Operation and Maintenance Report
January 2015 to December 2015

McCormick and Baxter Superfund Site

Portland, Oregon
ECSI Site ID: No. 74

Prepared for
Oregon Department of Environmental Quality

June 3, 2016
15670-10/Task 4

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HARTCROWSER

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ACRONYMS AND ABBREVIATIONS

ACB	articulated concrete block
ACLs	alternate concentration limits
AWQC	ambient water quality criteria
Ballard	Ballard Underwater Construction
bgs	below ground surface
BES	City of Portland, Bureau of Environmental Services
°C	degrees Celsius
COCs	contaminants of concern
cPAH	carcinogenic polynuclear aromatic hydrocarbons
DEQ	Oregon Department of Environmental Quality
DGT	diffusive gradients in thin film
DNAPL	dense non-aqueous phase liquid
EPA	US Environmental Protection Agency
ESC	ESC Lab Sciences
f_{oc}	fractional organic carbon
f_{om}	fractional organic matter
ft/ft	foot per foot
FWDA	Former Waste Disposal Area
GSI	GSI Water Solutions, Inc.
Hart Crowser	Hart Crowser, Inc.
HC/GSI	Hart Crowser/GSI Water Solutions, Inc.
ICs	institutional controls
IGA	Intergovernmental Agreement
LDPE	low density polyethylene
LNAPL	light non-aqueous phase liquid
MCLs	maximum contaminant levels
RDL	reported detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MRL	method reporting limit
NAPL	non-aqueous phase liquid
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
ng/L	nanograms per liter

ACRONYMS AND ABBREVIATIONS (CONTINUED)

NRWQC	National Recommended Water Quality Criteria
NW Natural	Northwest Natural Gas Company
O&M	Operation and Maintenance
OSU	Oregon State University
PAHs	polycyclic aromatic hydrocarbons
PCP	pentachlorophenol
PDMS	polydimethylsiloxane
PRC	performance reference compounds
PSDs	passive sampling devices
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RM	river mile
ROD	Record of Decision
SAP	Sampling and Analysis Plan
site	McCormick & Baxter Superfund site
SOPs	Standard Operating Procedures
SPME	solid phase micro-extraction
Tidbits	Temperature loggers
TFA	Tank Farm Area
TOC	total organic carbon
TOM	total organic matter
TRM	turf-reinforced matting
UCL	Upper Confidence Level
µg/L	micrograms per liter
µmol C/g	micromole carbon per gram
USGS	US Geological Survey

Operation and Maintenance Report
January 2015 to December 2015

McCormick and Baxter Superfund Site

Portland, Oregon

1.0 INTRODUCTION AND PURPOSE

This Operation and Maintenance (O&M) Report has been prepared for the Oregon Department of Environmental Quality (DEQ) to document the O&M activities implemented at the McCormick & Baxter Superfund Site (the site) located in Portland, Multnomah County, Oregon, between January 1, 2015, and December 31, 2015.

O&M activities are identified in the Final O&M Plan (DEQ/US Environmental Protection Agency [EPA] 2014), prepared by the DEQ and EPA. The Final O&M Plan defines the administrative, financial, and technical details and requirements for inspecting, operating, and maintaining the remedial actions at the site. The O&M Manual (Hart Crowser, Inc./GSI Water Solutions, Inc. [HC/GSI] 2010) specifies the sampling and monitoring procedures, quality assurance and quality control, technical information, and data necessary for implementing O&M activities. The O&M Manual is a living document that is modified periodically to reflect necessary monitoring and maintenance needs at the site. The DEQ and EPA reduced the scope and frequency of O&M activities conducted at the site in 2010, from the frequency conducted at the site from 2005 through 2010. The Final O&M Plan reflects that reduction.

The purpose of this O&M Report is to document the operation, monitoring, and maintenance activities that occurred during calendar year 2015. Figure 1-1 shows the location of the site, Figure 1-2 presents the site layout and features, and Figure 1-3 presents the site capping components. Figure 1-4 presents the site layout with surface elevations. Figure 1-5 presents the historical contaminant areas, and Figure 1-6 presents historical non-aqueous phase liquid (NAPL) distribution. This report has been prepared by DEQ's contractor team, Hart Crowser, and GSI.

The O&M performance standards and activities for the soil cap are discussed in Section 2, the O&M performance standards and activities for the sediment cap are discussed in Section 3, and the groundwater performance standards and activities are summarized in Section 4. Vegetation management is presented in Section 5. Section 6 discusses the remedy protectiveness, and Section 7 presents recommendations for 2016. Section 8 provides references. Appendix A provides a photographic log of activities or observations associated with O&M activities. Appendix B provides documentation from the Fall 2015 surface, inter-armoring, and sub-armoring water passive sampling event, including the Oregon State University (OSU) analytical report. Appendix C provides documentation including the field observation forms for the soil and sediment cap, status meeting summaries, and the sign-in log. Appendix D provides results of the groundwater sampling at monitoring well MW-59s, and Appendix E provides the photographic log for vegetation observations and the vegetative shoreline repair activities.

Routine operation, monitoring, and maintenance activities in 2015 were implemented primarily by the DEQ's contractor, Hart Crowser, and its teaming partner GSI (under subcontract to Hart Crowser). O&M activities were also performed by Amaral Nursery (vegetation management) and Ballard Marine Construction (Ballard; buoy replacement). OSU and the EPA assisted with the 2015 sediment cap performance monitoring activities.

Key personnel for implementation of O&M activities include:

- Sarah Miller: DEQ Project Officer
- Scott Manzano: DEQ Project Officer
- Steve Campbell: DEQ Contract Officer
- Rick Ernst: Hart Crowser Program Manager
- Heidi Blischke: GSI Technical Manager
- Phil Cordell: Hart Crowser Site Manager

2.0 SOIL CAP PERFORMANCE STANDARDS AND ACTIVITIES

This section presents a summary of soil cap performance standards, observations, and maintenance activities at the site for the reporting period January 1, 2015, through December 31, 2015, and a summary of remedy performance as related to the performance standards. The Final O&M Plan provides a description of the remedial action objectives and the soil operable unit remedy. Table 2-1 provides the soil cap O&M activities conducted in 2015.

2.1 Soil Cap Performance Standards

Contaminated soil was removed and an upland soil cap was constructed on approximately 41 acres of the site in September 2005. Institutional controls (ICs) have not been completed for this portion of the site. Soil beneath the soil cap remains contaminated with arsenic, pentachlorophenol (PCP), polycyclic aromatic hydrocarbons (PAHs), dioxins, and NAPL and requires long-term monitoring and maintenance. The performance standards for the soil cap are:

- Maintain contaminant concentrations in surface soil below the following risk-based cleanup goals, as specified in the Record of Decision (ROD) (EPA 1996):
    - Arsenic: 8 milligrams per kilogram (mg/kg)
    - PCP: 50 mg/kg
    - Total carcinogenic PAHs: 1 mg/kg
    - Dioxins/furans: 0.00004 mg/kg

- Maintain the topsoil layer to within 50 percent of its design specification:
  - Maintain a topsoil thickness of at least 6 inches for the area over the impermeable geomembrane cap.
  - Maintain a topsoil thickness of at least 12 inches for all areas except over the impermeable geomembrane cap.
- Minimize infiltration of rainwater within the subsurface barrier wall by maintaining the subsurface stormwater conveyance system.
- Minimize stormwater erosion and ponding outside the barrier wall by maintaining site grading, surface stormwater conveyance, and native vegetation.
- Maintain native vegetation within the 6-acre riparian zone for compliance with the National Marine Fisheries Service Biological Opinion (National Oceanic and Atmospheric Administration [NOAA] 2004).

2.2 Soil Cap Observations

Soil cap observations were conducted according to the Final O&M Plan. Site inspections were conducted on January 26, April 30, July 17, and November 4, 2015, by the DEQ and HC/GSI. The EPA attended the July site inspection. Observations of interest from the routine inspections are summarized on Figure 2-1 and described below.

Routine inspections are documented on observation forms developed for the site. Supporting documentation and pertinent details are included in Appendix C. As required for the site administrative record, a log of all site visitors in 2015 was kept and is also included in Appendix C.

2.2.1 Visual Inspection

Wildlife, including rabbits, ground squirrels, Canada geese, several other species of birds, and coyotes have been observed using the upland soil cap. Despite placing gravel to fill gaps under the fence around the upland portion of the site, periodic burrowing continues to be observed under the fence and along the perimeter road. These burrows are filled as necessary and are not of major concern (Photograph 2, Appendix A).

Evidence of ground squirrel activity was observed at several locations throughout the upland soil cap. Ground squirrels are common to the area and their burrows typically extend to approximately 1 foot below ground surface (bgs). The ground squirrels use the surplus articulated concrete block (ACB) stockpiled at the site, paved roadway, and concrete well monuments as habitat. None of the observed burrows extend more than 1 foot into the 2-foot soil cap and, therefore, the soil cap continues to isolate site contaminants from human and ecological receptors. Continued monitoring of the burrows is recommended; no action to remove burrowing animals or to fill in the burrows is planned or is necessary at this time.

The gate at the top of North Edgewater Road marks the entrance to the site and Willamette Cove property. This gate, which is locked with a series of locks and a chain, provides access for two railroads, Northwest Natural Gas Company (NW Natural), the DEQ, and other agencies that require access to the area. The Union Pacific Railroad tracks, which run parallel to the site and neighboring properties, are often used by transients and the public to access the area. Access to the area generally does not affect security because of the surrounding fence, lighting, and the alarm system at the site.

2.2.2 Soil Cap Subsidence

In June 2008, subsidence of the soil cap was observed near groundwater monitoring wells EW-1s and MW-23d. An upland site survey confirmed that the ground surface had subsided approximately 1 foot between the time that the soil cap was installed in 2005 and 2008 in a limited area around the wells. A Subsidence in Upland Cap Memorandum (HC/GSI 2008) and an Additional Subsidence Monitoring Memorandum (HC/GSI 2009) present the results of the survey and additional investigation to determine the cause of the subsidence.

Based on elevated groundwater temperatures in well EW-1s (40 °C) and the large amount of buried woody debris in the area, it is suspected that aerobic degradation of woody debris was occurring and causing the ground surface subsidence. Decreasing groundwater levels within the sediment cap also may have contributed by opening a larger unsaturated zone that allows compaction. In 2009, the shallow well EW-1s was sealed to reduce the amount of oxygen reaching the unsaturated zone. Since the well was sealed, the subsidence has slowed and in the past few years has become insignificant. The groundwater temperature dropped to approximately 23 to 25°C and has remained stable for the past 4 years (see Figure 4-6). This temperature is still higher than groundwater from surrounding wells (approximately 15°C) indicating that some heat is still being produced in the subsurface near well EW-1s; this may be caused by anaerobic degradation, which generates less heat than aerobic degradation.

Ground surface subsidence is monitored by measuring the inner polyvinyl chloride (PVC) casing at well MW-23d relative to the steel outer casing of the well. The inner casing extends to 182 feet bgs and is considered to be stable. The outer casing is representative of the ground surface and if the casing (or ground surface) subsides, then the distance between the inner and outer casing decreases. There has been little change in distance measured since 2012. Slight differences in the distance measured (within 0.10 inch for all events) is likely due to variability in measuring equipment and field personnel. The distance was measured at 2.75 inches during all 2015 site inspections. The total decrease in distance between the inner and outer casing since the first periodic measurement conducted in December 2008 is approximately 1.35 inches. Thus, approximately 1.35 inches of subsidence of the ground surface in this area since 2008 with most of it occurring in 2008 and 2009.

While not anticipated, significant additional settling in this area could affect performance of the stormwater conveyance system. The stormwater conveyance system was inspected four times during 2015 and continues to perform as designed with steady flow from the outfall during and immediately after rainfall events. HC/GSI will continue to monitor the area by measuring the casing difference at MW-23d, continuously measuring the water level and temperature at EW-1s, and monitoring the discharge at the stormwater conveyance system outfall.

2.3 Soil Cap Maintenance Activities

Relatively little soil cap maintenance was required in 2015. Routine maintenance consisted of filling small animal burrows, primarily below the perimeter fence. During site inspections, grasses were observed to have established themselves in the northeast corner of the site where NW Natural abandoned their pipeline in 2014.

In December 2015, the irrigation system was removed and approximately 270 linear feet of shoreline turf-reinforced matting (TRM) was repaired along the shoreline after soil erosion below the TRM was observed.

2.4 Summary of Soil Cap Remedy Performance

Overall, upland soil cap observations and inspections revealed no significant change in remedy performance or areas of concern. Future O&M activities will primarily consist of quarterly inspections and routine maintenance. Initial planning to decommission nonessential and obsolete equipment, including the irrigation system, began in 2012, and removal of the irrigation system was completed in December 2015.

The degree of upland soil cap subsidence near wells EW-1s and MW-23d is currently stable. This area will continue to be monitored in 2016 by taking inner and outer casing measurements at well MW-23d; by monitoring stormwater flow at the outfall during quarterly inspections; and by collecting and reviewing transducer data from EW-1s that measures groundwater temperature and elevation.

3.0 SEDIMENT CAP PERFORMANCE STANDARDS AND ACTIVITIES

This section summarizes sediment cap observation, sampling, and maintenance activities for the reporting period January 1, 2015, through December 31, 2015. Table 3-1 provides a summary of sediment cap activities conducted in 2015.

Site observations, sediment cap porewater and surface water sampling, and maintenance activities were conducted according to the Final O&M Plan. Sediment cap inspections were conducted in January, April, July, and November 2015 by the DEQ and HC/GSI in conjunction with inspections for the entire site. Observations of interest from the routine inspections and site meetings are presented on Figure 2-1. Routine inspections are documented in observation forms developed and recorded for the site (Appendix C). Passive sampling of surface water, inter-armoring water, and sub armoring water and collection of cores were conducted in fall 2015 in anticipation of the 2016 Fourth Five-Year Review. Dr. Kim Anderson with OSU conducted the passive sampling, and the OSU report is provided in Appendix B1. The EPA conducted the diving associated with sampler deployment and retrieval. The EPA Dive Report is provided in Appendix B2. Results are summarized in Section 3.3 and Tables 3-2 through 3-9.

3.1 Sediment Cap Performance Standards

The sediment remedy consists of a 23-acre cap over contaminated sediment within the Willamette River and includes ICs. The sediment cap remedy was completed in September 2005 and an Easement and Equitable Servitude was completed in 2006 to restrict sediment cap use and access. Sediment beneath the sediment cap remains contaminated with arsenic, PCP, PAHs, dioxins, and NAPL. The performance standards for the sediment cap are as follows.

- Maintain contaminant concentrations in surface sediment below the following risk-based cleanup goals, as specified in the ROD (EPA 1996):
  - Arsenic: 12 mg/kg, dry weight
  - PCP: 100 mg/kg, dry weight
  - Total carcinogenic PAHs: 2 mg/kg, dry weight
  - Dioxins/furans: $8x10^{-5}$ mg/kg, dry weight
  - Protection of benthic organisms based on sediment bioassay tests, resulting in impaired survival and growth (i.e., weight)
- Minimize contaminant releases from sediment that might result in contamination of the Willamette River in excess of the following federal and state ambient water quality criteria (AWQC[1]):
  - Arsenic (III): 190 micrograms per liter (µg/L)
  - Chromium (III): 210 µg/L
  - Copper: 12 µg/L
  - Zinc: 110 µg/L
  - PCP: 13 µg/L
  - Acenaphthene: 520 µg/L
  - Fluoranthene: 54 µg/L
  - Naphthalene: 620 µg/L
  - Total carcinogenic PAHs: 0.031 µg/L
  - Dioxins/furans: $1.4x10^{-5}$ nanograms per liter (ng/L)
- Maintain the armoring layer to within 50 percent of the design specification throughout the cap. The design specifications are:
  - 6-inch rock armoring: maintain at least 6 inches thick
  - 12-inch rock armoring: maintain at least 7.5 inches thick

[1] These AWQCs are the values that were effective in 1996 at the time the ROD was signed.

- 24-inch rock armoring: maintain at least 12 inches thick

- Maintain uniformity and continuity of ACB armoring.
- Assess performance of organophilic clay to ensure it is preventing the release of mobile NAPL to the Willamette River (potential assessment parameters include sorption capacity, measure of NAPL currently sorbed, and permeability).

AWQCs listed above were the surface water criteria in effect at the time of the ROD (EPA 1996); since completion of the ROD, additional recommended EPA water quality criteria were published in 2007, and more stringent AWQCs for human health were adopted by the DEQ and approved by the EPA in 2011. During meetings in August 2007 among stakeholders (DEQ, EPA, NOAA, Confederated Tribes of Warm Springs, and Yakama Nation), it was agreed that for comparison purposes, the following five criteria would be included in analytical results summary tables in the Annual O&M Reports:

- Two AWQCs in effect at the time the ROD was issued:
  - 1996 criteria for chronic effects to aquatic life
  - 1996 criteria for human health based on fish consumption
- Two 2007 National Recommended Water Quality Criteria, updated in 2015:
  - 2007 criteria for chronic effects to aquatic life, updated in 2015
  - 2007 criteria for human health (consumption of organisms), updated in 2015
- Current EPA maximum contaminant levels (MCLs)

Future comparison criteria will include the EPA-approved 2011 AWQCs updated in 2015 for human health and other applicable AWQCs at the time of sediment cap water sampling. These criteria were used as comparison criteria for the Fall 2015 passive surface water and sediment cap porewater sampling event.

3.2 Sediment Cap Observations

Routine sediment cap inspections were conducted on January 26, April 30, July 17, and November 4, 2015 in conjunction with the four quarterly site meetings. Sediment cap inspection documentation is included in Appendix C. Sections 3.2.1 and 3.2.2 describe sediment cap observations regarding habitat enhancement features, wildlife, vandalism, and/or trespassing. In general, the sediment cap remains in good condition. Shoreline sheen was not observed in 2015. Limited ebullition was observed primarily within the two areas of the sediment cap where granular organophilic clay is present.

3.2.1 Habitat Enhancement Features and Wildlife

Habitat enhancement features, such as boulder clusters and sand cover as a biotic layer, are design elements of the sediment cap. Large woody debris also provides habitat enhancement along the shoreline and in the Riparian Area above the shoreline. The distribution of sand cover over the ACB is similar to previous years. Originally, sand was placed over a large portion of the shoreline and Willamette Cove ACB armoring, but high river flow conditions and wakes from passing boats have washed sand from the ACB where the bank slopes are steeper. Rounded gravel (1-½-inch minus) was placed within the ACB voids along a large portion of the shoreline and Willamette Cove in October 2012. The gravel has largely remained in place through 2015; however, some has washed down steeper shorelines and has settled onto lower ACB surfaces. Shoreline conditions and the distribution of the ACB gravel are shown in the Photograph Log (Appendix A).

Large woody debris along the shoreline at higher elevations was deposited during high river stage events. The amount of woody debris at the site appears to remain fairly consistent year to year. The highest river stage recorded since the sediment cap was installed occurred in June 2011, reaching 22 feet North American Vertical Datum (NAVD88), or 1 foot below the 23-foot flood stage. Erosion of soil mulch and vegetation cover on the green TRM was observed in several areas near the lower riparian/ACB armoring elevation after river levels receded. During ACB gravel placement in October 2012, these areas were also repaired. TRM was pulled away from the ACB and voids were filled with crushed rock. The TRM was then pulled back over the crushed rock and re-secured to the ACB using concrete anchor nails. The repairs were observed to remain in place through 2015. As mentioned in Section 2.3, additional TRM repairs were completed in December 2015 to repair shoreline erosion damage. The Willamette River did not reach flood stage in 2015 with the maximum elevation at approximately 17.39 feet NAVD88 in December 2015.

Three areas of the shoreline appear to accumulate more woody debris than other areas:

- The south end of the shoreline near the City of Portland outfall
- Along the shoreline near the former Tank Farm Area (TFA)
- The north end of the site near the Burlington Northern Railroad bridge

Boulder clusters placed during the sediment cap construction remained in place during 2015.

