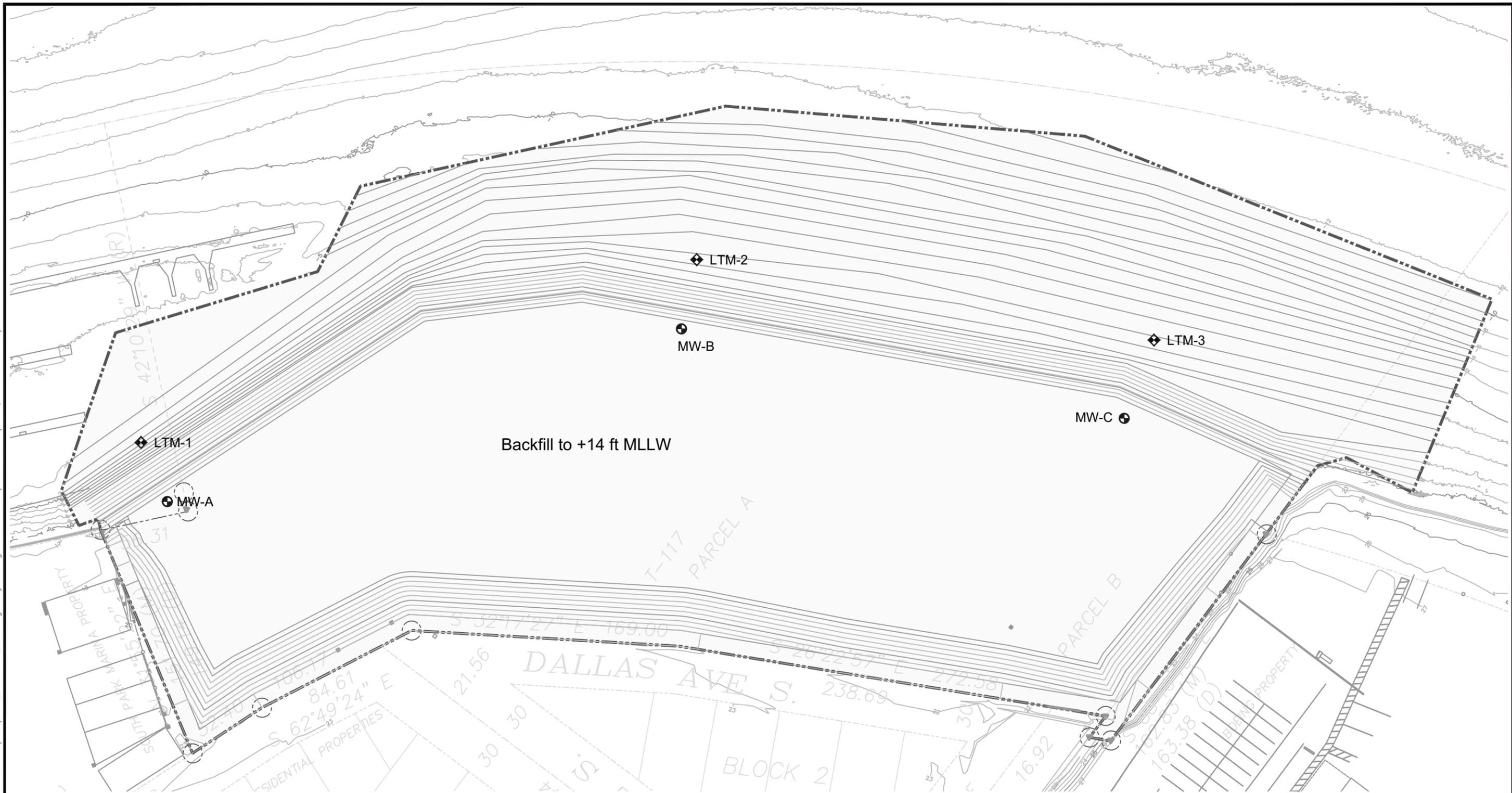
Appendices: Laboratory Reports, Validation Reports, Inspection Forms (if used).

5 References

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- Windward, AECOM, CRETE, Integral, DOF. 2010. Revised Engineering Evaluation/Cost Analysis Final. Prepared for the Port of Seattle and the City of Seattle. Windward Environmental LLC, Seattle, WA; AECOM, Seattle, WA; CRETE Consulting, Inc., Seattle, WA; Integral Consulting, Inc., Mercer Island, WA; and Dalton, Olmsted & Fuglevand, Inc., Seattle, WA. July, 2010.