Numerous wildlife species continue to be observed site-wide; various birds seen most frequently include Canada geese, gulls, cormorants, pigeons, blue herons, ospreys, hawks, and flickers. Crayfish and clams were observed in the Willamette River.

3.2.2 Vandalism and Trespassing

The shoreline along the site and in the Willamette Cove is accessible and is used by the public for various forms of recreation. Throughout 2015, shoreline trash, campfires, and graffiti were observed.

Numerous dilapidated boats (used as dwellings) were seen anchored in the Willamette Cove during every site visit (Photograph 13, Appendix A). It was not apparent that any of the boats were moored on the footprint of the sediment cap, and no effects to the sediment cap were observed from potential mooring or from physical contact with these boats on the sediment cap. Although no damage to the ACB was observed or expected, the DEQ typically communicates these observations to Portland's regional metropolitan government agency, Metro, that owns the Willamette Cove property. The US Coast Guard and Oregon State Marine Board rules prohibit anchoring on the sediment cap.

3.2.3 Buoys

Five permanent buoys were installed in August 2011 along the perimeter of the sediment cap warning boaters of navigational hazards. During the January 2014 site inspection, it was observed that Buoy #4 was missing. This was confirmed during site inspections in April and July 2014. An underwater inspection of the buoy location was conducted in September 2014 and confirmed the buoy became detached. As detailed in Section 3.5, the buoy was replaced in February 2015.

3.2.4 ACB Buckling in Willamette Cove

During the passive sampling event in fall 2015, the area where ACB buckling was observed in 2009 was exposed in Willamette Cove. The buckling observed in 2015 appeared similar to that observed in 2009 when an investigation was conducted to determine whether the buckling compromised the sediment cap. Based on that study and the recent passive sampling, the buckling of the ACB is not compromising the integrity of the sediment cap.

3.3 Surface, Inter-Armoring, and Sub-Armoring Water Assessment

3.3.1 Sampling Approach

Sediment cap porewater and surface water sampling was conducted in fall 2015 to comply with the long-term monitoring objectives and inform 2016 Fourth Five-Year Review Report. The passive sampling approach and methodology was developed in conjunction with the DEQ, EPA, and OSU with assistance from GSI. Upon agreement regarding the specifics of the passive sampling approach and target sampling depths within the sediment cap and the overlying surface water, GSI prepared a Surface Water, Inter-armoring Water, and Sub-armoring Water Sampling and Analysis Plan (SAP) that has been incorporated into the updated O&M Manual (as Chapter 4). Unless otherwise noted, the Fall 2015 passive sampling event followed the procedures set forth in that updated SAP.

The 2015 target sample locations and analytical program is provided as Appendix J to the updated O&M Manual and includes collection of 12 compliance monitoring stations, 4 early-warning stations, and an upstream and downstream reference location. Target versus actual sampling locations are shown in Figure 3-1. While most stations were collected near target, sample stations “A” and “D” were moved off-shore to account for the low water levels present during the deployment period. Table 3-2 provides the actual sample coordinates and summarizes the sampling intervals and analytical suite at each station. Surface water and inter-armoring water was sampled at all of the compliance monitoring and early warning stations. The early warning stations also included a sample from the sub-armoring layer. The upstream and downstream reference stations assess concentrations in surface water only.

The passive samplers[2] equipped with Passive Sampling Devices (PSDs) were developed by Dr. Kim Anderson at OSU. Two PDSs were employed including 1) inert low density polyethylene (LDPE) tubing, which essentially acts as a carbon sink so that PAHs and PCP will sorb to the LDPE and approach equilibrium with freely dissolved concentrations in porewater, and 2) diffusive gradients in thin film (DGT) technology to measure freely dissolved metals in porewater. Temperature loggers (TidbiTs ®) were also deployed in a large subset of the samplers. To facilitate the measurement of porewater concentration from the mass of chemical that sorbs to the LDPE and allow for a shorter deployment period than would be required if a chemical needed to reach equilibrium with the LDPE, performance reference compounds (PRCs) were impregnated into the LDPE as described in OSU's Standard Operating Procedures (SOPs) for passive sampling provided in Appendix K of the updated O&M Manual and OSU's 2015 Analytical Report (Appendix B1).

Passive samplers were deployed on September 15 and 16, 2015. Shallow water stations that were accessible from shore were deployed by field staff wearing waders. Off-shore samplers were deployed by the EPA Region 10 Dive Team in accordance with the SAP and their Dive Plan. The general set-up of samplers during field deployment is illustrated on Figure 3-2. A rigid passive sampling probe equipped with LDPE and DGT PSDs and TidbiTs ® (if applicable) was inserted approximately 6 inches into the inter-armoring or sub-armoring layer of the sediment cap for performance monitoring and early warning monitoring, respectively. Surface water was sampled from a depth of approximately 12 inches (1 foot) above the mudline by placing the LDPE and DGT PSDs and TidbiTs ® (if applicable) in sampling cages on the river bottom. The samplers were then left in the sediment and overlying water for approximately 21 days and allowed to approach equilibrium. Samplers were retrieved on October 6, 2015. At the time of retrieval, the divers inspected the sampling area to confirm that the passive samplers remained intact and had not been disturbed. The divers then removed the inter-armoring and/or sub-armoring sediment probes from the cap and the sampling assemblies were recovered by OSU and GSI personnel on the sample vessel for sample handling and transport to the OSU laboratory in Corvallis, Oregon. Samples were processed and analyzed at the OSU laboratory for PAHs, PCP, and dissolved metals (arsenic, chromium, copper, and zinc) in accordance with their SOPs provided in Appendix K of the updated O&M Manual and/or OSU's 2015 Analytical Report (Appendix B1).

3.3.2 Sampling Results

The actual sample locations are shown on Figure 3-1. Anticipated water depth, and number and type of sample(s) for each location are provided in Table 3-2. EPA's dive report documenting the deployment procedures and subsurface conditions is provided as Appendix B2.

[2] The term "passive sampler" is used in this report to refer to the sampling hardware (either sediment probes or surface water cages) that the passive sampling media is placed inside of and deployed in. Note that this term is used to distinguish it from the term Passive Sampling Device (PSD), which is used in the OSU Standard Operating Procedures (SOPs) to refer to the prepared sampling media (either the LDPE or DGT) that is ready to deploy in the field, but has not yet been placed in the "passive sampler".

OSU's analytical report is provided as Appendix B1. OSU performed all data quality checks and converted the LDPE and DGT results into associated water concentrations and provided the final results to DEQ/GSI electronically. The current and previous results are presented in the following tables.

- Table 3-3 provides the results for the surface, inter-armoring, and sub-armoring water collected during the Fall 2015 passive sampling event. The method detection limits presented in Table 3-3 are approximate based on work OSU conducted for another site. However, they are not expected to vary significantly and serve the purpose of showing that the detection limits were low enough, with the exception of arsenic, to meet our comparison criteria and serve as the best available information to use in the statistical evaluations.
- Table 3-4 provides the statistical summary information for the Fall 2015 passive sampling from surface, inter-armoring, and sub-armoring water samples.
- Tables 3-5, 3-6, and 3-7 present summary statistics from the previous and current sampling events for surface, inter-armoring, and sub-armoring water, respectively.
- Table 3-8 presents a summary of comparison criteria exceedances for selected analytes for sampling events conducted after the sediment cap was installed (2005 to present). Note that the lowest comparison criteria were revised for the 2015 event.
- Table 3-9 presents a summary of maximum detected concentration for selected analytes for sampling events from 2002 through 2015.
- Table 3-10 presents a summary of the detection frequency for selected analytes for sampling events from 2002 through 2015.

3.3.2.1 Comparison to Criteria

Analytical results for COCs identified in the ROD (EPA 1996) for the site were compared to the 1996 ROD AWQC, the most recent EPA National Recommended Water Quality Criteria (NRWQC) (EPA 2015), the most recent EPA National Primary Drinking Water Regulations (EPA 2015), and the DEQ 2011 EPA-approved Aquatic Water Quality Criteria for Aquatic Life (chronic) and Human Health (consumption of organism only). These comparison criteria and their sources are provided in Table 3-3. The following values are the lowest values for each COC from the above-mentioned comparison criteria:

- Arsenic (III) – 0.00014 milligrams per liter (mg/L)
- Chromium (III) – 0.053 mg/L
- Copper – 0.0049 mg/L
- Zinc – 0.066 mg/L
- PCP – 0.04 µg/L
- Acenaphthene – 90 µg/L
- Anthracene – 400 µg/L
- Benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene – 0.0013 µg/L each

- Benzo(a)pyrene and dibenz(a,h)anthracene – 0.00013 µg/L each
- Chrysene – 0.13 µg/L
- Fluoranthene – 14 µg/L
- Fluorene – 70 µg/L
- Naphthalene – 620 µg/L
- Pyrene – 30 µg/L
- Total carcinogenic polynuclear aromatic hydrocarbons (cPAHs) – 0.031 µg/L

The comparison criteria allow for site-specific adjustments to their standard table values. PCP can be adjusted for site-specific pH; and chromium, copper, and zinc can be adjusted for hardness. Comparison criteria presented in Tables 3-3 and 3-4 reflect adjustments to the PCP comparison criteria to reflect site pH (using a pH of 7.2), but the metals criteria have not been revised to reflect site-specific hardness. The hardness of the Willamette River water is approximately 25 mg/L, while the hardness in the sub-armoring zone ranges from 70 to 190 mg/L. Hardness of the inter-armoring zone has not been measured. Therefore, until the water quality point of compliance is resolved, the comparison criteria calculated on the basis of a hardness of 50 mg/L is used (email from Rob Burkhart/DEQ). Data collected prior to 2015 were compared to the comparison criteria appropriate for the year the data was collected.

The criteria listed above for total cPAHs is based on AWQCs in place in 1996. In 1996, AWQCs for metals were based on total metal concentrations. The criteria listed above for arsenic, chromium, copper, and zinc are based on the lowest of either the 2015 NRWQCs or the 2011 AWQCs, which were developed for dissolved metals.

3.3.2.2 Surface Water

During the Fall 2015 sampling event, 14 surface water samples and one duplicate sample were collected. Twelve of the 14 locations were collected over top of the sediment cap and 2 were collected upstream and downstream of the sediment cap as shown on Figure 3-1. The DGT samplers for chromium, copper, and zinc at Location A and background Location 1 could not be analyzed due to fouling (described in the OSU report, Appendix B1). The samplers were fouled with sediment adhering to the gel and thus compromising the sampler. Table 3-3 provides the results for each location and Table 3-4 presents the summary statistics. The total PAH concentrations in Table 3-3 are calculated by summing only detected values unless there are no detected values for a given analyte group (such as cPAHs), then half the detection limit of each analyte in the analyte group is summed. Only the 12 locations collected overlying the sediment cap were used in calculating the summary statistics presented in Table 3-4. Half the detection limit is used for calculating summary statistics.

Of the 12 surface water samples collected overlying the sediment cap, dissolved arsenic was detected in one sample at 0.001 mg/L at Location 1. Dissolved arsenic was detected in both the upstream and downstream surface water samples at 0.00074 and 0.00077 mg/L, respectively. These concentrations exceed the lowest comparison criteria of 0.00014 mg/L, as does the detection limit for other samples of 0.0015 mg/L. The lowest criteria is based on the 2015 NRWQC human health consumption of organism only value. However, the promulgated DEQ 2011 EPA-Approved AWQC for human health consumption of organism only is 0.0021 mg/L. None of the surface water samples exceeded the 2011 AWQC.

Chromium was not detected in any of the 11 sediment cap locations, where chromium was measured, or in the two background (upstream and downstream) locations. The detection limit of 0.002 mg/L is well below the lowest comparison criteria of 0.053 mg/L.

Copper was detected in 11 locations overlying the sediment cap, where copper was analyzed, and in the one background location where chromium was measured. The highest concentration detected was 0.00019 mg/L which is well below the lowest comparison criteria of 0.0049 mg/L. The background concentration was 0.00016 mg/L which is similar to the maximum concentration overlying the sediment cap.

Zinc was analyzed for in 11 locations overlying the sediment cap and one background location. It was detected in 82 percent of the samples overlying the sediment cap with a maximum concentration of 0.0038 mg/L which is an order of magnitude below the lowest criteria of 0.066 mg/L. The background concentration was 0.01 mg/L which is also below the lowest comparison criteria but above the maximum concentration detected in surface water overlying the sediment cap.

PCP was not detected in surface water at any of the 14 locations sampled overlying the sediment cap or the 2 background locations. The detection limit of 0.00043 μg/L is well below the lowest comparison criteria of 0.04 μg/L.

PAHs were detected in all samples from the 14 locations analyzed overlying the sediment cap and the 2 background locations, at concentrations well below the lowest comparison criteria.

Table 3-5 presents the surface water summary statistics for 2002 and 2003 prior to sediment cap installation, and 2005 through 2015 after the sediment cap was installed. The comparison criteria presented represent the lowest of the comparison values, including the newer 2015 NWRQCs and AWQCs. Metal concentrations have decreased when looking at both maximum concentration and at mean concentrations over time. Only arsenic regularly exceeds the lowest NWRQC criteria of 0.00014 mg/L in both samples collected from overtop the sediment cap as well as the background samples. However, only once at one location has arsenic in surface water exceeded the next lowest comparison criteria, the 2015 DEQ AWQC of 0.0021 mg/L. PCP was detected in surface water in one location during the Spring 2010 sampling event and otherwise was not detected in surface water after installation of the sediment cap.

PAHs in surface water rarely exceeded comparison criteria for PAHs since 2002 and no exceedances have been observed since spring 2009 (See Table 3-8). Table 3-9 presents the maximum detections for select analytes. The maximum value detected shows a slight decrease since 2005. Table 3-10 presents the detection frequencies for select analytes. It appears that the detection frequency has increased in recent years; however, that is due to lower detection limits achieved with passive sampling in 2010 and 2015.

3.3.2.3 Inter-Armoring Water

Inter-armoring water samples were collected from 14 locations as shown on Figure 3-1. At locations B, D, E, G, H, I, and L, the DGT samplers for copper, chromium, and zinc were fouled and the analysis could not be conducted. The DGT samplers for arsenic were fouled at Locations D, E, G, K, and L . The samplers fouled with sediment adhering to the gel and thus compromising the sampler. At the sub-armoring sample locations 5, 12, 13, and 16, metals were not analyzed for since the PAHs and PCP serve as the early warning indicators.

Arsenic was detected at 0.00096 mg/L in one of the five locations (Location I) where arsenic was analyzed for. This concentration is above NRWQC criteria of 0.00014 mg/L but below the AWQC of 0.0021 mg/L. Chromium, copper, and zinc were detected in two of the three locations analyzed, at concentrations below the lowest comparison criteria.

PCP was not detected in any of the 14 locations analyzed and the detection limit was well below the lowest comparison criteria of 0.04 μg/L.

Of the PAHs, benzo(a)pyrene and dibenzo(a,h)fluoranthene were not detected in any of the 14 locations. Other PAHs were detected in two or more of the locations at concentrations below the lowest comparison criteria. The 95 percent upper confidence level (UCL), where sufficient detections were present to calculate, were also below the lowest comparison criteria.

Table 3-6 presents the summary statistics for sampling events since 2006. Measuring the dissolved arsenic using the DGT sampler, lower detection limits were achievable and the maximum detected concentration from the one location where arsenic was detected is lower than when total and/or dissolved arsenic was measured using the conventional grab sample method during past sampling events.

PCP has not been detected since 2006 when it was detected below comparison criteria concentrations in 3 of 22 locations.

PAH concentrations have remained well below comparison criteria since 2007. In 2006, Locations 5 and 12 (refer to the 2006, 2007 annual reports for the location maps) contained a few PAHs above comparison criteria.

3.3.2.4 Sub-Armoring Water

PAHs and PCP were measured from within the sub-armoring layer of the sediment cap at the four early warning locations. PCP was not detected. PAHs were detected at concentrations below the comparison criteria. Table 3-7 presents the summary statistics for each event since 2005 and Table 3-8 presents the number of exceedances for each event. Prior to 2010? there were regular PAH concentration exceedances within the sub-armoring layer of the sediment cap. Using passive sampling technology in 2010 and 2015, while there were frequent PAH detections, no comparison criteria were exceeded. The maximum total PAH concentration has decreased significantly since the sediment cap was installed.

3.3.2.5 Comparison to Conventional Sampling Results

The passive sampling technologies achieve lower detection limits, allow for a time-averaged sample, and measure the dissolved fraction which best simulates biotic uptake. With the lower detection limits, the detection frequency for many analytes has increased, but the concentrations detected are below the comparison criteria with the exception of arsenic. Arsenic is detected at similar concentrations in the background locations.

3.3.2.6 Comparison to SPME Results

In fall 2009, the solid phase micro-extraction (SPME) passive sampling technique using polydimethylsiloxane (PDMS) was conducted at 13 sampling locations that were co-located with conventional sampling methods. Results of the sampling and comparison between the conventional and SPME sampling are included in the 2009 O&M Report (HC/GSI 2010). Using the SPME methodology allowed for significantly lower detection limits in addition to obtaining samples that represent water equilibrated during an entire week, measurement of only the dissolved constituents, and a reduced effort for obtaining the samples. Based on the results from the Fall 2009 sampling event, it was decided that SPME would be used to measure inter-armoring and sub-armoring water quality within the sediment cap in fall 2010.

In 2015, metals were also measured by passive sampling technology (DGT samplers). These samplers measure the dissolved metals in water. Many of the samplers fouled with sediment adhering to the gel and thus compromising the sampler. The LDPE samplers for PCP and PAHs achieved similarly low detection limits as the SPME sampler. In 2015, the PAH concentrations in water were lower than in 2010. It is not clear whether this is the effect of the sampling methodology or a decrease in PAH concentrations in water. The largest decrease was observed in the total PAHs and cPAHs within the sub-armoring samples. When the maximum total PAHs are plotted, the data decrease exponentially with the 2015 total PAH concentration fitting in well with the trendline produced by the previous data (see Figure 3-4). The same exponentially decreasing trend is present for cPAHs. For both datasets, the R^2 value is above 0.85 suggesting a good fit of the data with the trendlines. This decrease suggests that the sediment cap will last longer than the anticipated design life.

For metals, the concentrations of metals detected using the DGT samplers was similar to the most recent conventional sampling events suggesting that the metals are present in the water primarily in a dissolved form. Metals concentrations have decreased slightly over time since the cap was installed; however, the trendline is linear and the R^2 value is small suggesting a poor fit. The metals concentrations in surface water are similar to the background locations and therefore, is not clearly associated with the site, with the exception of arsenic in a few locations where it was detected in earlier sampling events at concentrations sufficiently above background to be associated with the site.

3.3.2.7 Summary

Passive water sampling from the surface water and from porewater within the sediment cap, using the DGT for metals and either the SPME with PDMS or the LDPE for organics is an appropriate method to measure the protectiveness of the sediment cap. Based on the 2015 passive sampling results, the sediment cap continues to be functioning as designed and is protective of human health and the environment.

3.4 Organophilic Clay Assessment

3.4.1 Background and Previous Studies

The granular organophilic clay (Aqua Technologies ET-1) was placed in two locations of the sediment cap to reduce the potential of creosote seeps from reaching the river. Immediately after its emplacement in summer 2004, ebullition was observed overtop the footprint of the granular organophilic clay placement at significantly higher rates than what was observed in other locations within the sediment cap or elsewhere in the river adjacent to the sediment cap. In order to understand the ebullition, extensive study was conducted on the ET-1 organophilic clay from the sediment cap by both Dr. Danny Reible while at the University of Texas and Dr. Kiara Smith as part of her PhD thesis while at Portland State University (PSU). The reports for these studies are provided in the 2008, 2009, and 2010 Annual Operations and Maintenance Reports for the site (HC/GSI 2008, 2009, and 2010). Initially, the cores were collected to understand the performance of the organophilic clay in regards to its sorption of creosote. There was no creosote observed in any of the organophilic clay cores from the site, and it was assumed that due to the installation of the barrier wall, the source to potential creosote seeps had been eliminated by the wall. The low level PAHs detected within the organophilic clay is consistent with low level PAHs present in groundwater passing through the sediment cap. PAH concentrations within the organophilic clay have consistently been well below comparison criteria for the project.

The organic content was measured from organophilic clay samples taken from cores in 2008 and 2009 as a part of three separate studies. In the 2008 Dr. Reible study, the average organic matter content of several site ET-1 organophilic clay samples was 15.9 percent (+/- 2.6 percent). Fresh ET-1 organic content has an average of 24.1 percent (+/- 0.16 percent). At that time, the organophilic clay had been in place within the sediment cap for 4 years, which results in an estimated half-life for the organic matter within the clay of 6.6 years at an estimated rate of 0.105 $year^{-1}$. Core samples were also provided to Kiara Smith; PSU PhD student, for use in her thesis. She measured the total carbon content of fresh ET-1 and organophilic clay from the sediment cores from the site. She also measured changes in total organic carbon (TOC) content in the organophilic clay from site sediment cores that were incubated for 300 days. A significant loss of TOC was observed. For the incubated samples, the rates of carbon loss were on the same order of magnitude as the molar rates of methane production from the incubations suggesting that the carbon originating from the ET-1 is ultimately converted to methane gas. The rates calculated from the 300 day incubations corresponded to a first-order half-life of the carbon in the organophilic clay of 1.4 years. Using the estimated initial TOC content of the ET-1 of 11,600 μmol C/g (micromole carbon per gram), she estimated the first order half-life for the average of the samples from each core to be 3.87 years and 16.48 years. While the two studies were conducted slightly different, the results showed that the ET-1 was losing organic matter and based on Kiara's study, that loss could be attributed to degradation resulting in methane.

In 2009, additional core samples were collected from within the granular organophilic clay footprint at the site, and the organophilic clay was analyzed by Dr. Reible for organic matter. The result was an average of 16 percent (+/- 1.6 percent) organic matter which was similar to the 2008 results suggesting that the degradation of the organic carbon within the organophilic clay was stabilizing. However, since differences between years are small, he suggested that the organic content should continue to be measured. Therefore, cores were collected again in 2015 as described below.

3.4.2 Sampling Approach

Organophilic clay cores were collected in 2006, 2008, 2009, and again in 2015. Previous sampling efforts show evidence that increased biological activity within the footprint of the organophilic clay has led to a significant reduction in organic matter of the organophilic clay used in the sediment cap. Although degradation of the organic matter will ultimately result in a reduced sorption capacity of the organophilic clay, the 2008 and 2009 data suggested that the degradation of the organophilic clay may have stabilized at about 16 percent organic matter (down from 24 percent in fresh organophilic clay). The primary purpose of the 2015 sampling event was to determine whether the organophilic clay continues to degrade, losing organic matter content, or whether the degradation has stabilized.

On September 14, 2015, two sediment cores were collected from the area where granular organophilic clay is present within the sediment cap in Willamette Cove (See Figure 3-1). Prior to coring, an ACB block was removed from each sampling location using a jackhammer, the geotextile fabric was cut, and approximately 4 inches of 1-inch minus gravel beneath the geotextile was removed to expose the sand portion of the sediment cap. The 2-inch PVC core tubes, which were pre-cut with a beveled edge, were driven using a metal slide hammer and removed using a car jack. The drive length of the core tubes beneath the top of the sand cap was approximately 27 inches for core C1 and 25 inches for core C2. Recovery of sediment within the cores was 70 percent (19 inches for core C1 and 17.5 inches for core C2). The cores were opened and logged on-site; the boring logs and photographs are included in Appendix B3. Due to the relatively short organophilic clay recovery (8.5 inches in core C1 and 7.5 inches in core C2), the decision was made to divide the cores into a top and bottom half rather than thirds (as directed in the SAP). The decision was approved by a DEQ representative and two 2.5- to 3.0-inch long organophilic clay samples were collected from each boring and submitted to the contract laboratory, ESC Lab Sciences (ESC) of Mt. Juliet, Tennessee, for analysis of PAHs, TOC, total organic matter (TOM), and total solids. ESC also calculated and reported the fractional organic carbon (f_{oc}) and fractional organic matter (f_{om}). Additional details on the organophilic clay sampling approach and methodology are provided in the Organophilic Clay SAP that has been incorporated into the updated O&M Manual (as Chapter 5).

3.4.3 Sampling Results

The PAH, total solids, TOC, f_{oc}, and f_{om} results for the organophilic clay samples are provided in Table 3-11. No evidence of creosote (NAPL) was observed in the organophilic clay cores. The results are summarized below.

3.4.3.1 PAHs

Low-level PAHs were detected at concentrations that typically fell between the method detection limit (RDL) and reported detection limit (RDL). The summation of carcinogenic PAHs ranges from 0.03 mg/kg to 0.4591 mg/kg for the four organophilic clay samples collected from the two cores from the sediment cap. These carcinogenic PAH concentrations are well below the risk-based cleanup goal of 2 mg/kg (see Section 3.1).

3.4.3.2 Organic Carbon

Since the PAH concentrations within the organophilic clay are very low and there are no other significant sources of organic carbon expected to sorb to the organophilic clay within the sediment cap, the primary source of organic matter observed in the clay layer is within the structure of the organophilic clay itself. As discussed above, the estimated half-life for the ET-1 organic matter degradation was estimated to be 6.6 years based on the data collected after the clay had been in place for four years. Using the first order half-life equation with a 6.6 year half-life and a starting percent organic matter of 24 percent, the estimated FOM now should be approximately 7.6 percent (after 11 years in place). The FOM results from the recent work were:

- OC-1 1 to 3.5 feet = 8.04 percent
- OC-1 3.5 to 6 feet = 8.57 percent
- OC-2 0.5 to 3.5 feet = 7.78 percent
- OC-2 3.5 to 6.5 feet = 9.85 percent

The average percent organic matter from the four stations is 8.56 percent. Using the average, the estimated half-life after 11 years is 7.4 years. These results indicate that the ET-1 organophilic clay is continuing to break down.

In Kiara's study, she measured TOC, with the fresh ET-1 containing 11,600 μmol C/g OC, which is approximately 139,316 mg/kg TOC (or mg C/kg soil, or 13.9 percent carbon). Using the first order half-life equation, the initial TOC of 139,316 mg/kg and the current average TOC concentration of 38,850 mg/kg, the estimated half-life is 5.96 years. These results are consistent with the conclusion that the organophilic clay continues to degrade with a half-life on the order of approximately 6 to 7 years. If the clay continues to degrade at this rate, it will return to its original bentonite form in approximately 40 years after installation of the sediment cap or in the year 2044. Figure 3-3 shows the percent organic matter from actual site data versus the predicted data using a 7 year half-life.

Microbial degradation of the organic matter is likely also causing the thickness of the organophilic clay layer to decrease as the organic mass decreases. If in its original state it contained 24 percent organic matter and it currently contains approximately 8.5 percent organic matter, then it has lost 15.5 percent of its original mass. This loss may have caused some of the buckling in the ACB armoring that is observable in the areas where organophilic clay was placed. However, there is not a large amount of remaining organic matter and therefore, additional buckling, if this is the cause, is not anticipated.

3.4.4 Summary

Multiple lines of evidence indicate that the loss in carbon content and organic matter is ongoing. The low PAH levels observed within the organophilic clay layer indicate that this adsorptive component of the remedy was overly conservative and that large-scale creosote migration into the sediment cap was abated by installation of the barrier wall. Thus, there is no evidence that the observed reduction in organic matter in the ET-1 organophilic clay samples will result in creosote release through the sediment cap in the future. Therefore, even if the organophilic clay EC-1 reverts back to bentonite, the remedy will continue to be effective and protective.

3.5 Sediment Cap Maintenance Activities

The sediment cap was designed to be generally maintenance free. Maintenance in 2015 included cutting ACB cables that became exposed on the shoreline (Appendix A; Photographs 3 and 4) and replacement of Buoy #4 (Appendix A; Photograph 12).

Cable loops used to install and adjoin ACB armoring sheets were observed sticking out of the armoring. The cables used to place the ACB are no longer necessary to maintain the integrity of the ACB armoring. On March 12, 2015, the cables were cut off close to the ACB armoring to remove the potential trip hazard from the shoreline.

The location of buoy #4 was inspected in 2014 and the buoy, the buoy chain, and securing hardware were all missing. On February 11, 2015, Hart Crowser and Ballard replaced the missing buoy. All buoys were visible during the April, July, and November 2015 site inspections.

Riparian vegetation watering events occurred in July and August 2015 and are further detailed in Section 5.0. Watering was deemed necessary following months of below average precipitation.

ACB blocks in Willamette Cove were removed and replaced on October 4, 2015, to facilitate organophilic clay sampling and porewater sampling in Willamette Cove. The replacement ACB blocks were painted bright orange and the sample number and year were painted onto the bricks (Appendix A; Photograph 18) for identification. Two additional ACB blocks were removed and replaced to allow deployment of passive sampling equipment at early warning locations 12 and 13. A fifth block was observed to be missing and was replaced in October 2015.

3.6 Summary of Sediment Cap Remedy Performance

Overall, the sediment cap observations, inspections, and passive water and porewater sampling revealed no significant change in remedy performance or areas of concern. Future O&M activities primarily will consist of quarterly inspections and routine maintenance. Sediment cap porewater and surface water sampling was conducted in fall 2015 to support the 2016 Fourth Five Year Review

Report. The sampling approach and methodology was developed in conjunction with the DEQ, EPA, and OSU with assistance from GSI. Upon agreement regarding the specifics of the sediment cap water sampling, GSI prepared a SAP that has been incorporated into the updated O&M Manual (as Chapter 4). Results of the organophilic clay cores and passive water and porewater sampling indicate that the sediment cap is protective of human health and the environment. The degradation of the organophilic clay, while not intended in the design of the sediment cap, will not affect the cap's protectiveness since creosote is not seeping into the sediment cap. This is likely due to the installation of the barrier wall that has cut off the flow of creosote from the upland source area.

Sand covers the shoreline at lower, less steep elevations, and there are significant amounts of large woody debris that have accumulated to help create wildlife habitat. Numerous wildlife species continue to be observed; various birds including Canada geese, gulls, cormorants, pigeons, blue herons, ospreys, hawks, flickers, and kingfisher were observed in 2015. Crayfish and clams were also observed in the Willamette River. The public frequents the shoreline for recreation, most commonly for walking dogs. Infrequent and minor instances of vandalism and littering have been noted. Rounded gravel used to fill voids within the ACB has created a more stable substrate for wildlife and for a consistent and safer walking surface for public use.

4.0 GROUNDWATER PERFORMANCE STANDARDS AND ACTIVITIES

This section summarizes groundwater performance standards and activities for the reporting period January 1, 2015, through December 31, 2015. Groundwater remedy observations and maintenance activities were conducted according to the Final O&M Plan. Manual NAPL and groundwater level data were collected during the site-wide semiannual monitoring events conducted on June 9, 2015, and October 2, 2015. Sampling of MW-59s was completed on October 2 and 21, 2015, and sampling details are presented in Appendix D.

4.1 Groundwater Performance Standards

The groundwater remedy consists of groundwater monitoring, NAPL recovery, a subsurface barrier wall surrounding approximately 18 acres beneath the footprint of the upland soil cap, and ICs. NAPL recovery was terminated by the EPA and the DEQ in 2011 because the performance standard for NAPL recovery was met; recovery rates were minimal and remaining NAPL at the site does not pose a threat to the Willamette River. ICs have yet to be completed to restrict groundwater use beneath the site.

Groundwater within and outside of the subsurface barrier wall remains contaminated with metals, PCP, PAHs, dioxins, and NAPL. Contaminated groundwater within the barrier wall is contained and is not migrating to the river. Outside the barrier wall, residual product in soil within the Former Waste Disposal Area (FWDA) results in elevated concentrations of PCP and PAHs and the presence of localized NAPL in groundwater. Despite the groundwater contamination in this area, monitoring of downgradient wells, surface water, and the sediment cap (inter-armoring, sub-armoring, and porewater in the organophilic clay) has demonstrated that the groundwater remedy is performing as designed and that groundwater is not adversely affecting the river.

The performance standards for the subsurface barrier wall are:

- Maintain contaminant concentrations in shallow, downgradient compliance wells (or sediment porewater) below the alternate concentration limits (ACLs) set forth in the ROD (EPA 1996):
  - Arsenic (III): 1,000 µg/L
  - Chromium (III): 1,000 µg/L
  - Copper: 1,000 µg/L
  - Zinc: 1,000 µg/L
  - PCP: 5,000 µg/L
  - Total PAHs: 43,000 µg/L
  - Dioxins/furans: 0.2 ng/L
- Minimize the transport of NAPL and communication of groundwater zones across the subsurface barrier wall.
- Minimize visible discharge of creosote to the Willamette River.
- Maintain contaminant concentrations in the Willamette River below background concentrations or less than the sediment cap performance standards for surface water.

As discussed in Section 6 of the Second Five-Year Review Report (DEQ/EPA 2006), the EPA determined that ACLs were not valid as substitutes for the EPA's MCLs in groundwater. Because of this determination, the DEQ and EPA anticipate that amended groundwater cleanup goals for the site will be established in a ROD Amendment consistent with groundwater cleanup goals for the Portland Harbor Superfund Site ROD, expected in 2016. After new groundwater cleanup goals are established in a ROD Amendment, the Final O&M Plan will be revised to reflect the new cleanup goals.

4.2 Groundwater Flow Direction and Gradient Assessment

Manual NAPL and groundwater level data were collected during site-wide semiannual monitoring events conducted on June 9, 2015, and October 2, 2015; continuous water levels were also collected using dataloggers installed in selected monitoring wells. The current monitoring well network is shown on Figure 4-1. This section summarizes groundwater flow based on the 2015 water level measurements.

4.2.1 Horizontal Flow Direction and Gradients

Manual fluid measurements were collected during or immediately following low tide in the Willamette River. Shallow groundwater elevation contour maps were developed for each semiannual event during what is typically the seasonal high (June) and low (October) river stage (Figures 4-2 and 4-3, respectively). Weather in 2015 was unusually dry and warm, and the highest water levels were observed in December 2014 through February 2015. The water levels in June 2015 were lower than usual due to the lack of snowpack (and thus snowmelt/runoff) in the Cascades. The groundwater and NAPL elevation data are included in Table 4-1 (June 9, 2015) and Table 4-2 (October 2, 2015).

As shown in the shallow groundwater contour maps (Figures 4-2 and 4-3), the shallow horizontal groundwater gradient within the barrier wall is independent of the gradient outside the barrier wall. This demonstrates that the barrier wall has effectively cut off the hydraulic connection between the shallow groundwater zone inside and outside of the barrier wall. The groundwater gradient inside the barrier wall remains relatively flat (typically less than 0.002 foot per foot [ft/ft]) compared to the slightly steeper groundwater gradients (ranging from 0.002 ft/ft to 0.03 ft/ft) outside the barrier wall that are directed westerly toward the river and Willamette Cove. When the Willamette River reaches approximately 12 to 15 feet NAVD88, which typically occurs in the winter and spring and often peaks in June with the snow melt, the gradient partially reverses within the barrier wall near MW-36s in the northwest corner. This is because of the deep hydraulic connection through sand at the base of the western edge of the barrier wall where the reversal in vertical gradient to an upward gradient when the river level exceeds the groundwater level within the barrier wall area. The Willamette River stage peaked earlier than usual in 2015, between late November 2014 and February 2015, and the lack of snowpack didn't produce the peak typically observed in late spring. Therefore, a significant flow reversal within the barrier wall area was not observed in June. The gradient within the barrier wall area in June, with a 2.2-foot variation between MW-48s in the eastern end and MW-36s in the western end, was only slightly greater than the 1.6 foot variation in October.

Historical and annual hydrographs were prepared using the 30-minute pressure transducer data from paired monitoring wells located inside and outside the barrier wall as shown on Figures 4-4 through 4-11. The 11 site wells containing transducers are shown on Figure 4-1 and include two shallow and deep paired well clusters (MW-36s/37s, MW-36d/37d, MW-44s/45s, and MW-44d/45d) along the riverfront portion of the barrier wall, one shallow well pair (MW-52s/53s) on the upland side of the barrier wall, and one shallow interior well (EW-1s). The hydrographs compare water level elevations for selected well pairs to river stage elevation[3] and precipitation data[4]. The hydrographs show water levels in wells through the October 2015 semiannual monitoring event. Breaks in the monitoring well data are due to malfunctioning transducers, as further discussed in Section 4.5. Water level data beyond this date will be included in the 2016 Annual Report.

The hydrographs document groundwater elevation differences and assess barrier wall performance over time. Clear differences in the groundwater elevations between shallow wells within, and directly outside of the barrier wall demonstrate that the barrier wall is effectively isolating the groundwater within the barrier wall.

[3] River stage data were recorded every 30 minutes from US Geological Survey (USGS) station number 14211720 (USGS 2015a). This station is located on the upstream side of the Morrison Bridge (River Mile [RM] 12.8). River stage elevation data reported by the USGS are relative to the Portland River Datum at this location. The river stage data are corrected to NAVD88 at the site (approximately RM 7) by adding 5.001 feet to the USGS reading.

[4] Precipitation data shown on Figures 4-4 through 4-11 were obtained from the Astor Elementary School rain gauge located approximately 0.5 mile from the site. Daily totals were obtained from the City of Portland Hydra Network available on the USGS Web site (USGS 2015b).

4.2.2 Vertical Flow Direction and Gradients

Vertical gradients inside and outside the barrier wall along the Willamette River were observed in monitoring well clusters MW-36/MW-37 and MW-44/MW-45. The hydrographs for these wells (Figures 4-8 through 4-11) indicate that the deep groundwater zone is in direct hydraulic connection with the river. The deep zone both inside and outside of the barrier wall closely mimics the river stage, both in elevation and timing, with a small vertical gradient that varies upward and downward with the tidal changes. The exterior shallow wells, also in hydraulic connection with the river, show about a quarter cycle delay from river fluctuations and have dampened amplitude in comparison with the deeper wells.

The muted or nonexistent response of interior shallow wells compared with the intermediate and deep zone wells suggests a clear hydraulic disconnect between the shallow aquifer within the barrier wall and the deeper water-bearing zones. The location where the response is greatest, but still significantly muted, is in well MW-36s (Figures 4-6 through 4-9), where a hydraulic connection exists at the base of the barrier wall. While a muted response of well MW-36s to changes in daily river stage elevation is still observed, water levels in the shallow interior wells MW-44s and EW-1s are virtually non-responsive to the changes in the Willamette River stage (Figures 4-10 and 4-11 for MW-44s, and Figures 4-6 and 4-7 for EW-1s). This reflects the presence of a confining silt layer between the shallow and intermediate zones near wells MW-44 and EW-1s.

Although precipitation in the Willamette River watershed ultimately affects the stage of the river, direct precipitation near the site appears to play a minor role in determining the water levels of wells within the barrier wall and along the river. The Resource Conservation and Recovery Act (RCRA)-style soil cap was designed to divert precipitation so that little infiltration occurs within the barrier wall. Although some infiltration occurs along the fringes of the soil cap and within the riparian zone, the volume of infiltration is minimal. Between the barrier wall and the river, precipitation inputs are vastly overshadowed by the response of groundwater to variations in river stage. The shallow zone up-gradient or cross-gradient from the barrier wall appears to react subtly to precipitation and is less connected to the river because of its distance from the river and the presence of the barrier wall, which is sealed into the underlying silt. One location where infiltration may influence groundwater elevation and flow path is in the retention pond (Figure 1-3) that receives diverted runoff from the soil cap. Historical water level data indicates that the groundwater gradient in this area is flat, and that there may be a slight groundwater mound east of the soil cap. See Section 4-4 for additional information regarding groundwater quality in the area of the retention pond.