Figures

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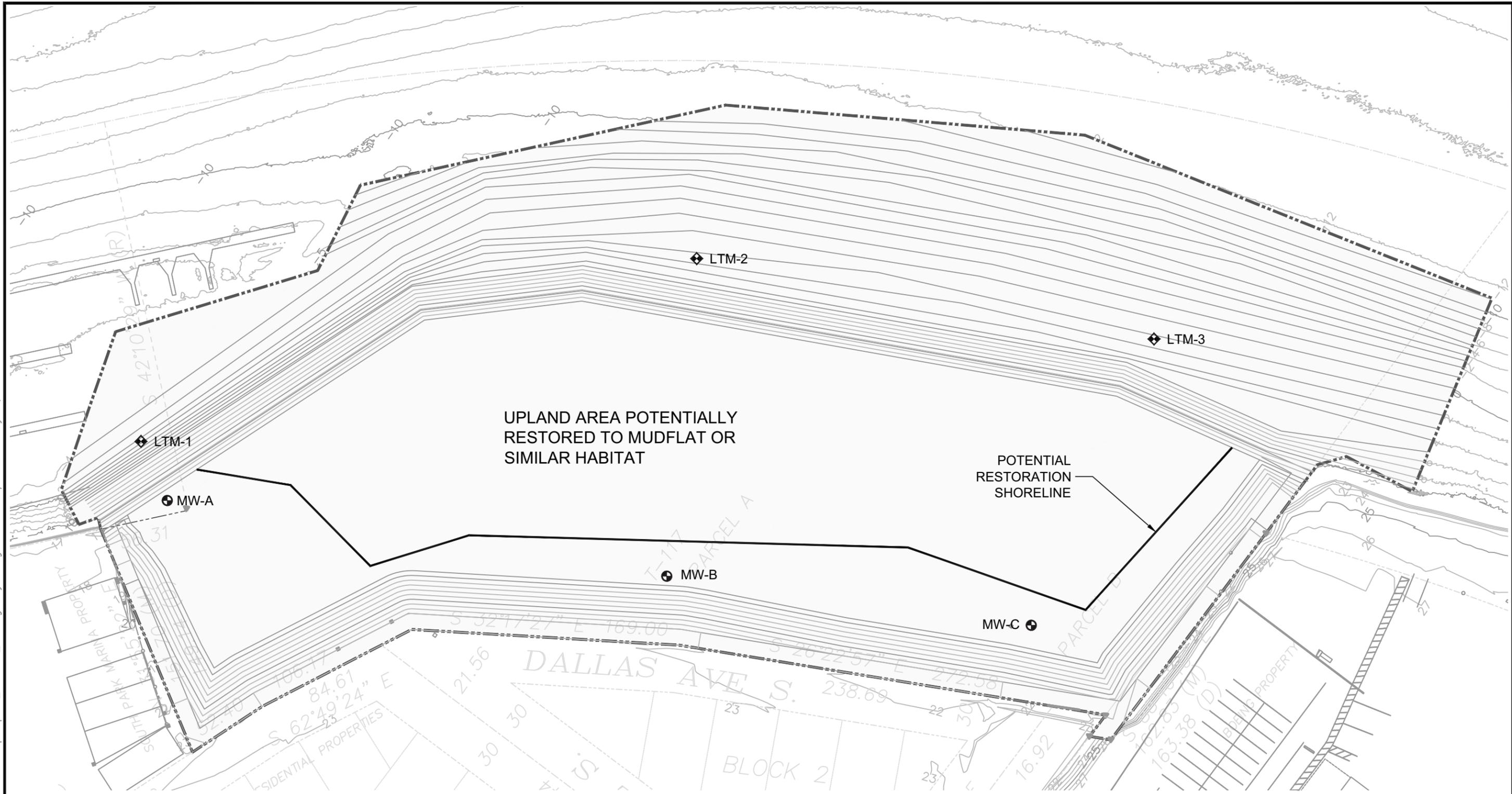
- LEGEND**
-  MW-A GROUNDWATER MONITORING LOCATION
 -  LTM-1 SURFACE SEDIMENT SAMPLE LOCATION
 -  BACKFILL ELEVATION CONTOUR (FT MLLW)
 -  T-117 EARLY ACTION AREA