The hydrographs illustrate a net vertical gradient between the shallow and deep water-bearing zones, which continues to be slightly downward inside the barrier wall, similar to vertical gradients measured in 2008 through 2014. The net downward gradient is greater inside the barrier wall because the net shallow groundwater elevation inside the barrier wall continues to be slightly elevated compared to the net river stage. The net vertical gradient outside the barrier wall on the river side is small and varies upward and downward according to the trends of the Willamette River. Neutral or upward vertical gradients occurred when the river stage was at a higher elevation for a prolonged period, which occurred several times between late November 2014 and February 2015.

4.3 NAPL Gauging and Monitoring Assessment

Between February 1993 and April 2011, approximately 6,550 gallons of NAPL were extracted from site wells. Because recovery was slow and there was uncertainty about the benefits of ongoing recovery, a NAPL investigation in the FWDA outside the barrier wall (the remaining area with active NAPL recovery) was conducted in 2011. Based on the findings from the NAPL investigation (Dense Non-Aqueous Phase Liquid [DNAPL] Data Gap Investigation; HC/GSI 2011a) and extensive monitoring of the sediment cap (described in the Third Five-Year Review Report [DEQ/EPA 2011]), the DEQ and EPA decided to discontinue NAPL extraction on April 20, 2011. Subsequent monitoring of the post-extraction NAPL thickness in the FWDA was conducted in 2011 (HC/GSI 2011a), and the results supported the regulatory decision and confirmed that the residual NAPL in the FWDA is isolated and stable and does not pose a risk to the Willamette River. To confirm that this remains the case and to continue to evaluate the functional performance of the barrier wall and soil cap, NAPL presence and thickness continues to be monitored during the semiannual monitoring events.

Measurable quantities of NAPL were present in 12 site wells (EW-1s, EW-8s, EW-10s, EW-15s, EW-18s, EW-23s, MW-10r, MW-20i, MW-22i, MW-56s, MW-Ds, and MW-Gs) gauged semiannually in 2015. Figures 4-12 and 4-13 show the locations of wells that contained measurable quantities of light NAPL (LNAPL) and/or DNAPL for the June and October 2015 monitoring events, respectively. Tables 4-1 and 4-2 provide semiannual NAPL gauging measurements. Figures 4-14 through 4-24 show the NAPL and groundwater elevations versus time in individual wells that routinely contain NAPL. A NAPL thickness figure has not been prepared for well MW-10r because of the limited appearance of LNAPL in this well. The screened interval elevations and the well depth are also shown. The thickness of LNAPL can be calculated by subtracting the LNAPL elevation (when LNAPL is present) from the groundwater elevation. Similarly, the DNAPL thickness is represented by the difference between the DNAPL elevation and the well depth elevation.

Given that NAPL within the barrier wall is constrained laterally by the barrier wall, NAPL observations within and outside of the barrier wall are discussed separately below.

4.3.1 Outside the Barrier Wall

The only area where NAPL is observed routinely outside of the barrier wall is next to the northwest corner of the enclosure that corresponds to the FWDA (Figure 1-3). In 2015, measureable quantities of NAPL were observed in four wells (EW-10s [DNAPL], MW-20i [DNAPL], MW-Ds [DNAPL], and MW-Gs [DNAPL]) in this area. As shown on Figures 4-14 through 4-17, the NAPL thicknesses measured in wells EW-10s, MW-20i, MW-Ds, and MW-Gs in 2015 are generally stable since NAPL recovery was discontinued in April 2011. This is consistent with historical observations and supports the conclusion that NAPL observed in the FWDA is localized and stable. There is no evidence of NAPL mobility either across the barrier wall or to the Willamette River.

4.3.2 Inside the Barrier Wall

During semiannual monitoring, measurable LNAPL was present in five wells (EW-1s, EW-15s, EW-23s, MW-10r, and MW-56s) within the barrier wall. Figures 4-18 through 4-21 show the elevation of LNAPL and shallow groundwater versus time in wells EW-15s, EW-23s, MW-56s, and EW-1s, respectively. As shown in these figures, the LNAPL thickness is generally greater when the groundwater elevation is low. This is the result of gravity drainage of LNAPL through the unsaturated zone when the water table drops. This pattern has been consistent since mid-2006 because LNAPL was not recovered inside of the barrier wall during this time (i.e., LNAPL thickness was not disturbed by recovery). Although the LNAPL thickness varies cyclically with changes in the groundwater elevation, the overall LNAPL thickness in these wells has remained stable. In monitoring wells EW-15s and EW-23s, the decrease in groundwater level during 2015 accentuates the LNAPL thickness, but the overall LNAPL levels are consistent with past trends.

DNAPL was detected during the 2015 semiannual monitoring events within the barrier wall near the former TFA (see Figure 1-5 for TFA location) in wells EW-1s, MW-22i, EW-8s, and EW-18s, as shown on Figures 4-21 through 4-24, respectively. The DNAPL thickness in well EW-1s (Figure 4-21) has been increasing slowly to a thickness of approximately 10 feet since mid-2011, after termination of a temporary recovery period in April 2011. The DNAPL thickness in well MW-22i is approximately 8 feet thick (Figure 4-22). Historically, DNAPL measurements in this well have been shown through extraction to be triggered by the presence of floating pin-sized globules of DNAPL and not a continuous layer of pure DNAPL. In well EW-8s, the DNAPL thickness has been generally stable since 2012, with the exception of the June 2014 semiannual monitoring event with a thickness of 4.9 feet and the October 2015 semiannual monitoring event with 2.9 feet DNAPL thickness. In the time between these two monitoring events, the thickness returned to the stable 2 feet (Figure 4-23).

Overall, both LNAPL and DNAPL appear to be stable and there is no evidence of their mobility either across the barrier wall or to the Willamette River.

4.4 Infiltration Pond MW-59s Groundwater Quality Assessment

The soil cap remedy was completed in 2005. A component of the soil cap is the infiltration pond at the southwestern corner of the site, which was constructed to collect surface water runoff from a portion of the upland cap. A groundwater monitoring well, MW-59s, was installed downgradient from the infiltration pond in 2005 to monitor changes in contaminant levels in groundwater. As specified in the O&M Plan (HC/GSI 2010) in 2010, four quarters of groundwater samples were to be collected from MW-59s to evaluate the potential for subsurface contaminants to be mobilized by the upland cap infiltration pond. A total of seven samples were collected from MW-59s through 2010 and analyzed for PAHs and total metals including arsenic, chromium, copper, iron, and zinc. Following the 2010 sampling, the O&M plan prescribed sampling every five years.

In October 2015, the well was sampled. Sampling details are provided in Appendix D. Concentrations for chromium, copper, and zinc remained relatively constant in comparison to prior data from MW-59s. Five low-molecular weight PAHs and two high-molecular weight PAHs, including one carcinogenic PAH, were detected at relatively low levels. Metals and PAH concentrations appear to have stabilized at low levels (Appendix D; Figure E-2); however, arsenic concentrations have slightly increased since

2006. There does not currently appear to be a risk of subsurface contaminant mobilization by the infiltration pond, but monitoring should continue every five years.

4.5 Groundwater Remedy Maintenance Activities

Table 4-3 provides the groundwater O&M activities conducted in 2015. Transducer data loggers were inspected in 2015 during semiannual monitoring events. Due to the age of the transducers on-site, transducers malfunctions have been increasing over time as can been seen in the data breaks in Figures 4-4 through 4-11. Over the next three years, all of the transducers will be replaced on-site. During the June 9, 2015 semiannual monitoring event, new transducers were installed in MW-36d, MW-36s, MW-37d, and MW-53s.

Between the September 2014 and June 2015 monitoring events, the transducer in well MW-45d malfunctioned due to water damage, creating a data gap in the well between March and June 2015. A spare transducer was installed during the June 2015 semiannual monitoring event. When downloading the data from the transducer in well MW-45d during the September 2015 semiannual monitoring event, it was discovered that the replacement transducer had malfunctioned approximately two months after installation in June 2015. The data appear to be erroneous and are inconsistent with historical trends in well MW-45d; therefore, the data are not used in this report. Currently, there is no transducer in MW-45d, but a new transducer will be purchased and installed in this well and three other wells in 2016.

4.6 Summary of Groundwater Remedy Performance

Hydraulic conditions are consistent with previous years, verifying that the remedy continues to function as designed. Groundwater monitoring data are used to understand groundwater flow conditions inside and outside of the barrier wall. This information is evaluated to determine whether the barrier wall and impermeable RCRA-type soil cap are functioning as designed.

The semiannual NAPL gauging and water level monitoring events were conducted on June 9 and October 2, 2015. There was no measureable LNAPL in wells outside the barrier wall. DNAPL was measured in four wells outside the barrier wall. The DNAPL in these wells has remained stable with some variation due to temperature and pressure (i.e., water level variation).

Horizontal gradients outside the barrier wall are greatest during periods of high precipitation and/or low river levels and decrease during periods of low precipitation and/or high river levels. Groundwater gradients inside the barrier wall remain flat and generally to the west (except when peak river stage causes a gradient reversal), while outside and up-gradient of the barrier wall, shallow groundwater flow is diverted around the barrier wall to the northwest and south. While most of the monitoring wells mimic the stage variations in the Willamette River, the oscillations in the shallow interior wells are delayed and muted and likely are the result of changes in pressure at depth rather than a hydraulic connection to the river. The large differences in shallow groundwater elevations in wells within the barrier wall compared to directly outside the barrier wall indicate that these zones are hydraulically separate. Under stable river conditions, vertical groundwater gradients are generally slightly downward inside the barrier wall in the FWDA and former TFA, with the exception of small upward gradients observed during high river levels in the former TFA.

Based on the findings from the DNAPL Data Gap Investigation (HC/GSI 2011a), subsequent monitoring of the post-extraction NAPL thicknesses in wells in the FWDA, and extensive monitoring of the sediment cap (described in the Third Five-Year Review Report [DEQ/EPA 2011]) and groundwater, the decision to discontinue NAPL recovery is justified, and residual NAPL remaining in the FWDA does not pose a threat to the Willamette River.

Based on the evaluation of groundwater data from 2005 through 2015, the barrier wall and impermeable soil cap are functioning as designed to divert groundwater flow around and prevent rainwater infiltration into NAPL source areas contained within the barrier wall and NAPL contained within the barrier wall is prohibited from migrating to the Willamette River.

5.0 VEGETATION MANAGEMENT

This section summarizes the vegetation management and monitoring activities for the reporting period January 1, 2015 through December 31, 2015. Vegetation management activities on the upland cap were conducted in accordance with the Vegetation Management Plan (HC/GSI 2011b).

The upland cap was constructed during a two-year period beginning in 2004 with the re-grading of the Willamette River bank. The 6-acre Riparian Area cap was installed and tied into the in-water sediment cap. In 2005, a 34-acre multiple-component designed soil cap was constructed to complete the upland cap. The City of Portland, Bureau of Environmental Services (BES), entered into an Intergovernmental Agreement (IGA) with the DEQ to provide vegetation planning and vegetation management services for the upland cap from 2005 through 2010. In February 2006, the soil cap was planted with native grasses, plants, and trees, and an irrigation system was installed. After the fifth growing season, BES determined that the vegetation was fully established and the irrigation system was no longer needed.

Overall, the planting and vegetation management goals have been met. The irrigation system and piping have been inactive since 2009 and were decommissioned in 2015. Semiannual noxious weed control activities, including herbicide application, were conducted by BES from spring 2006 through spring 2010. Hart Crowser assumed vegetation management responsibilities at that time. A private subcontractor (Native Ecosystems Northwest) provided herbicide services to targeted areas of noxious weeds as needed starting in the fall of 2010. Herbicide application was temporarily discontinued in June 2013 when nearby desirable native vegetation was observed to be stressed and dying. No herbicide was applied in 2014 or 2015, but will resume in 2016 to control noxious weeds at the site.

Rodents that inhabit the cap have damaged vegetation in the past; however, with the exception of some earlier targeted damage to the grand fir (*Abies grandis*) seedlings (BES 2010), there has been insignificant damage to other plantings. Rodent activities are monitored during quarterly site inspections. Vegetation damage from rodents was not observed during site visits in 2015.

5.1 Vegetation Management Components and Goals

The upland cap has five distinct components, each with corresponding goals and objectives for managing hydrology, soil, and wildlife habitat (Figure 5-1). These components are:

- Entrance Area;
- Impermeable Cap;
- Riparian Area;
- Stormwater Retention Pond and Drainage Swale; and
- Earthen Cap.

Performance standards to assess whether the planting goals in the DEQ/BES IGA for the entire upland cap are met include:

- Bare soil spaces are small and well dispersed.
- Soil movement, such as active rills or gullies and soil deposition around plants or in small basins, is absent or slight and local.
- Plant litter is well distributed and effective in protecting the soil with few or no litter dams present.
- Native woody and herbaceous vegetation, and germination micro-sites, are present and well distributed across the site.
- Vegetation structure results in rooting throughout the available soil profile.
- Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy, and dominant over undesired competing vegetation.
- Stream banks have less than 5 percent exposed soil with margins anchored by deeply rooted vegetation or coarse-grained alluvial debris.
- A continuous corridor of shrubs and trees provides shade for the entire stream bank.

Specific goals were set for planting the Riparian Area to create habitat, including elements such as large woody material, riparian vegetation for food, habitat cover and shelter, and shading (NOAA 2004).

5.2 Baseline Conditions

In 2010, the BES determined that the vegetation had been fully established, as discussed in its final 2010 Vegetation Management Report (BES 2010). Hart Crowser assumed responsibility for the vegetation management at that time. In June 2011, a Hart Crowser ecologist inspected the upland cap to confirm the vegetation conditions discussed in the report. The inspection included visual observation of vegetation planting areas, species identification (native, non-native, and invasive), growth, density, general coverage, and relative health of vegetation throughout the site. Photographic documentation of the inspection was completed to establish a baseline to evaluate the progress of future vegetation treatments and the qualitative observations at select site locations. These Photograph Locations are shown on Figure 5-1 and the photographs are provided in Appendix E, Photograph Log – Vegetation Observations. The following sections summarize the initial conditions and observations made during the baseline visit in June 2011.

5.2.1 Riparian Area

The Riparian Area is divided into two components: upper and lower. Each component received similar vegetation treatments (Photograph Locations 8 and 9). The lower component is subject to Willamette River stage fluctuations, which influence vegetation conditions at its lower edge during high-water events.

Lower Component. The lower component originally was planted with a variety of native trees and shrubs including: Oregon ash (*Fraxinus latifolia*), black hawthorn (*Crataegus suksdorfii*), cascara (*Rhamnus purshiana*), hardhack (*Spiraea douglasii*), red-osier dogwood (*Cornus sericea*), Pacific ninebark (*Physocarpus capitatus*), swamp rose (*Rosa pisocarpa*), river willow (*Salix fluviatilis*), Sitka willow (*Salix sitchensis*), rigid willow (*Salix rigida*), Piper's willow (*Salix piperi*), and black twinberry (*Lonicera involucrata*). Groundcover species planted in the lower component included: California brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), meadow barley (*Hordeum brachyantherum*), slender hairgrass (*Deschampsia elongata*), spike bentgrass (*Agrostis exerata*), globe gilia (*Gilia capitata*), lupine (*Lupinus albicaulis*), and Canada goldenrod (*Solidago canadensis*). Tree plantings were not installed at lower elevations in the lower component of the Riparian Area because of the potential for late season inundation from high river levels. Instead, appropriate shrubs, primarily willows, were installed along the lower edge of this component to provide food and shade. By 2011, a significant quantity of large woody debris were observed along the entire length of the lower edge. Trees and shrubs within the lower component were observed to be well established and growing both vertically and laterally. No indications of stress were noted. Localized areas of exposed TRM were observed along the length of the lower edge of the TRM, likely because of river fluctuations and movement of large woody debris along the shoreline. Thistle (*Cirsium arvense*) was the most common noxious weed with lesser quantities of knapweed (*Centaurea Sp*.) and butterfly bush (*Buddleia davidii*) present.

Upper Component. The upper component was planted with native vegetation including: red alder (*Alnus rubra*), big-leaf maple (*Acer macrophyllum*), Western red cedar (*Thuja plicata*), madrone (*Arbutus menziesii*), grand fir, Garry oak (*Quercus garryana*), Oregon ash, black hawthorn, cascara, red elderberry (*Sambucus racemosa*), blue elderberry (*Sambucus cerulea*), Nootka rose (*Rosa nutkana*), tall Oregon-grape, snowberry (*Symphoricarpos albus*), red-flowering currant (*Ribes sanguineum*), oceanspray (*Holodiscus discolor*), red-osier dogwood, twinberry, and Pacific ninebark. Groundcover species in the upper component are identical to those in the lower component. Similar to the lower component, trees and shrubs were well established and appeared healthy by 2011. Trees were 6 to 12 feet tall. Few areas containing bare ground were observed. Thistle and knapweed were present in small quantities among the groundcover plantings throughout the upper component.

Summary. In general, the Riparian Area components appeared to be performing well by 2011, with the installed trees and shrubs looking healthy and spreading. Groundcover species provided relatively good coverage of the soil, with the exception of a few areas containing bare ground and observed TRM along the shoreline. In addition, large woody debris were present throughout the lower component and in smaller quantities within the upper component. Thistle, knapweed, and butterfly bush continue to grow within the Riparian Area.

5.2.2 Upland Area

The Upland Area is divided into three components—the earthen cap, the stormwater retention pond/drainage swale, and the impermeable cap (Figure 5-1). A variety of native trees, shrubs, and herbaceous species are present on the earthen cap (Photograph Locations 1, 2, 3, and 5, Appendix E). Native shrubs and herbaceous species are present in the stormwater retention pond/drainage swale (Photograph Location 4, Appendix E). Meadow grasses and herbs are present on the impermeable cap (Photograph Location 6, Appendix E).

Earthen Cap Component. Originally, this component was planted with a variety of native trees, shrubs, and grasses including: Garry oak, Ponderosa pine (*Pinus ponderosa*), black hawthorne (*Crataegus douglasii*), madrone, snowberry, blue elderberry (*Sambucus cerulea*), Oregon-grape (*Mahonia aquifolium*), Nootka rose, red-flowering currant, oceanspray, serviceberry (*Amelanchier alnifolia*), and mock orange (*Philadelphus lewisii*). Herbaceous species installed on the earthen cap included chewings fescue (*Festuca rubra var. comutata*), California brome, meadow barley, slender hairgrass, Spanish clover (*Lotus purshiana*), claria (*Clarkia amoena*), globe gilia, meadow checkermallow (*Sidalcea campestris*), large-leaved lupine (*Lupinus polyphullus*), and Canada goldenrod. In 2011, nearly all of these plant varieties remained on the earthen cap and appeared to be well established and growing both vertically and laterally. Nootka rose had dominated the northwest corner of the earthen cap component; however, some of the Nootka rose appeared to have been highly stressed or had died, and most were regenerating. The black hawthorn had grown to 6 to 8 feet tall. Localized areas of moss were observed within the grasses and herbaceous vegetation. Small quantities of knapweed and thistle were also present.

Stormwater Retention Pond/Drainage Swale Component. This component was planted with a native shrub overstory consisting of hardhack, Sitka willow, and Piper's willow (Photograph Location 5, Appendix E). Volunteer red alder and black cottonwood (*Populus balsamifera*) were observed among the shrub plantings. Understory herbaceous species were planted in the pond and swale area based on anticipated inundation within the pond and swale area and included: water plantain (*Alisma plantago aquatica*), slough sedge (*Carex obnupta*), soft stem bulrush (*Scirpus tabernaemontanii*), small-fruited bulrush (*Scirpus microcarpus*), Western sloughgrass (*Beckmania syzigachne*), Western mannagrass (*Glyeria occidentalis*), tufted hairgrass (*Deschapsia cespitosa*), slender hairgrass, meadow barley, spike bentgrass, meadow foxtail (*Alopecuris geniculatus*), self heal (*Prunella vulgaris*), Spanish clover, and gumweed (*Grindelia integrifolia*). By 2011, the shrub plantings in the pond and swale area were well established and appeared healthy. Many of the grasses and herbs in the pond area did not survive because the infiltration of surface runoff limits moisture and the understory is dominated by sand and bare ground. Given that the shrubs were well established, the area is flat, and erosion generally was not occurring, replanting grasses and herbs was not recommended at that time. No noxious weeds were observed in this component.

Impermeable Cap Component. This component was seeded with a grassland mixture including: chewings fescue, California brome, meadow barley, slender hairgrass, large-leaved collomia (*Collomia grandiflora*), globe gilia, large-leaved lupine, and Canada goldenrod. By 2011, grassland species provided excellent cover of the impermeable cap. Moss was present in localized areas where grasses and herbs did not become established. Small quantities of knapweed, thistle, skeletonweed (*Chondrilla juncea*), and dandelion (*Taraxacum officinale*) were present within the southwestern portion of this component and did not appear to be encroaching on desirable vegetation.

Summary. In general, the Upland Area appeared to be performing well in 2016 with the installed trees and shrubs looking healthy and spreading on the earthen cap component, shrubs well established within the stormwater retention pond/drainage swale component, and good soil coverage and vegetative diversity on the impermeable cap component. Groundcover species provided excellent coverage of the ground, with the exception of a few sections containing bare ground and the relatively bare understory in the pond area. Limited quantities of noxious weeds were observed in the Upland Area and were primarily limited to the southwestern edge of the impermeable cap component.

5.3 Vegetation Observations

On June 9 and December 30, 2015, a Hart Crowser ecologist inspected the upland cap to assess the current conditions as compared to the baseline conditions observed in June 2011. Qualitative data were recorded on species composition, cover and density of vegetation, growth and vigor, and presence of noxious weeds. The Photograph Log (Appendix E) documents conditions at select Photograph Locations during the June 2015 inspection. Some of these photographs are paired with photographs from the June 2011 baseline inspection for a qualitative assessment of the site. Photograph Locations are shown on Figure 5-1. Due to particularly dry conditions during spring and early summer, a drought tolerance assessment was conducted on July 21, 2015. The assessment indicated that many trees and shrubs were stressed within the Riparian Area. As a result, irrigation water was applied on July 27 and August 18, 2015 to help reduce water stress. In December 2015, new plantings were installed and amended soil was added to stabilize eroded shoreline areas and protect the underlying soil cap. Post-planting photographs of the shoreline repair are provided in Appendix A (Photographs 14, 15, and 16).

5.3.1 Riparian Area

Lower Component. During the June 2015 site visit, trees and shrubs in the lower component were observed to be well established and growing both vertically and laterally. Grasses provide good ground coverage. The survey was conducted in early June before the onset of drought conditions. Many of the trees and shrubs planted in this area have reached a height of 8 to 20 feet. As the tree species continue to develop, they will increase shading along the shoreline of the river. Water levels in the Willamette River were low, and the mid- to upper-beach face was exposed (Photograph 7, Appendix E). Thistle was prevalent between shrubs and trees, particularly between the lower and upper Riparian Areas. St. John's wort (*Hypericum sp.*) was common at the top of the bank where the vegetation meets the shoreline. Smaller areas of dock (*Rumex, sp.*) and butterfly bush were also present.

During the July drought tolerance assessment, many trees and shrubs within the lower Riparian Area were found to be stressed by heat and lack of water. Oregon ash appeared to be the most stressed tree within the entire Riparian Area (approximately 80 percent stressed), with many trees showing yellowing or brown leaves. Oregon ash has a fairly high tolerance to summer drought; however, it generally ceases growth and drops its leaves when conditions become hot and dry. The red osier dogwood and nootka rose within this area appeared to be highly stressed, with many of the dogwood featuring wilty or rolled brown leaves. This was also the case for exposed ninebark and hardhack plants within the lower Riparian Area. In general, plants within the western half of the Riparian Area appeared more stressed than those within the eastern half.

In December 2015, it appeared that most of the Oregon ash and red osier dogwood had survived the dry summer. Oregon ash trees were budding, and the limbs appeared hardy and healthy. It was difficult to identify noxious weeds during this survey since much of the grasses were matted down and covering up the vegetation. In addition to the thistle previously observed, some black mustard was observed near Photograph Location 7.

In June 2015, localized areas of exposed TRM were observed along the lower edge of the Riparian Area. As detailed in Section 2.3, these areas were repaired in December 2015 by installing new plantings and replacing soil under the TRM. This will encourage groundcover growth and help stabilize the eroding areas. Large woody debris were present along the shoreline in June, but had increased significantly by December.

Upper Component. Native trees and shrubs in the upper component appeared to be performing fairly well. Ponderosa pine and grand fir were 15 to 20 feet tall. Douglas hawthorne, Oregon grape, and elderberry appear to be thriving. Groundcover plantings also appeared healthy. The summer drought conditions did result in the mortality of a total of approximately 20 grand fir and cedar trees. Although these trees were provided with a deep soak during the irrigation events, it was surprising to find that many of these 10 year old conifers turned brown and died. Many of the trees that died were in close proximity to another conifer (less than 5 feet apart), so they likely competed with each other for water and nutrients. It is likely that some thinning in these circumstances will be beneficial for the future health of the trees. However, it will be very important to be sure that the remaining trees receive enough water to survive, particularly if drought conditions occur during spring/summer 2016.

During the July visit, the red osier dogwood and nootka rose within this area appeared to be highly stressed, with many of the dogwood featuring wilty or rolled brown leaves. Several big leaf maples also appeared stressed in the middle of the Riparian Area. Some were surviving well on their own or when shaded by a larger tree (e.g. elderberry), but a few exposed maples had either perished or featured brown, wilty leaves. Many of the stressed deciduous trees and shrubs that survived have recovered, due in part, to heavy rains during fall 2015.

Summary. The extremely dry conditions during spring and summer 2015 caused significant stress on the riparian community. Watering events provided a deep soak to stressed vegetation, but some trees and shrubs were lost due to the unusually hot and dry conditions. Despite these conditions, the upper and lower components appear to be performing relatively well with many of the installed trees and shrubs looking healthy and spreading. Groundcover species are providing good coverage of the site soils, with the exception of a few small areas of bare ground. The new shoreline plantings are expected to reduce erosion and enhance the lower riparian community. Significant amounts of large woody debris were present during December 2015 along the shoreline and the lower part of the Riparian Area (Photographs 7 and 9, Appendix E). These large woody debris provides habitats for birds, small mammals, and other wildlife using this portion of the site. Low to moderate quantities of thistle, St. Johns wort, and butterfly bush continue to grow in the Riparian Area and will be treated with herbicide in 2016 to prevent their further spread within this area.

5.3.2 Upland Area

Earthen Cap Component. Tree and shrub plantings on the earthen cap were generally healthy and growing well (Photographs 2, 3, and 5, Appendix E). Ponderosa pine, Oregon grape, and elderberry were performing the best. A few stressed oaks were observed at the north end of the site. Trees and shrubs ranged in height from approximately 6 to 15 feet. Herbaceous species provided full coverage of the ground. During our June 2015 site visit, gumweed (native plant) was frequently observed throughout the site. Common mullein were flowering and prevalent within the northwest portion of the earthen cap. Common vetch was blooming and fairly abundant along the eastern portion of the cap. Localized areas of moss were observed in the herbaceous layer. Skeletonweed was common in the northern corner of the earthen cap and should be treated with herbicide in spring 2016.

Stormwater Retention Pond/Drainage Swale Component. Vegetation in the drainage swale area was well established and generally appeared healthy. Sitka willow had grown to 10 to 15 feet tall, and the Piper's willow were 6 to 8 feet tall. Volunteer cottonwoods were observed to range from 20 to 25 feet tall. Alder and willow were present and expanding around the periphery of the stormwater retention pond, but some dead and stressed shrubs were observed in the pond and its outlet (Photograph 4, Appendix E). Most of the herbaceous and emergent plantings in this component did not survive because of the sandy nature of the soil, which does not provide adequate moisture retention and inundation to support all of the originally installed plant species during the dry months of the year. Limited amounts of dock and clover were observed in the vicinity of the stormwater retention pond.

Impermeable Cap Component. The grassland species on the impermeable cap provided excellent coverage of the ground (Photograph 6, Appendix E). Gumweed was observed along the southwestern edge of the impermeable cap and provides increased diversity in this area. The remaining grasses and herbs were thriving. Skeletonweed rosettes were common along the southern portion of the impermeable cap. This species was also noted in the June 2014 site visit. Spot herbicide treatment is recommended to prevent these weeds from continuing to expand their range.

Summary. The Upland Area components were generally performing well with the exception of small areas of alder and willow in the stormwater retention pond and its riprap-lined outlet channel. Groundcover (herbaceous) species provided excellent coverage of the ground with the exception of a few areas containing bare ground and the relatively bare understory in the pond area. Skeletonweed was abundant in the Upland Area, with greatest densities found in the western portion of the impermeable cap and the northern portion of the earthen cap.

5.4 Vegetation Maintenance Activities

This section describes activities conducted to maintain vegetation in 2015. The general planting goals (NOAA 2004) continue to be met.

5.4.1 Noxious Weed Control

A preventive control approach continues to be implemented as part of an ongoing effort to control the spread of noxious weed species. Spot spraying was last completed in June 2013. Following this event, several areas of desirable native plants were observed to be stressed in the immediate vicinity of spot spraying activities. Based on these observations, and the reduced number of noxious weeds, noxious weed control efforts were not completed in 2014 or 2015. Native plants stressed from spraying have begun to return to normal growth. Due to the increased presence of noxious weeds on the site (particularly skeletonweed in the upper cap area and thistle in the Riparian Area), weed control is planned for May 2016. Care will be taken to limit the effects of the herbicide on native plant species.

5.4.2 Irrigation

Due to exceptionally dry conditions during spring and summer 2015, irrigation water was applied throughout the upper and lower Riparian Areas to help alleviate stressed vegetation. The water was applied with a water tank trailer and pressurized firehose. Effort was taken to apply water to the soil above the root systems. In cases where the vegetation density was too thick, water was applied on top of the vegetation. Care was taken to prevent damage to the vegetation or soil erosion from water released from the firehose. The water infiltrated well into the soil over the entire site and did not result in significant runoff. This approach was effective in providing a deep soak to trees/shrubs within the most stressed portion of the Riparian Area. On July 27, 2015, approximately 5,450 gallons of water were applied on stressed plants throughout the north (downriver) half of the Riparian Area (both lower and upper zones). On August 18, 2015, approximately 4,000 gallons of water were applied on the south end of the Riparian Area. The watering targeted all stressed trees and shrubs, although greater emphasis was placed on the vegetation that appeared to be the most stressed, which included Oregon ash, red osier dogwood, and nootka rose.

This irrigation method was used because the original irrigation system installed after cap construction was no longer operational and was decommissioned in December 2015. In 2011, it was not anticipated that further irrigation would be needed beyond the five year post-planting period. It is anticipated that additional irrigation water may be needed in 2016, particularly if the site is subject to similar drought conditions as 2015. It will be particularly important to provide water to the new shoreline plantings and prevent further loss of conifers. The water tank trailer and firehose worked well to apply water throughout the site and this same technique could be used again in 2016, if needed. Conditions will be monitored during June 2016 and, if dry conditions are prevalent, another drought assessment survey will be conducted in early summer 2016 to determine if additional watering is needed.

5.5 Vegetation Performance Summary

Overall, the tree, shrub, and groundcover plantings are performing well throughout the site. Although alder and willow are present along the periphery, much of the stormwater retention pond remains barren. Groundcover species provide excellent coverage over much of the site. Noxious weeds continue to be present and will likely require ongoing management and control to prevent them from colonizing larger areas. Skeletonweed and thistle were the most notable noxious weeds observed in 2015.

The exceptionally dry summer conditions resulted in significant stress of the riparian community and other localized habitats across the site. Although the Oregon ash and red osier dogwood appear to have bounced back after fall rains, several conifers in the upper Riparian Area did not survive. This could be due to the high density of these trees and competition for food and nutrients during the summer drought. Although previous vegetation performance suggested that the irrigation system was no longer needed, Portland experienced record heat conditions during summer 2015, which required providing irrigation to trees and shrubs within the Riparian Area. Although some conifers were lost, the remaining trees should face less competition, which will help them thrive. When the site is monitored again in June 2016, we will have a better idea of how the site has recovered from the 2015 drought. Vegetation monitoring will continue to be performed during summer 2016 and additional watering will be provided as needed to help ensure survival of the plantings.

6.0 SUMMARY OF OVERALL REMEDY PERFORMANCE

Overall, the 2015 soil and sediment cap observations and inspections and groundwater monitoring revealed no significant change in remedy performance or areas of concern. The remedy continues to perform as designed and is protective of human health and the environment.

7.0 SUMMARY OF PLANNED ACTIVITIES FOR 2016

The Final O&M Plan with descriptions of O&M activities and a schedule for the next five years was completed by the DEQ with assistance from EPA, GSI, and Hart Crowser in March 2014.

Table 7-1 presents the soil cap O&M activities planned through 2021. Soil cap O&M activities in 2016 will consist primarily of quarterly inspections and routine maintenance. Semiannual inspections should be continued in 2016 to assess and monitor vegetation planting areas, species identification (native, non-native, and invasive), growth, density, and general coverage throughout the site. Noxious weed control activities will be completed in spring 2016 to maintain a thriving and functional riparian habitat. And additional equipment will be identified for potential decommissioning, including the leftover ACB and job trailers.

Table 7-2 presents the sediment cap O&M activities planned through 2021. In 2016, activities are expected to include quarterly inspections and routine maintenance.

The frequency of the groundwater monitoring activities through September 2021 are summarized in Table 7-3. The next groundwater quality sampling event will occur in 2020. Routine maintenance of the data logger transducers are also included as elements of groundwater O&M.

8.0 REFERENCES

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Table 2-1: Soil Cap O&M Activities in 2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency in 2015
Visual Inspections:	
Cap surface	January, April, July, October
Subsidence near EW-1s	January, April, July, October
Stormwater conveyance system	January, April, July, October
Security fencing	January, April, July, October
Warning signs	January, April, July, October
Abundance and survival of vegetation	January, April, June, July, October
Routine Maintenance and Monitoring:	
Manual removal of invasive plant	None
Targeted application of herbicides	None
Non-Routine Maintenance:	
Riparian area water events	August and September
Filling of potential animal burrow into the earthen cap	Periodically
Utilities Service:	
Water, electric, phone, alarm, solid waste, toilet	None

Table 3-1: Sediment Cap O&M Activities in 2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency in 2015
Visual Inspections (from shore):	
Warning buoys	January, April, July, October
Cap surface	January, April, July, October
Habitat quality	January, April, June, July, October
Routine Monitoring:	
Surface, Inter-Armoring, and Sub-Armoring Water Assessment	September-October
Organophilic Clay Assessment	September
Non-Routine Monitoring:	
Multibeam bathymetric surveys, side-scan sonar survey	None
Non-Routine Maintenance:	
Cut ACB cable loops	March
Shoreline vegetation repairs	December

Table 3-2: Surface, Inter-Armoring, and Sub-Armoring Water Sampling Locations, Type, Number, and Analyte Groups
2015 O&M Annual Report
McCormick and Baxter Superfund Site

Sampling Station ID	Sample Location							Sampling Interval(s) and Deployment Methodology (S=Field Staff from Shore; D=Diver Deployed; B=Field Staff from Boat; --=No Sample)			Field Duplicate Collected? (SW=Surface Water; IA=Inter-Armoring; -- No Sample)	Analytes [5]					
	Sample Coordinates (NAD83) [2]				Sample Elevation [3] (ft NAVD88)	Lowest Water Depth [4] (ft NAVD88)	Diver Water Depth at Deployment (ft NAVD88)	Surface Water	Inter-Armoring	Sub-Armoring							
	Northing	Easting	Latitude	Longitude				6-12 inches above sediment cap	Centered 6 inches into armoring layer	Approximately 18 inches below the top of the sediment cap		PAHs	PCP	As	Cr	Cu	Zn
Compliance Sampling Locations																	
A	704252.63	7628667.14	45.57657	-122.73977	3.29	2.0	--	S	--	--	--	1	1	1	1	1	1
B	704419.07	7628430.38	45.57700	-122.74071	5.26	0.1	--	S	S	--	--	2	2	2	2	2	2
C	704612.64	7628005.77	45.57750	-122.74239	0.24	5.1	10.0	D	D	--	IA	3	3	3	3	3	3
D	704671.38	7627647.06	45.57764	-122.74380	-3.96	9.3	13.0	D	D	--	--	2	2	2	2	2	2
E	704832.87	7627353.32	45.57806	-122.74496	-3.37	8.7	13.0	D	D	--	SW	3	3	3	3	3	3
F [1]	705298.30	7627312.63	45.57933	-122.74517	4.99	0.3	--	S	--	--	--	1	1	1	1	1	1
G	705265.49	7626841.16	45.57920	-122.74701	-18.13	23.4	26.0	D	D	--	--	2	2	2	2	2	2
H	705039.89	7627078.86	45.57860	-122.74606	-10.32	15.6	18.0	D	D	--	--	2	2	2	2	2	2
I	704559.44	7627525.49	45.57732	-122.74426	-33.85	39.2	38.0	D	D	--	--	2	2	2	2	2	2
J	704406.88	7627811.63	45.57692	-122.74313	-17.66	23.0	20.0	D	D	--	--	2	2	2	2	2	2
K	704246.23	7628056.82	45.57650	-122.74215	-13.98	19.3	16.0	D	D	--	--	2	2	2	2	2	2
L	704385.16	7628225.94	45.57690	-122.74151	4.36	1.0	5.0	D	D	--	--	2	2	2	2	2	2
Early Warning Sampling Locations																	
5	704581.45	7627999.77	45.57742	-122.74241	3.47	1.9	5.0	D	D	D	--	3	3	--	--	--	--
12	705194.50	7627234.03	45.57904	-122.74547	4.72	0.6	--	S	S	S	--	3	3	--	--	--	--
13 [1]	705298.30	7627312.63	45.57933	-122.74517	4.99	0.3	--	--	S	S	--	2	2	--	--	--	--
16	704288.78	7627815.11	45.57660	-122.74310	-29.44	34.8	41.0	D	D	D	--	3	3	--	--	--	--
Background Sampling Locations																	
1 (Upstream)	703738.51	7628587.04	45.57515	-122.74003	NA	NA	--	B	--	--	--	1	1	1	1	1	1
27 (Downstream)	705657.10	7626346.06	45.58024	-122.74898	-19.76	25.1	--	B	--	--	--	1	1	1	1	1	1
							TOTAL COUNT	**D=11; S=4; B=2; Total=17**	**D=11; S=3; Total=14**	**D=2; S=2; Total=4**	**2**	**37**	**37**	**26**	**26**	**26**	**26**
								D=24; S=9; B=2; Total=35									

Notes:

[1] The surface water compliance sampling location in Area F was co-located with the early warning inter-armoring and sub-armoring samples at sampling location number 13

[2] Northing and easting coordinates exist in the following coordinate system: North American Datum of 1983 (NAD83), Oregon State Plane North Zone, International Feet

[3] Elevations exist in the following coordinate system: North American Vertical Datum of 1988 (NAVD88) in units of feet.

[4] The passive sampler deployment period was from September 15, 2015 to October 6, 2015. The lowest river stage during deployment was 5.32 feet NAVD 88, recorded on September 22, 2015 at 9:30 am. The surface water cages for the nearshore stations 12 and 13/F were placed slightly offshore of the sediment probes in an effort to keep them submerged throughout the deployment period.

[5] Analytes include the following polyaromatic hydrocarbons (PAHs): acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene; pentachlorophenol (PCP); and the following metals: arsenic (As), chromium (Cr), copper (Cu), and zinc (Zn).

NA = not available.