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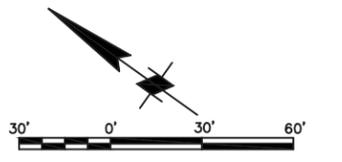
LONG-TERM MONITORING AND MAINTENANCE PLAN T-117 EARLY ACTION AREA		SEDIMENT AND GROUNDWATER MONITORING LOCATIONS - INTERIM COMPLETION
DATE: 4/18/2012	DRWN: BTS	FIGURE 2-1

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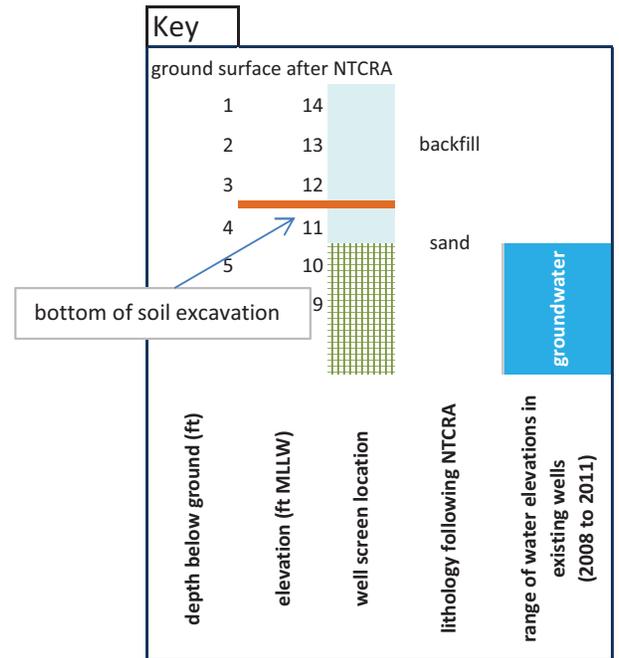
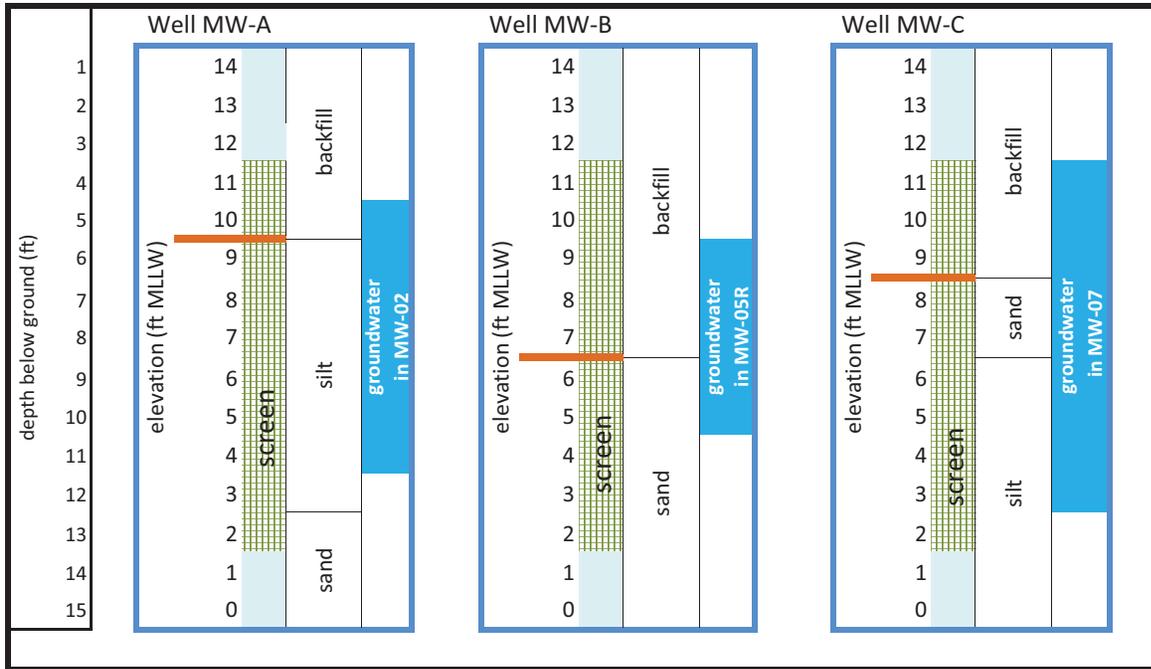
- LEGEND**
- ⊕ MW-A GROUNDWATER MONITORING LOCATION
 - ◆ LTM-1 SURFACE SEDIMENT SAMPLE LOCATION
 - BACKFILL ELEVATION CONTOUR (FT MLLW)
 - - - T-117 EARLY ACTION AREA