Table 3-3: Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE LOCATION		Screening Criteria							Location A		Location B				Location C					
SAMPLE TYPE		1996 AWQCs[1]		2015 NRWQCs[2]		DEQ 2011 EPA-Approved AWQCs updated 2015 [3]		2011 MCLs updated 2015[4]	Surface Water		Surface Water		Inter-Armoring Water		Surface Water		Inter-Armoring Water		Inter-Armoring Water	
Sample ID		Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Maximum Contaminant Levels (MCLs)	MBSW1015-A		MBSW1015-B		MBIA1015-B		MBSW1015-C		MBIA1015-C		MBIA1015-C-Dup	
Deployment Date Time									9/15/15 16:12		9/15/15 15:33		9/15/15 15:33		9/16/15 9:15		9/16/15 9:15		9/16/15 9:15	
Sample Date Time									10/6/15 8:38		10/6/15 8:20		10/6/15 8:20		10/6/15 15:20		10/6/15 15:20		10/6/15 15:20	
CONTAMINANT OF INTEREST																				
Dissolved Metals (mg/L)																				
Arsenic		0.19		0.15	**0.00014**	0.15	0.0021	0.01	**0.0010**		*0.0015*	U	*0.0015*	U	*0.0015*	U	*0.0015*	U	*0.0015*	U
Chromium		0.21		0.074		**0.053**		0.1	--		0.002	U	--		0.002	U	0.00053		0.000079	
Copper		0.012		**0.0049**		0.0065			--		0.00011		--		0.00011		0.0051		0.0010	
Zinc		0.11		0.12	26	**0.066**	2.6		--		0.0026	B	--		0.02	B,U	0.0075	B	0.011	B
Pentachlorophenol (µg/L)		13		15	**0.04**	8.2	0.3	1	0.0004325	U	0.0004325	U	0.0004325	U	0.0004325	U	0.0004325	U	0.0004325	U
Polyaromatic Hydrocarbons (µg/L)																				
Acenaphthene	L	520			**90**		99		0.025	B	0.10	B	5.6	B	0.041	B	0.0079	B	0.0076	B
Acenaphthylene	L								0.00024		0.0010		0.012		0.00046		0.0001	U	0.0001	U
Anthracene	L				**400**		4000		0.00031		0.0012		0.057		0.00061		0.000064		0.000060	
Benzo(a)anthracene	H,C				**0.0013**		0.0018		0.00017		0.00019		0.00010		0.00014		0.000013	U	0.000013	U
Benzo (a) pyrene	H,C				**0.00013**		0.0018	0.2	0.000023	U	0.000032		0.000023	U	0.000023	U	0.0000115	U	0.0000115	U
Benzo (b) fluoranthene	H,C				**0.0013**		0.0018		0.000093		0.00011		0.000066		0.000066		0.0000065	U	0.0000065	U
Benzo (g,h,i) perylene	H,C								0.000034		0.000028		0.000015		0.000022		0.0000041	U	0.0000041	U
Benzo (k) fluoranthene	H				**0.0013**		0.0018		0.000042		0.000046		0.000028		0.000030		0.000005	U	0.000005	U
Chrysene	H,C				0.13		**0.0018**		0.00021		0.00023		0.00013		0.00017		0.0000088	U	0.0000088	U
Dibenzo (a,h) anthracene	H,C				**0.00013**		0.0018		0.000013	U	0.000013	U	0.000013	U	0.000013	U	0.000013	U	0.000013	U
Fluoranthene	H		54		20		**14**		0.0021		0.0034		0.034		0.0023		0.00020		0.00018	
Fluorene	L				**70**		530		0.0079	B	0.040	B	1.9	B	0.015	B	0.0026	B	0.0025	B
Indeno (1,2,3-c,d) pyrene	H,C				**0.0013**		0.0018		0.000025		0.000020		0.0000033	U	0.000015		0.0000033	U	0.0000033	U
Naphthalene	L	**620**							0.00044	B,U	0.00052	B	0.0030	B	0.074	B	0.0083	B	0.0077	B
Phenanthrene	L								0.0010	B	0.0037	B	0.60	B	0.0031	B	0.00074	B	0.00061	B
Pyrene	H				**30**		400		0.0014		0.0024		0.012		0.0017		0.00014		0.00013	
Total LPAHs (µg/L)									0.034		0.15		8.17		0.13		0.020		0.018	
Total HPAHS (µg/L)									0.0041		0.0065		0.046		0.0044		0.00034		0.00031	
Total cPAHs (µg/L)			**0.031**						0.00053		0.00061		0.00031		0.00041		0.00003	U	0.00003	U
Total PAHs (µg/L)									0.039		0.15		8.22		0.14		0.020		0.019	

Refer to notes at end of this table.

Table 3-3: Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE LOCATION		Location D		Location E			Location 13-SW	Location G		Location H	
SAMPLE TYPE		Surface Water	Inter-Armoring Water	Surface Water	Surface Water	Inter-Armoring Water	Surface Water	Surface Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water
Sample ID		MBSW1015-D	MBIA1015-D	MBSW1015-E	MBSW1015-E-Dup	MBIA1015-E	MBSW1015-F	MBSW1015-G	MBIA1015-G	MBSW1015-H	MBIA1015-H
Deployment Date Time		9/15/15 10:52	9/15/15 10:52	9/15/15 10:24	9/15/15 10:24	9/15/15 10:24	9/15/15 14:45	9/15/15 12:23	9/15/15 12:23	9/15/15 11:25	9/15/15 11:25
Sample Date Time		10/6/15 13:54	10/6/15 13:54	10/6/15 13:42	10/6/15 13:42	10/6/15 13:42	10/6/15 10:03	10/6/15 13:02	10/6/15 13:02	10/6/15 13:25	10/6/15 13:25
CONTAMINANT OF INTEREST											
Dissolved Metals (mg/L)											
Arsenic		*0.0015* U	--	*0.0015* U	*0.0015* U	--	*0.0015* U	*0.0015* U	--	*0.0015* U	*0.0015* U
Chromium		0.002 U	--	0.002 U	0.002 U	--	0.002 U	0.002 U	--	0.002 U	--
Copper		0.00019	--	0.00016	0.00016	--	0.00016	0.00015	--	0.00015	--
Zinc		0.00016 B	--	0.00043 B	0.00038 B	--	0.0020 B	0.00045 B	--	0.02 B,U	--
Pentachlorophenol (μg/L)		0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U
Polyaromatic Hydrocarbons (μg/L)											
Acenaphthene	L	0.0036 B	0.0031 B	0.0026 B	0.0027 B	0.3700 B	0.0094 B	0.00096 B	0.00029 B	0.0022 B	0.00029 B
Acenaphthylene	L	0.0001 U	0.00005 U	0.0001 U	0.0001 U	0.0001 U	0.00024	0.0001 U	0.00005 U	0.0001 U	0.00005 U
Anthracene	L	0.00023	0.000087	0.00018	0.00013	0.00013	0.00024	0.00018	0.000032 U	0.00017	0.000032 U
Benzo(a)anthracene	H,C	0.00019	0.000013 U	0.00012	0.00013	0.000013 U	0.000060	0.00020	0.000013 U	0.00016	0.000013 U
Benzo (a) pyrene	H,C	0.000038	0.0000115 U	0.000023 U	0.000023 U	0.0000115 U	0.000012	0.000023 U	0.0000115 U	0.000023 U	0.0000115 U
Benzo (b) fluoranthene	H,C	0.000077	0.000013	0.000051	0.000052	0.0000065 U	0.000030	0.000076	0.0000065 U	0.000061	0.0000065 U
Benzo (g,h,i) perylene	H,C	0.000030	0.0000041 U	0.000022	0.000026	0.0000041 U	0.0000083	0.000037	0.0000041 U	0.000027	0.0000041 U
Benzo (k) fluoranthene	H	0.000036	0.00001 U	0.000026	0.000027	0.00001 U	0.000013	0.000040	0.00001 U	0.000031	0.00001 U
Chrysene	H,C	0.00022	0.000017	0.00014	0.00015	0.0000088 U	0.000076	0.00022	0.0000088 U	0.00018	0.0000088 U
Dibenzo (a,h) anthracene	H,C	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U
Fluoranthene	H	0.0024	0.00036	0.0018	0.0017	0.0034	0.0014	0.0017	0.00032	0.0016	0.00056
Fluorene	L	0.0012 B	0.00044 B	0.00082 B	0.00077 B	0.00510 B	0.0033 B	0.00048 B	0.00025 B	0.00079 B	0.00026 B
Indeno (1,2,3-c,d) pyrene	H,C	0.000021	0.0000033 U	0.000017	0.000020	0.0000033 U	0.0000063	0.000028	0.0000033 U	0.000019	0.0000033 U
Naphthalene	L	0.00019 B	0.00044 B,U	0.00044 B,U	0.00041 B	0.00022 B,U	0.00088 B	0.00051 B	0.00044 B,U	0.00061 B	0.00044 B,U
Phenanthrene	L	0.00086 B	0.00063 B	0.00060 B	0.00042 B	0.00065 B	0.00082 B	0.00048 B	0.00032 B	0.00047 B	0.00034 B
Pyrene	H	0.0020	0.00028	0.0014	0.0013	0.0014	0.0011	0.0013	0.00024	0.0013	0.00042
Total LPAHs (μg/L)		0.0061	0.0043	0.0042	0.0044	0.38	0.0149	0.0026	0.00086	0.0042	0.00089
Total HPAHS (μg/L)		0.0050	0.00067	0.0036	0.0034	0.0048	0.0027	0.0036	0.00056	0.0034	0.0010
Total cPAHs (μg/L)		0.00058	0.00003	0.00035	0.00038	0.00003 U	0.00019	0.00056	0.00003 U	0.00045	0.00003 U
Total PAHs (μg/L)		0.011	0.0049	0.0078	0.0078	0.38	0.018	0.0062	0.0014	0.0076	0.0019

Refer to notes at end of this table.

Table 3-3: Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2015
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McCormick and Baxter Superfund Site

SAMPLE LOCATION		Location I		Location J		Location K		Location L		Location 5			Location 12-SW
SAMPLE TYPE		Surface Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water	Sub-Armoring Water	Surface Water
Sample ID		MBSW1015-I	MBIA1015-I	MBSW1015-J	MBIA1015-J	MBSW1015-K	MBIA1015-K	MBSW1015-L	MBIA1015-L	MBSW1015-5	MBIA1015-5	MBSA1015-5	MBSW1015-12
Deployment Date Time		9/15/15 13:22	9/15/15 13:22	9/15/15 13:51	9/15/15 13:51	9/15/15 14:22	9/15/15 14:22	9/16/15 9:45	9/16/15 9:45	9/15/15 16:12	9/15/15 16:12	9/15/15 16:12	9/15/15 14:15
Sample Date Time		10/6/15 12:15	10/6/15 12:15	10/6/15 11:10	10/6/15 11:10	10/6/15 11:40	10/6/15 11:40	10/6/15 15:20	10/6/15 15:20	10/6/15 9:00	10/6/15 9:00	10/6/15 9:00	10/6/15 9:38
CONTAMINANT OF INTEREST													
Dissolved Metals (mg/L)													
Arsenic		*0.025* U	**0.00096**	*0.0015* U	*0.0015* U	*0.0015* U	NR	*0.0015* U	--	--	--	--	--
Chromium		0.002 U	--	0.002 U	0.002 U	0.002 U	0.00059	0.002 U	--	--	--	--	--
Copper		0.00014	--	0.00013	0.00031	0.00014	0.00021	0.00012	--	--	--	--	--
Zinc		0.0038 B	--	0.00010 B	0.00036 B	0.0025 B	0.0024 B	0.000049 B	--	--	--	--	--
Pentachlorophenol (μg/L)		0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U	0.0004325 U
Polyaromatic Hydrocarbons (μg/L)													
Acenaphthene	L	0.00088 B	0.0033 B	0.0011 B	0.000023 B,U	0.0012 B	0.0018 B	0.0072 B	0.000120 B	0.044 B	0.0031 B	0.45 B	0.16 B
Acenaphthylene	L	0.0001 U	0.00005 U	0.0001 U	0.00005 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.00035	0.0001 U	0.00062	0.0021
Anthracene	L	0.00018	0.00022	0.00022	0.000032 U	0.00020	0.000085	0.00030	0.00028	0.00071	0.00013	0.00024	0.00046
Benzo(a)anthracene	H,C	0.00013	0.000055	0.00032	0.0000065 U	0.00025	0.000013 U	0.00026	0.000054	0.00023	0.000013 U	0.000062	0.00018
Benzo (a) pyrene	H,C	0.000023 U	0.000023 U	0.000049	0.0000115 U	0.000023 U	0.0000115 U	0.000046	0.000023 U	0.000023 U	0.0000115 U	0.000023 U	0.000039
Benzo (b) fluoranthene	H,C	0.000059	0.000033	0.00011	0.0000065 U	0.000091	0.0000065 U	0.00012	0.000039	0.00012	0.000020	0.000053	0.000090
Benzo (g,h,i) perylene	H,C	0.000028	0.000024	0.000044	0.0000041 U	0.000036	0.0000041 U	0.000039	0.0000081 U	0.000046	0.0000081 U	0.0000081 U	0.000032
Benzo (k) fluoranthene	H	0.000029	0.00001 U	0.000054	0.0000050 U	0.000043	0.00001 U	0.000051	0.00001 U	0.000055	0.00001 U	0.00001 U	0.000040
Chrysene	H,C	0.00015	0.000066	0.00034	0.0000088 U	0.00028	0.0000088 U	0.00031	0.000041	0.00028	0.000030	0.000071	0.00024
Dibenzo (a,h) anthracene	H,C	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U	0.000013 U
Fluoranthene	H	0.0014	0.0010	0.0024	0.00029	0.0022	0.00031	0.0024	0.00075	0.0030	0.00055	0.00067	0.0022
Fluorene	L	0.00041 B	0.00110 B	0.00065 B	0.000098 B	0.00056 B	0.00031 B	0.0027 B	0.00036 B	0.017 B	0.00130 B	0.027 B	0.040 B
Indeno (1,2,3-c,d) pyrene	H,C	0.000020	0.000019	0.000029	0.0000033 U	0.000024	0.0000033 U	0.000027	0.0000033 U	0.000030	0.0000033 U	0.0000033 U	0.000021
Naphthalene	L	0.00044 B,U	0.00044 B,U	0.00013 B	0.00044 B,U	0.00044 B,U	0.00044 B,U	0.0043 B	0.00044 B,U	0.0260 B	0.0006 B	0.0008 B	0.0006 B
Phenanthrene	L	0.00043 B	0.00094 B	0.00066 B	0.000082 B	0.00066 B	0.00024 B	0.0014 B	0.00043 B	0.0041 B	0.00035 B	0.00084 B	0.00048 B
Pyrene	H	0.0011	0.00074	0.0018	0.00019	0.0016	0.00024	0.0016	0.0021	0.0020	0.00037	0.00056	0.0026
Total LPAHs (μg/L)		0.0019	0.00556	0.0028	0.00018	0.0026	0.00244	0.016	0.0012	0.092	0.0055	0.48	0.20
Total HPAHS (μg/L)		0.0029	0.0019	0.0051	0.00048	0.0045	0.00055	0.0048	0.0030	0.006	0.0010	0.0014	0.0054
Total cPAHs (μg/L)		0.00039	0.00020	0.00089	0.00003 U	0.00068	0.00003 U	0.00080	0.00013	0.00071	0.000050	0.00019	0.00060
Total PAHs (μg/L)		0.0048	0.0075	0.0079	0.00066	0.0071	0.0034	0.021	0.0042	0.098	0.0065	0.48	0.21

Refer to notes at end of this table.

Table 3-3: Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2015
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SAMPLE LOCATION		**Location 12**				**Location 13**				**Location 16**						**Location 1**		**Location 27**	
SAMPLE TYPE		**Inter-Armoring Water**		**Sub-Armoring Water**		**Inter-Armoring Water**		**Sub-Armoring Water**		**Surface Water**		**Inter-Armoring Water**		**Sub-Armoring Water**		**Surface Water**		**Surface Water**	
Sample ID		MBIA1015-12		MBSA1015-12		MBIA1015-13		MBSA1015-13		MBSW1015-16		MBIA1015-16		MBSA1015-16		MBSW1015-1		MBSW1015-27	
Deployment Date Time		9/15/15 14:15		9/15/15 14:15		9/15/15 13:30		9/15/15 13:30		9/16/15 10:14		9/16/15 10:14		9/16/15 10:14		9/15/15 15:23		9/16/15 10:40	
Sample Date Time		10/6/15 9:38		10/6/15 9:38		10/6/15 10:06		10/6/15 10:06		10/6/15 10:52		10/6/15 10:52		10/6/15 10:52		10/6/15 9:45		10/6/15 10:00	
CONTAMINANT OF INTEREST																			
Dissolved Metals (mg/L)																			
Arsenic		--		--		--		--		--		--		--		**0.00074**		**0.00077**	
Chromium		--		--		--		--		--		--		--		--		0.002	U
Copper		--		--		--		--		--		--		--		--		0.00016	
Zinc		--		--		--		--		--		--		--		--		0.010	B
Pentachlorophenol (μg/L)		0.0004325	U	0.0004325	U	0.0004325	U	0.0004325	U	0.0004325	U	0.0004325	U	0.0004325	U	0.0004325	U	0.0004325	U
Polyaromatic Hydrocarbons (μg/L)																			
Acenaphthene	L	6.0	B	2.7	B	0.0082	B	0.0031	B	0.0016	B	0.019	B	0.40	B	0.00080	B	0.00094	B
Acenaphthylene	L	0.016		0.0060		0.00005	U	0.00005	U	0.0001	U	0.0001	U	0.00097		0.0001	U	0.0001	U
Anthracene	L	0.0059		0.0017		0.00120		0.00068		0.00019		0.000032	U	0.00052		0.00017		0.00022	
Benzo(a)anthracene	H,C	0.00012		0.00013		0.000013	U	0.000013	U	0.00012		0.000013	U	0.000013	U	0.000087		0.00015	
Benzo (a) pyrene	H,C	0.000023	U	0.000031		0.0000115	U	0.0000115	U	0.000021		0.0000115	U	0.000023	U	0.000023	U	0.000023	U
Benzo (b) fluoranthene	H,C	0.000041		0.000065		0.0000065	U	0.0000065	U	0.000047		0.0000065	U	0.000011		0.000038		0.000066	
Benzo (g,h,i) perylene	H,C	0.0000092		0.000014		0.0000041	U	0.0000041	U	0.000017		0.0000041	U	0.0000083		0.000018		0.000026	
Benzo (k) fluoranthene	H	0.000018		0.000027		0.0000050	U	0.0000050	U	0.000021		0.0000050	U	0.00001	U	0.000020		0.000034	
Chrysene	H,C	0.00016		0.00016		0.000016		0.000012		0.00014		0.0000088	U	0.000013		0.00010		0.00018	
Dibenzo (a,h) anthracene	H,C	0.000013	U	0.000013	U	0.000013	U	0.000013	U	0.000013	U	0.000013	U	0.000013	U	0.000013	U	0.000013	U
Fluoranthene	H	0.0042		0.0015		0.00051		0.00063		0.0016		0.00021		0.00017		0.0014		0.0017	
Fluorene	L	0.63	B	0.120	B	0.0040	B	0.00110	B	0.00052	B	0.0032	B	0.067	B	0.00036	B	0.00038	B
Indeno (1,2,3-c,d) pyrene	H,C	0.0000033	U	0.000012		0.0000033	U	0.0000033	U	0.000010		0.0000033	U	0.0000033	U	0.000016		0.000021	
Naphthalene	L	0.020	B	0.026	B	0.00044	B,U	0.00044	B,U	0.00044	B,U	0.00044	B,U	0.00044	B,U	0.00044	B,U	0.00044	B,U
Phenanthrene	L	0.0130	B	0.0077	B	0.0120	B	0.0048	B	0.00050	B	0.00014	B	0.00048	B	0.00042	B	0.00044	B
Pyrene	H	0.0048		0.0024		0.00045		0.00052		0.0013		0.00014		0.00017		0.0011		0.0014	
Total LPAHs (μg/L)		6.68		2.86		0.0254		0.0097		0.0028		0.022		0.47		0.0018		0.0020	
Total HPAHS (μg/L)		0.0093		0.0043		0.00098		0.0012		0.0033		0.00035		0.00037		0.0028		0.0036	
Total cPAHs (μg/L)		0.00033		0.00041		0.000016		0.000012		0.00036		0.00003	U	0.000032		0.00026		0.00044	
Total PAHs (μg/L)		6.69		2.87		0.026		0.01		0.0061		0.023		0.47		0.0045		0.0056	

Refer to notes at end of this table.

Notes:

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 2 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

[1]The 1996 Record of Decision (ROD) specifies the remedial action objectives of the sediment cap as: 1) preventing human and aquatic organisms from direct contact with contaminated sediment; and 2) minimizing releases of contaminants from sediment that might result in contamination of the Willamette River in excess of Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of 2007 and updated 2015, are included for comparison (see https://www.epa.gov/wqc/national-recommended-water-quality-criteria)

[3] Aquatic Water Quality Criteria (AWQCs) published as of 2011, and updated effective August 4, 2015, are included for comparison (see http://www.deq.state.or.us/wq/standards/docs/tables303140.pdf)

[4] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://water.epa.gov/drink/contaminants/index.cfm).

Key:

C = carcinogenic PAH (cPAH)
H = high molecular weight PAH (HPAH)
J = estimated value
L = low molecular weight PAH (LPAH)
µg/L = micrograms per liter
mg/L = milligrams per liter
MDL = method detection limit
-- = not analyzed
ND = not detected
U = value below MDL (value represents MDL)

Table 3-4: Surface, Inter-Armoring, and Sub-Armoring Water Statistical Summary: Fall 2015
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McCormick and Baxter Superfund Site

SAMPLE TYPE		Screening Criteria							Surface Water Statistics						
		1996 AWQCs[1]		2015 NRWQCs[2]		DEQ 2011 EPA-Approved AWQCs updated 2015 [3]		2011 MCLs updated 2015[4]							
CONTAMINANT OF INTEREST		Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Maximum Contaminant Levels (MCLs)	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration**	**Data Distribution**	**95% UCL Value**
Dissolved Metals (mg/L)															
Arsenic		0.19		0.15	**0.00014**	0.15	0.0021	0.01	12	8	**0.0010**	MBSW1015-A	**0.0018**	NA	NA
Chromium		0.21		0.074		**0.053**		0.1	11	0	ND	NA	NA	NA	NA
Copper		0.012		**0.0049**		0.0065			11	100	0.00019	MBSW1015-D	0.00014	Normal	0.00016
Zinc		0.11		0.12	26	**0.066**	2.6		11	82	0.0038	MBSW1015-I	0.0029	Gamma	0.0072
Pentachlorophenol (µg/L)		13		15	**0.04**	8.2	0.3	1	15	0	NA	NA	NA	NA	NA
Polyaromatic Hydrocarbons (µg/L)															
Acenaphthene	L	520			**90**		99		15	100	0.16	MBSW1015-12	0.027	Gamma	0.067
Acenaphthylene	L								15	50	0.0021	MBSW1015-12	0.00032	NP	0.00095
Anthracene	L				**400**		4000		15	100	0.0012	MBSW1015-B	0.00036	NP	0.00068
Benzo(a)anthracene	H,C				**0.0013**		0.0018		15	100	0.00032	MBSW1015-J	0.00018	NP	0.00021
Benzo (a) pyrene	H,C				**0.00013**		0.0018	0.2	15	47	0.000049	MBSW1015-J	0.000022	NP	0.0000383
Benzo (b) fluoranthene	H,C				**0.0013**		0.0018		15	100	0.00012	MBSW1015-5	0.000080	Normal	0.000097
Benzo (g,h,i) perylene	H,C								15	100	0.000046	MBSW1015-5	0.000030	Normal	0.000035
Benzo (k) fluoranthene	H				**0.0013**		0.0018		15	100	0.000055	MBSW1015-5	0.000037	Normal	0.00004
Chrysene	H,C				0.13		**0.0018**		15	100	0.00034	MBSW1015-J	0.00021	Normal	0.00025
Dibenzo (a,h) anthracene	H,C				**0.00013**		0.0018		15	0	ND	NA	NA	NA	NA
Fluoranthene	H		54		20		**14**		15	100	0.0034	MBSW1015-B	0.0021	Normal	0.0024
Fluorene	L				**70**		530		15	100	0.040	MBSW1015-12	0.0088	NP	0.024
Indeno (1,2,3-c,d) pyrene	H,C				**0.0013**		0.0018		15	100	0.000030	MBSW1015-5	0.000021	Normal	0.000024
Naphthalene	L	**620**							15	67	0.074	MBSW1015-C	0.0073	NP	0.0293
Phenanthrene	L								15	100	0.0041	MBSW1015-5	0.0013	NP	0.027
Pyrene	H				**30**		400		15	100	0.0026	MBSW1015-12	0.0016	Normal	0.0018
Total LPAHs (µg/L)									15	100	0.20	MBSW1015-12	0.045	NP	0.118
Total HPAHS (µg/L)									15	100	0.0065	MBSW1015-5	0.0043	Normal	0.0049
Total cPAHs (µg/L)			**0.031**						15	100	0.00089	MBSW1015-J	0.00054	Normal	0.00063
Total PAHs (µg/L)									15	100	0.21	MBSW1015-12	0.049	NP	0.12

Refer to notes at end of this table.

Table 3-4: Surface, Inter-Armoring, and Sub-Armoring Water Statistical Summary: Fall 2015
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SAMPLE TYPE	Inter-Armoring Water Statistics							Sub-Armoring Water Statistics						
CONTAMINANT OF INTEREST	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL Value**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Conc.**	**Data Distribution**	**95% UCL Value**
Dissolved Metals (mg/L)														
Arsenic	5	20	**0.0010**	MBIA1015-I	**0.00044**	NA	NA	0	NA	NA	NA	NA	NA	NA
Chromium	3	67	0.00059	MBIA1015-K	0.00071	NA	NA	0	NA	NA	NA	NA	NA	NA
Copper	3	67	0.0051	MBIA1015-C	0.0019	NA	NA	0	NA	NA	NA	NA	NA	NA
Zinc	3	67	0.0075	MBIA1015-C	0.0034	NA	NA	0	NA	NA	NA	NA	NA	NA
Pentachlorophenol (µg/L)	14	0	NA	NA	NA	NA	NA	4	0	NA	NA	NA	NA	NA
Polyaromatic Hydrocarbons (µg/L)														
Acenaphthene L	14	93	6.0	MBIA1015-12	0.92	NP	24	4	100	2.7	MBSA1015-12	0.89	NA	NA
Acenaphthylene L	14	14	0.016	MBIA1015-12	0.0022	NA	NA	4	100	0.0060	MBSA1015-12	0.0019	NA	NA
Anthracene L	14	71	0.057	MBIA1015-B	0.0050	NP	0.021	4	100	0.0017	MBSA1015-12	0.00079	NA	NA
Benzo(a)anthracene H,C	14	29	0.00012	MBIA1015-12	0.000030	NP	0.000069	4	50	0.00013	MBSA1015-12	0.000051	NA	NA
Benzo (a) pyrene H,C	14	0	NA	NA	NA	NA	NA	4	25	0.000031	MBSA1015-12	0.000015	NA	NA
Benzo (b) fluoranthene H,C	14	43	0.000066	MBIA1015-B	0.000018	NP	0.000038	4	75	0.000065	MBSA1015-12	0.000033	NA	NA
Benzo (g,h,i) perylene H,C	14	21	0.000024	MBIA1015-I	0.0000056	NP	0.000012	4	50	0.000014	MBSA1015-12	0.0000071	NA	NA
Benzo (k) fluoranthene H	14	14	0.000028	MBIA1015-B	0.0000070	NA	NA	4	25	0.000027	MBSA1015-12	0.000010	NA	NA
Chrysene H,C	14	50	0.00016	MBIA1015-12	0.000037	NP	0.000088	4	100	0.00016	MBSA1015-12	0.000064	NA	NA
Dibenzo (a,h) anthracene H,C	14	0	NA	NA	NA	NA	NA	4	0	NA	NA	NA	NA	NA
Fluoranthene H	14	100	0.034	MBIA1015-B	0.0035	NP	0.013	4	100	0.0015	MBSA1015-12	0.00074	NA	NA
Fluorene L	14	100	1.9	MBIA1015-B	0.20	NP	0.74	4	100	0.12	MBSA1015-12	0.054	NA	NA
Indeno (1,2,3-c,d) pyrene H,C	14	0	NA	NA	NA	NA	NA	4	25	0.000012	MBSA1015-12	0.0000042	NA	NA
Naphthalene L	14	29	0.020	MBIA1015-12	0.0026	NP	0.0090	4	50	0.026	MBSA1015-12	0.0068	NA	NA
Phenanthrene L	14	100	0.60	MBIA1015-B	0.048	NP	0.22	4	100	0.0077	MBSA1015-12	0.0035	NA	NA
Pyrene H	14	100	0.012	MBIA1015-B	0.0018	NP	0.0051	4	100	0.0024	MBSA1015-12	0.00091	NA	NA
Total LPAHs (µg/L)	14	100	8.2	MBIA1015-B	1.18	NP	3.97	4	100	2.9	MBSA1015-12	0.95	NA	NA
Total HPAHS (µg/L)	14	100	0.046	MBIA1015-B	0.0054	NP	0.018	4	100	0.0043	MBSA1015-12	0.0018	NA	NA
Total cPAHs (µg/L)	14	57	0.00033	MBIA1015-D	0.00012	NP	0.00026	4	100	0.00041	MBSA1015-12	0.00016	NA	NA
Total PAHs (µg/L)	14	100	8.2	MBIA1015-B	1.2	NP	3.98	4	100	2.9	MBSA1015-12	0.96	NA	NA

Refer to notes at end of this table.

Notes:

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 2 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

[1] The 1996 Record of Decision (ROD) specifies the remedial action objectives of the sediment cap as: 1) preventing human and aquatic organisms from direct contact with contaminated sediment; and 2) minimizing releases of contaminants from sediment that might result in contamination of the Willamette River in excess of Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of 2007 and updated 2015, are included for comparison (see https://www.epa.gov/wqc/national-recommended-water-quality-criteria)

[3] Aquatic Water Quality Criteria (AWQCs) published as of 2011, and updated effective August 4, 2015, are included for comparison (see http://www.deq.state.or.us/wq/standards/docs/tables303140.pdf)

[4] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://water.epa.gov/drink/contaminants/index.cfm).

Key:

C = carcinogenic PAH (cPAH)
Gamma = gamma distribution
H = high molecular weight PAH (HPAH)
J = estimated value
L = low molecular weight PAH (LPAH)
µg/L = micrograms per liter
mg/L = milligrams per liter
MDL = method detection limit
NA= not applicable
Normal = normal distribution
ND = not detected
NP = nonparametric distribution
U = value below MDL (value represents MDL)

Table 3-5: Summary of Surface Water Data 2002-2015
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McCormick and Baxter SupMerfund Site

SAMPLE TYPE	Screening Criteria							Surface Water Fall 2002 (Conventional Sampling)						
	1996 AWQCs[1]		**2015 NRWQCs[2]**		**DEQ 2011 EPA-Approved AWQCs updated 2015 [3]**		**2011 MCLs updated 2015[4]**							
CONTAMINANT OF INTEREST	Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Maximum Contaminant Levels (MCLs)	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)								--	--	--	--	--	--	--
Total Suspended Solids (mg/L)								--	--	--	--	--	--	--
Dissolved Organic Carbon (mg/L)								--	--	--	--	--	--	--
Total Metals (mg/L)														
Arsenic	0.19		0.15	**0.00014**	0.15	0.0021	0.01	15	27	0.0011	SED-6	0.0003	NP	0.0005
Chromium	0.21		0.074		**0.053**		0.1	15	33	0.0021	SED-8	0.0006	NP	0.0010
Copper	0.012		**0.0049**		0.0065			15	100	0.0209	SED-7	0.0046	Gamma	0.0158
Zinc	0.11		0.12	26	**0.066**	2.6		15	100	0.0181	SED-9	0.0049	NP	0.0083
Dissolved Metals (mg/L)														
Arsenic	0.19		0.15	**0.00014**	0.15	0.0021	0.01	--	--	--	--	--	--	--
Chromium	0.21		0.074		**0.053**		0.1	--	--	--	--	--	--	--
Copper	0.012		**0.0049**		0.0065			--	--	--	--	--	--	--
Zinc	0.11		0.12	26	**0.066**	2.6		--	--	--	--	--	--	--
Pentachlorophenol (μg/L)	13		15	**0.04**	8.2	0.3	1	15	0.40	0.079	SED-3	0.0684	NP	0.1233
Polyaromatic Hydrocarbons (μg/L)														
Acenaphthene L	520			**90**		99		15	13	9.8	SED-6	0.6634	NP	7.1568
Acenaphthylene L								15	7	0.042	SED-6	0.0127	NA	NA
Anthracene L				**400**		4000		15	7	3.8	SED-6	0.2632	NA	NA
Benz[a]anthracene H, C				**0.0013**		0.0018		15	27	1.5	SED-6	0.1140	NP	1.0992
Benzo[a]pyrene H, C				**0.00013**		0.0018	0.2	15	7	0.44	SED-6	0.0441	NA	NA
Benzo[b]fluoranthene H, C				**0.0013**		0.0018		15	7	0.77	SED-6	0.0612	NA	NA
Benzo[g,h,i]perylene H, C								15	7	0.087	SED-6	0.0157	NA	NA
Benzo[k]fluoranthene H				**0.0013**		0.0018		15	7	0.39	SED-6	0.0359	NA	NA
Chrysene H, C				0.13		**0.0018**		15	27	1.2	SED-6	0.0941	NP	0.8803
Dibenzo[a,h]anthracene H, C				**0.00013**		0.0018		15	20	0.093	SED-6	0.0282	NP	0.0374
Fluoranthene H		54		20		**14**		15	60	11.9	SED-6	0.8068	NP	8.6908
Fluorene L				**70**		530		6	0	ND	N/A	0.0120	NA	NA
Ideno[1,2,3-cd]pyrene H, C				**0.0013**		0.0018		15	7	0.13	SED-6	0.0234	NA	NA
Naphthalene L	**620**							15	7	3.3	SED-6	0.2299	NA	NA
Phenanthrene L								15	33	22.7	SED-6	1.5239	NP	16.5739
Pyrene H				**30**		400		15	33	5.3	SED-6	0.3645	NP	3.8722
Total LPAHs								15	33	39.6	SED-6	2.6800	NP	14.1800
Total HPAHs								15	60	21.8	SED-6	1.5200	NP	7.8300
Total cPAHs		**0.031**						15	20	4.22	SED-6	0.2720	NP	1.5700
Total PAHs								15	53	61.5	SED-6	4.1980	NP	22.0400

Refer to notes at end of this table.

SAMPLE TYPE		Surface Water Fall 2002 - Without Sample SED-6 (Conventional Sampling)							Surface Water Fall 2003 (Conventional Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		--	--	--	--	--	--	--	21	100	180	MBSWGB0326	22.3333	NP	112.5361
Dissolved Organic Carbon (mg/L)		--	--	--	--	--	--	--	21	100	3.33	MBSWGB0312	2.2195	Gamma	2.3462
Total Metals (mg/L)															
Arsenic		14	21	0.00094	SED-8	0.0003	NP	0.0005	21	81	0.00206	MBSWGB0326	0.0010	Normal	0.0012
Chromium		14	36	0.0021	SED-8	0.0006	NP	0.0010	21	100	0.00547	MBSWGB0326	0.0024	NP	0.0027
Copper		14	100	0.0209	SED-7	0.0046	Gamma	0.0158	21	100	0.0211	MBSWGB0315	0.0035	NP	0.0079
Zinc		14	100	0.0181	SED-9	0.0049	NP	0.0083	21	100	0.0199	MBSWGB0326	0.0072	NP	0.0088
Dissolved Metals (mg/L)															
Arsenic		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol (µg/L)		14	36	0.079	SED-3	0.0677	Max	0.0790	21	0	ND	--	0.0340	NA	NA
Polyaromatic Hydrocarbons (µg/L)															
Acenaphthene	L	14	7	0.013	SED-8	0.0108	NA	NA	21	0	ND	--	0.0060	NA	NA
Acenaphthylene	L	14	0	ND	--	0.0106	NA	NA	21	0	ND	--	0.0060	NA	NA
Anthracene	L	14	0	ND	--	0.0106	NA	NA	21	0	ND	--	0.0060	NA	NA
Benz[a]anthracene	H, C	14	21	0.036	SED-1	0.0150	Gamma	0.0195	21	0	ND	--	0.0024	NA	NA
Benzo[a]pyrene	H, C	14	0	ND	--	0.0158	NA	NA	21	5	0.00239	MBSWGB0301	0.0012	NA	NA
Benzo[b]fluoranthene	H, C	14	0	ND	--	0.0106	NA	NA	21	5	0.00806	MBSWGB0309	0.0027	NA	NA
Benzo[g,h,i]perylene	H, C	14	0	ND	--	0.0106	NA	NA	21	0	ND	--	0.0060	NA	NA
Benzo[k]fluoranthene	H	14	0	ND	--	0.0106	NA	NA	21	5	0.00806	MBSWGB0309	0.0027	NA	NA
Chrysene	H, C	14	21	0.036	SED-1	0.0151	Gamma	0.0195	21	5	0.0121	MBSWGB0309	0.0028	NA	NA
Dibenzo[a,h]anthracene	H, C	14	14	0.037	SED-2	0.0235	Gamma	0.0265	21	0	ND	--	0.0027	NA	NA
Fluoranthene	H	14	57	0.032	SED-3	0.0144	Gamma	0.0192	21	19	0.0783	MBSWGB0309	0.0073	NP	0.0438
Fluorene	L	6	0	ND	--	0.0120	NA	NA	21	5	0.0125	MBSWGB0309	0.0063	NA	NA
Ideno[1,2,3-cd]pyrene	H, C	14	0	ND	--	0.0158	NA	NA	21	0	ND	--	0.0027	NA	NA
Naphthalene	L	14	0	ND	--	0.0106	NA	NA	21	0	ND	--	0.0073	NA	NA
Phenanthrene	L	14	29	0.018	SED-1	0.0114	Gamma	0.0125	21	5	0.116	MBSWGB0309	0.0112	NA	NA
Pyrene	H	14	29	0.018	SED-1	0.0120	Gamma	0.0132	21	33	2.58	MBSWGB0324	0.1269	NP	1.3475
Total LPAHs		14	29	0.076	SPMD 15	0.0458	NP	0.0772	21	5	0.116	MBSWGB0309	0.0407	NA	NA
Total HPAHs		14	57	0.162	SED-3	0.0705	NP	0.1340	21	43	0.16625	MBSWGB0309	0.0269	NP	0.0602
Total cPAHs		14	14	0.128	SED-3	0.0981	NP	0.1380	21	5	0.10085	MBSWGB0309	0.0238	NA	NA
Total PAHs		14	57	0.204	SPMD-20	0.1050	NP	0.2060	21	43	0.28225	MBSWGB0309	0.0498	NP	0.1070

Refer to notes at end of this table.