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LONG-TERM MONITORING AND MAINTENANCE PLAN T-117 EARLY ACTION AREA		CONCEPTUAL SEDIMENT AND GROUNDWATER MONITORING LOCATIONS - HABITAT COMPLETION
DATE: 4/18/2012	DRWN: BTS	FIGURE 2-2

Figure 2-3 Shoreline Monitoring Well Detail



Attachment A Draft LTMMMP Comments and Responses

Attachment A - EPA Comments on Draft LTMMMP

EPA and USACE Comments		Response Type:		Port Response	backcheck
General Comments		edited	need to discuss		
1		See Unresolved Comments			
2	Global: State PLACEHOLDER in areas where the text is as such, using a consistent format as what has been used in section 2.2.1.	x		Section 2.2.4 was formatted to match Section 2.2.1	
3	Restoration plans will likely impact monitoring and should be incorporated into the final LTMMMP		x	No revision made in Draft LTMMMP as this comment will be addressed in the Final LTMMMP. For reference, the following sections discuss modifications needed when final restoration plan is known. Restoration is mentioned in several sections of the LTMMMP. If restoration changes from what is assumed in the Final Design, the LTMMMP will be updated under EPA review. Section 1.2 has the following text: There is the potential for the site to undergo restoration or some other construction project at a later time. If that occurs, a revised LTMMMP will be developed and submitted to EPA. It will be specific to any unique monitoring or maintenance activities associated with that site configuration. Details on construction elements are provided in the Design Report. Section 2.2.2 has the following text: Any future site development/restoration or construction work (not associated with any Phase 1 cleanup activities) will be described under a separate plan, which will lay out appropriate monitoring and maintenance activities. The Port will work with EPA to determine if any future site work requires modification to the LTMMMP, if so; those modifications will be submitted to EPA for approval. Section 2.2.3 has the following text: If a habitat restoration project occurs, in which the location of the shoreline moves landward, shoreline wells will be placed along that revised shoreline (Figure 2-2). The final locations of each monitoring well will be determined when the LTMMMP is finalized.	ok - ensure that this comment is carried forward when finalizing the LTMMMP PORT: all outstanding LTMMMP comments have been included in Appendix A of the draft LTMMMP.
4	There are some word reversals in titles. The terms "Maintenance" and "Monitoring" are sometimes reversed in LTMMMP.	x		We did a global search for this in the August 20 clean version - did not find this. Updated Section 4.1 Report outline to discuss 'Monitoring' than 'Maintenance'. Checked other document references to the LTMMMP as well.	comment resolved
5	Note, if habitat restoration proceeds, remaining Uplands soils up to 0.65 mg/kg dw – or even higher, up to twice that RvAL for soils – that are left at the base of soil excavations and characterized by confirmation sampling may exceed the sediment RvAL for PCBs, depending on TOC. At TOCs between 0.5 and 4%, the OC-normalized values could readily exceed 12 mg/kg OC. This possibility should be understood. Additional costs imposed by such a circumstance may need to be part of the habitat restoration budget. See page 2-6		x	As discussed, we understand that this is a reminder for an issue that will be addressed as part of the restoration project. The evaluation of "what's left behind" in the context of the restoration project will be summarized in the RACR for use in the restoration project. No change was made to this document.	ok - ensure that this comment is carried forward when considering the restoration project PORT: all outstanding LTMMMP comments have been included in Appendix A of the draft LTMMMP.
Specific Comments Section					
6	2.2.3 Section 2.3.3 Select a statistical test to compare the pre- and post-cleanup GW data and confirm that the monitoring objective has been met for groundwater. The statistical test that was referenced in this revised document was Mann-Kendall trend analysis. That would be a good analysis to perform but the long-term monitoring objective for groundwater is to compare the pre groundwater data set with the post-removal conditions regarding groundwater quality. Two test that could be used would be (1) Pooled Variance T-test that compares the means of the two populations or the (2) Wilcoxon Rank-Sum Test which compares the median of the two populations. The Wilcoxon Rank-Sum test is recommended, as GW data is usually non-parametric, but the Port may make other recommendations as well. Review these two test methods or others and proposed a method to be included in this document.		x	text updated to state the following: Data will be compared to pre and post cleanup levels using statistical methods such as the, Wilcoxon Rank-Sum Test which compares the median of the two populations. The actual statistical method will be selected based on the distribution of the actual groundwater results. Statistical methods will be discussed and approved by EPA prior to the analysis.	comment resolved
7	Table 2-1 Header for right-hand column of table has "LTMMPP" – change to LTMMMP [?]	x		updated - typo, should be LTMMMP	comment resolved
8	Table 2-1 It is not necessarily true, as stated in this table, that no impacted soil will remain onsite. The MTCA three-part test can be met while some exceedances of RvALS – not too large in magnitude, not too frequent – still occur. Future activities that disturb onsite soils, such as future construction or habitat restoration, may encounter such soils and have to handle them appropriately. (All known locations of exceedances remaining after Superfund cleanup should be carefully documented). Changes to site land use or exposure unit size may require re-evaluations of compliance with unrestricted land use criteria. While the conclusion that LT monitoring of site soils is not necessary, as long as site conditions remain relatively the same, may be supportable, Table 2-1 should be careful not to overstate things. "Free fill dirt" that included soils above RvALS, for example, would be ill-advised.		x	We have included the potential to trigger Response Actions and Adaptive Management Strategies should upland land use change (e.g., habitat restoration).	comment resolved
9	2.3.1.2, page 2-8 If the ground surface elevation is below 15 feet ("...between 14 and 15 ft MLLW...", and well screens are between 2 and 12 ft MLLW, the required minimum 3-ft vertical separation won't be met. If vertical separation is stated as a criterion, well screen depths should probably be adjusted as needed.	x		Text updated.	comment resolved
10	2.3.1.2, page 2-9, second paragraph, line 1 Change "...may be installed in an alternative site restoration is conducted" to "...may be installed if an alternative site restoration is conducted"	x		Text updated.	comment resolved
11	2.3.3 Statistical data evaluation methods are subject to EPA approval.	x		Text updated.	comment resolved
12	2.3.3 Duration of long term monitoring has not been established to be confined to 5 years. Revise this section and add footnote to Table 4-1, stating that sampling duration will be contingent on monitoring results	x		Section 2.3.3. revised to state the following: "Sampling frequency may be revised based on changes to site conditions and sample results, upon approval by EPA." Table 4-1 - A new note 1 was added to state the following: 1. Sampling frequency may be revised based on changes to site condition or sample results; any revisions must be approved by EPA.	comment resolved
13	3.0, Line 4 change "...could be source" to "...could be sources". Line 6, change "...to evaluate potential source of recontamination" to "...to evaluate ground water as a potential source of recontamination"	x		Text updated.	comment resolved
14	Table 4-1 Won't ground water sampling continue past Year 2? Section 2.3.3, page 2-10 states that frequency may be revised, as approved by EPA, but Table 4-1 may be interpreted to mean no ground water sampling occurs past Year 2 – which does not appear to be correct. Revise table 4-1 by adding X codes for outyears with a footnote stating that frequency may be revised past Year 2.	x		2 years of quarterly groundwater sampling is typical for a long term monitoring, when all source materials are removed and groundwater recontamination is not likely. At this site, groundwater recontamination is not expected unless a catastrophic event - such as an upgradient spill - occurs. 2years of sampling is recommended to determine that site conditions are stable and that groundwater levels are below the RvALS. If data do not suggest this, additional monitoring may be required - which is why Section 2.3.3 mentions this. A note has been added to Table 4-1 to state the following: Sampling frequency may be revised based on changes to site condition per sample results; any revisions must be approved by EPA.	comment resolved
15	Fig 2-1 and 2-2 These figures only show 3 sediment sampling locations for long term monitoring. Figures in the draft final needs to be consistent with text and tables. EPA has not agreed to 3 sediment sampling locations.		x	No revision made in Draft LTMMMP, as this comment will be addressed in the Final LTMMMP.	should a placeholder be included in the text so that this issue is not missed during finalization of the LTMMMP. If EPA has not agreed to 3 sediment sampling locations should these be included at all? PORT: all outstanding LTMMMP comments have been included in Appendix A of the draft LTMMMP.

Attachment B Quality Assurance Project Plan

(to be provided in Final LTMMMP, 60 days after EPA approval of RACR)

Attachment C NTCRA As-Built Excavation Prism and Remaining Soil Data

(to be provided in Final LTMMMP, 60 days after EPA approval of RACR)