Table 3-5: Summary of Surface Water Data 2002-2015
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McCormick and Baxter Superfund Site

SAMPLE TYPE		Surface Water Fall 2005 (Conventional Sampling)							Surface Water Spring 2006 (Conventional Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		26	92	17	MBSWGB05-2A	5.9296	Gamma	7.3008	--	--	--	--	--	--	--
Dissolved Organic Carbon (mg/L)		26	88	10.9	MBSWGB05-12	2.7767	NP	5.3601	--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		26	100	0.00142	MBSWGB05-04	0.0008	Gamma	0.0008	23	22	0.00233	Location 25	0.0006	NP	0.0011
Chromium		26	0	ND	--	0.0004	NA	NA	23	74	0.00455	Location 14	0.0010	NP	0.0036
Copper		26	81	0.00283	MBSWGB05-32	0.0010	NP	0.0012	23	74	0.0168	Location 18	0.0040	Max	0.0168
Zinc		26	88	0.00843	MBSWGB05-32	0.0031	NP	0.0046	23	87	0.04	Location 25	0.0082	NP	0.0291
Dissolved Metals (mg/L)															
Arsenic		26	46	0.000978	MBSWGB05-18	0.0004	NP	0.0006	--	--	--	NA	--	--	--
Chromium		26	0	ND	--	0.0004	NA	NA	--	--	--	NA	--	--	--
Copper		26	81	0.0112	MBSWGB05-13	0.0014	NP	0.0031	--	--	--	NA	--	--	--
Zinc		26	85	0.00979	MBSWGB05-13	0.0036	Gamma	0.0046	--	--	--	NA	--	--	--
Pentachlorophenol (μg/L)		26	0	ND	--	0.1745	NA	NA	23	0	ND	NA	0.1197	NA	NA
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	26	19	0.0972	MBSWGB05-17	0.0168	NP	0.0356	23	0	ND	--	0.0060	NA	NA
Acenaphthylene	L	26	0	ND	--	0.0087	NA	NA	23	0	ND	NA	0.0060	NA	NA
Anthracene	L	26	0	ND	--	0.0087	NA	NA	23	0	ND	NA	0.0060	NA	NA
Benz[a]anthracene	H, C	26	0	ND	--	0.0087	NA	NA	23	0	ND	NA	0.0060	NA	NA
Benzo[a]pyrene	H, C	26	0	ND	--	0.0087	NA	NA	23	4	0.0146	Location 13	0.0064	NA	NA
Benzo[b]fluoranthene	H, C	26	0	ND	--	0.0087	NA	NA	23	4	0.0124	Location 13	0.0063	NA	NA
Benzo[g,h,i]perylene	H, C	26	0	ND	--	0.0087	NA	NA	23	0	0.0062	Location 12	0.0060	NA	NA
Benzo[k]fluoranthene	H	26	0	ND	--	0.0087	NA	NA	23	4	0.0119	Location 13	0.0063	NA	NA
Chrysene	H, C	26	0	ND	--	0.0087	NA	NA	23	9	0.0195	Location 25	0.0069	NA	NA
Dibenzo[a,h]anthracene	H, C	26	0	ND	--	0.0174	NA	NA	23	0	ND	NA	0.0120	NA	NA
Fluoranthene	H	26	0	ND	--	0.0087	NA	NA	23	9	0.0396	Location 25	0.0085	NA	NA
Fluorene	L	26	8	0.0234	MBSWGB05-17	0.0098	NA	NA	23	0	ND	NA	0.0060	NA	NA
Ideno[1,2,3-cd]pyrene	H, C	26	0	ND	--	0.0087	NA	NA	23	0	ND	NA	0.0060	NA	NA
Naphthalene	L	26	15	0.911	MBSWGB05-17	0.0663	NP	0.0444	23	26	0.19	Location 25	0.0173	NP	0.0523
Phenanthrene	L	26	4	0.0129	MBSWGB05-17	0.0090	NA	NA	23	4	0.0159	Location 13	0.0064	NA	NA
Pyrene	H	26	0	ND	--	0.0087	NA	NA	23	13	0.0319	Location 25	0.0082	NP	0.0104
Total LPAHs		26	19	1.0445	MBSWGB05-17	0.0931	NP	0.1150	23	26	0.19	Location 25	0.0402	NP	0.0709
Total HPAHs		26	4	0.0132	MBSWGB05-32	0.0460	NA	NA	23	13	0.1066	Location 13	0.0717	NP	0.0855
Total cPAHs		26	0	ND	--	0.0414	NA	NA	23	9	0.053	Location 13	0.0524	NA	NA
Total PAHs		26	19	1.10505	MBSWGB05-17	0.1437	NP	0.2000	23	30	0.281	Location 25	0.0936	NP	0.1450

Refer to notes at end of this table.

SAMPLE TYPE		Surface Water Fall 2006 (Conventional Sampling)							Surface Water Spring 2007 (Conventional Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		22	95	20	Location 19	5.6905	Lognormal	7.2709	23	100	12	Location 6	7.2609	Normal	8.4000
Dissolved Organic Carbon (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		22	95	0.00071	Location 25	0.0005	Gamma	0.0005	23	100	0.00041	Location 6	0.0003	Normal	0.0003
Chromium		22	64	0.00234	Location 3	0.0003	NP	0.0007	23	52	0.00165	Location 26	0.0004	NP	0.0015
Copper		22	100	0.00344	Location 3	0.0011	NP	0.0014	23	100	0.00315	Location 19	0.0014	NP	0.0016
Zinc		22	27	0.00482	Location 7	0.0016	NP	0.0028	23	35	0.0216	Location 20	0.0028	NP	0.0068
Dissolved Metals (mg/L)															
Arsenic		21	95	0.00061	Location 18	0.0004	NP	0.0005	23	83	0.00004	Location 10	0.0000	NP	0.0003
Chromium		21	52	0.00013	Location 11	0.0001	NP	0.0001	23	100	0.00039	Location 10	0.0004	Normal	0.0004
Copper		21	100	0.00132	Location 25	0.0007	NP	0.0008	23	100	0.00053	Location 10	0.0005	NP	0.0007
Zinc		21	71	0.00487	Location 11	0.0028	NP	0.0068	23	83	0.00158	Location 10	0.0003	NP	0.0120
Pentachlorophenol (μg/L)		22	0	ND	NA	0.1239	NA	NA	23	0	ND	NA	0.1229	NA	NA
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	22	23	0.166	Location 25	0.0190	NP	0.0534	23	0	ND	NA	0.0061	NA	NA
Acenaphthylene	L	22	5	0.0126	Location 4	0.0065	NA	NA	23	0	ND	NA	0.0061	NA	NA
Anthracene	L	22	5	0.0126	Location 4	0.0065	NA	NA	23	0	ND	NA	0.0061	NA	NA
Benz[a]anthracene	H, C	22	5	0.0126	Location 4	0.0065	NA	NA	23	0	ND	NA	0.0061	NA	NA
Benzo[a]pyrene	H, C	22	0	ND	NA	0.0062	NA	NA	23	0	ND	NA	0.0061	NA	NA
Benzo[b]fluoranthene	H, C	22	5	0.0126	Location 4	0.0065	NA	NA	23	0	ND	NA	0.0061	NA	NA
Benzo[g,h,i]perylene	H, C	22	0	ND	NA	0.0062	NA	NA	23	0	ND	NA	0.0061	NA	NA
Benzo[k]fluoranthene	H	22	0	ND	NA	0.0062	NA	NA	23	0	ND	NA	0.0061	NA	NA
Chrysene	H, C	22	5	0.0126	Location 4	0.0065	NA	NA	23	0	ND	NA	0.0061	NA	NA
Dibenzo[a,h]anthracene	H, C	22	0	ND	NA	0.0124	NA	NA	23	0	ND	NA	0.0123	NA	NA
Fluoranthene	H	22	5	0.0143	Location 14	0.0066	NA	NA	23	4	0.0133	Location 19	0.0065	NA	NA
Fluorene	L	22	9	0.062	Location 25	0.0098	NA	NA	23	0	ND	NA	0.0061	NA	NA
Ideno[1,2,3-cd]pyrene	H, C	22	0	ND	NA	0.0062	NA	NA	23	0	ND	NA	0.0061	NA	NA
Naphthalene	L	22	18	0.93	Location 25	0.0873	NP	0.6179	23	0	ND	NA	0.0064	NA	NA
Phenanthrene	L	22	9	0.0295	Location 25	0.0075	NA	NA	23	0	ND	NA	0.0061	NA	NA
Pyrene	H	22	9	0.0128	Location 14	0.0068	NA	NA	23	0	ND	NA	0.0061	NA	NA
Total LPAHs		22	18	1.1875	Location 25	0.1313	NP	0.4080	23	0	ND	NA	0.0371	NA	NA
Total HPAHs		22	0	ND	NA	0.0681	NA	NA	23	4	0.0133	Location 19	0.0652	NA	NA
Total cPAHs		22	0	ND	NA	0.0557	NA	NA	23	0	ND	NA	0.0553	NA	NA
Total PAHs		22	23	1.1875	Location 25	0.1429	NP	0.4160	23	4	0.0133	Location 19	0.1007	NA	NA

Refer to notes at end of this table.

Table 3-5: Summary of Surface Water Data 2002-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE TYPE		Surface Water Fall 2007 (Conventional Sampling)							Surface Water Spring 2008 (Conventional Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		22	91	86	Location 25	19.0427	Log	36.4492	--	--	--	--	--	--	--
Dissolved Organic Carbon (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		22	100	0.00143	Location 17	0.0007	NP	0.0010	22	0	ND	NA	0.0003	NA	NA
Chromium		22	55	0.000825	Location 10	0.0003	Log	0.0004	22	77	0.00097	Location 18	0.0004	NP	0.0006
Copper		22	86	0.00223	Location 12	0.0012	Normal	0.0014	22	77	0.00348	Location 12	0.0011	Normal	0.0012
Zinc		22	68	0.00445	Location 12	0.0027	Max	0.0045	22	9	0.0125	Location 25	0.0031	NA	NA
Dissolved Metals (mg/L)															
Arsenic		22	9	0.000967	Location 17	0.0004	NA	NA	22	0	ND	NA	0.0003	NA	NA
Chromium		22	0	ND	NA	0.0001	NA	NA	22	45	0.000319	Location 26	0.0001	NP	0.0002
Copper		22	95	0.00103	Location 25	0.0007	Normal	0.0072	22	64	0.00455	Location 13	0.0011	NP	0.0020
Zinc		22	73	0.0058	Location 2	0.0024	NP	0.0036	22	36	0.0136	Location 25	0.0027	Normal	0.0037
Pentachlorophenol (μg/L)		22	0	ND	NA	0.1189	NP	0.1191	22	0	ND	NA	0.1196	NA	NA
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	22	45	0.411	Location 12	0.0681	NP	0.3359	22	14	0.0661	Location 2	0.0125	NP	0.0287
Acenaphthylene	L	22	9	0.0581	Location 17	0.0088	NA	NA	22	0	ND	NA	0.0060	NA	NA
Anthracene	L	22	0	ND	NA	0.0059	NA	NA	22	0	ND	NA	0.0060	NA	NA
Benz[a]anthracene	H, C	22	0	ND	NA	0.0059	NA	NA	22	0	ND	NA	0.0060	NA	NA
Benzo[a]pyrene	H, C	22	0	ND	NA	0.0059	NA	NA	22	0	ND	NA	0.0060	NA	NA
Benzo[b]fluoranthene	H, C	22	0	ND	NA	0.0059	NA	NA	22	0	ND	NA	0.0060	NA	NA
Benzo[g,h,i]perylene	H, C	22	0	ND	NA	0.0059	NA	NA	22	0	ND	NA	0.0060	NA	NA
Benzo[k]fluoranthene	H	22	0	ND	NA	0.0059	NA	NA	22	0	ND	NA	0.0060	NA	NA
Chrysene	H, C	22	0	ND	NA	0.0059	NA	NA	22	0	ND	NA	0.0060	NA	NA
Dibenzo[a,h]anthracene	H, C	22	0	ND	NA	0.0119	NA	NA	22	0	ND	NA	0.0120	NA	NA
Fluoranthene	H	22	14	0.0286	Location 12	0.0084	NP	0.0109	22	0	ND	NA	0.0060	NA	NA
Fluorene	L	22	27	0.254	Location 17	0.0295	NP	0.1574	22	14	0.0237	Location 2	0.0078	Normal	0.0096
Ideno[1,2,3-cd]pyrene	H, C	22	0	ND	NA	0.0059	NA	NA	22	0	ND	NA	0.0060	NA	NA
Naphthalene	L	22	50	1.33	Location 7	0.1937	NP	1.0255	22	18	0.0934	Location 25	0.0135	Normal	0.0324
Phenanthrene	L	22	23	0.073	Location 17	0.0148	NP	0.0319	22	0	ND	NA	0.0060	NA	NA
Pyrene	H	22	14	0.0277	Location 12	0.0083	NP	0.0108	22	0	ND	NA	0.0060	NA	NA
Total LPAHs		22	68	1.9901	Location 17	0.3028	NP	0.8100	22	18	0.1475	Location 25	0.0463	NP	0.0789
Total HPAHs		22	14	0.0563	Location 12	0.0626	NP	0.0690	22	0	ND	NA	0.0628	NA	NA
Total cPAHs		22	0	ND	NA	0.0522	NA	NA	22	0	ND	NA	0.0514	NA	NA
Total PAHs		22	68	1.9901	Location 17	0.3200	NP	0.7970	22	18	0.1475	Location 25	0.0971	Normal	0.1220

Refer to notes at end of this table.

Table 3-5: Summary of Surface Water Data 2002-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE TYPE		Surface Water Fall 2008 (Conventional Sampling)							Surface Water Spring 2009 (Conventional Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	22	100	83	Location 13	52.0000	Student's T	58.2600
Total Suspended Solids (mg/L)		--	--	--	--	--	--	--	22	82	25	Location 25	4.5900	Gamma	6.4000
Dissolved Organic Carbon (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		22	91	0.00132	Location 26	0.0005	Gamma	0.0006	22	100	0.0018	Location 19	0.0005	NP	0.0008
Chromium		22	36	0.00257	Location 13	0.0005	NP	0.0012	22	100	0.0095	Location 19	0.0013	NP	0.0031
Copper		22	100	0.00282	Location 18	0.0011	Gamma	0.0013	22	95	0.015	Location 19	0.0026	NP	0.0053
Zinc		22	100	0.0111	Location 26	0.0057	Normal	0.0064	22	23	0.032	Location 19	0.0062	NP	0.0116
Dissolved Metals (mg/L)															
Arsenic		22	86	0.0018	Location 26	0.0004	Log	0.0005	22	100	0.0004	Location 3	0.0003	NP	0.0003
Chromium		22	5	ND	NA	0.0002	NA	NA	22	95	0.001	Location 8	0.0003	NP	0.0005
Copper		22	82	0.00403	Location 13	0.0009	Log	0.0017	22	59	0.0017	Location 5	0.0008	NP	0.0012
Zinc		22	100	0.005	Location 2	0.0044	Normal	0.0048	22	9	0.023	Location 3	0.0039	NA	NA
Pentachlorophenol (μg/L)		22	0	ND	NA	0.1245	NA	NA	22	0	ND	NA	0.1609	NA	NA
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	22	14	0.704	Location 26	0.0442	NP	0.3600	22	9	0.02	Location 2	0.0059	NA	NA
Acenaphthylene	L	22	0	ND	NA	0.0060	NA	NA	22	5	0.01	Location 4	0.0050	NA	NA
Anthracene	L	22	0	ND	NA	0.0060	NA	NA	22	0	ND	NA	0.0048	NA	NA
Benz[a]anthracene	H, C	22	0	ND	NA	0.0060	NA	NA	22	5	0.011	Location 15	0.0050	NA	NA
Benzo[a]pyrene	H, C	22	0	ND	NA	0.0060	NA	NA	22	0	ND	NA	0.0048	NA	NA
Benzo[b]fluoranthene	H, C	22	0	ND	NA	0.0060	NA	NA	22	5	0.012	Location 15	0.0051	NA	NA
Benzo[g,h,i]perylene	H, C	22	0	ND	NA	0.0060	NA	NA	22	5	0.015	Location 15	0.0052	NA	NA
Benzo[k]fluoranthene	H	22	0	ND	NA	0.0060	NA	NA	22	5	0.011	Location 15	0.0050	NA	NA
Chrysene	H, C	22	0	ND	NA	0.0060	NA	NA	22	5	0.011	Location 15	0.0050	NA	NA
Dibenzo[a,h]anthracene	H, C	22	0	ND	NA	0.0119	NA	NA	22	0	ND	NA	0.0048	NA	NA
Fluoranthene	H	22	5	0.0239	Location 26	0.0068	NA	NA	22	9	0.012	Location 15	0.0054	NA	NA
Fluorene	L	22	14	0.262	Location 26	0.0192	NP	0.0698	22	27	0.094	Location 2	0.0280	NP	0.1010
Ideno[1,2,3-cd]pyrene	H, C	22	0	ND	NA	0.0060	NA	NA	22	0	ND	NA	0.0048	NA	NA
Naphthalene	L	22	9	2.93	Location 26	0.1541	NA	NA	22	23	0.11	Location 13	0.0168	NP	0.2240
Phenanthrene	L	22	5	0.0566	Location 26	0.0083	NA	NA	22	0	ND	NA	0.0048	NA	NA
Pyrene	H	22	0	ND	NA	0.0060	NA	NA	22	5	0.011	Location 25	0.0051	NA	NA
Total LPAHs		22	14	3.95	Location 26	0.2343	NP	1.0100	22	50	0.114	Location 2	0.0525	NP	0.1530
Total HPAHs		22	5	0.0239	Location 26	0.0620	NA	NA	22	9	0.072	Location 15	0.0466	NA	NA
Total cPAHs		22	0	ND	NA	0.0527	NA	NA	22	5	0.06	Location 15	0.0382	NA	NA
Total PAHs		22	14	3.98	Location 26	0.2908	NP	1.0590	22	59	0.1158	Location 12	0.0735	NP	0.1690

Refer to notes at end of this table.

Table 3-5: Summary of Surface Water Data 2002-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE TYPE	Surface Water Fall 2009 (Conventional Sampling)							Surface Water Spring 2010 (Conventional Sampling)						
CONTAMINANT OF INTEREST	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency (%)**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)	22	100	73	Location 11	58.6818	Lognormal	61.0600	22	100	85	Location 07	62.5455	Normal	66.7000
Total Suspended Solids (mg/L)	21	100	37.2	Location 16	23.0857	Normal	25.1800	22	100	74.3	Location 16	16.8455	Normal	65.8000
Dissolved Organic Carbon (mg/L)	--	--	--	--	--	--	--							
Total Metals (mg/L)														
Arsenic	22	73	0.00071	Location 19	0.0004	NP	0.0005	22	100	0.00052	Location 16	0.0004	Normal	0.0004
Chromium	22	45	0.00046	Location 09	0.0002	NP	0.0003	22	100	0.0013	Location 06	0.0009	Normal	0.0010
Copper	22	100	0.0015	Location 04	0.0010	NP	0.0011	22	100	0.0025	Location 20	0.0016	Normal	0.0017
Zinc	22	73	0.0065	Location 10	0.0029	NP	0.0034	22	100	0.0064	Location 21	0.0039	Nonparametric	0.0663
Dissolved Metals (mg/L)														
Arsenic	22	100	0.00086	Location 19	0.0005	Gamma	0.0005	22	100	0.00036	Location 06	0.0002	Normal	0.0002
Chromium	22	23	0.00062	Location 25	0.0002	NP	0.0002	22	50	0.00048	Location 13	0.0002	Nonparametric	0.0003
Copper	22	100	0.0015	Location 19	0.0007	NP	0.0008	22	100	0.003	Location 21	0.0011	Gamma	0.0013
Zinc	22	27	0.0089	Location 13	0.0020	NP	0.0020	22	100	0.003	Location 21	0.0020	Normal	0.0022
Pentachlorophenol (μg/L)	22	0	ND	NA	0.0003	NA	NA	22	5	0.32	Location 9	0.0836	NA	NA
Polyaromatic Hydrocarbons (μg/L)														
Acenaphthene L	22	23	0.098	Location 05	0.0164	NP	0.0534	22	14	0.33	Location 12	0.0200	Nonparametric	0.0847
Acenaphthylene L	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0021	NA	NA
Anthracene L	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0026	NA	NA
Benz[a]anthracene H, C	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0016	NA	NA
Benzo[a]pyrene H, C	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0016	NA	NA
Benzo[b]fluoranthene H, C	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0026	NA	NA
Benzo[g,h,i]perylene H, C	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0010	NA	NA
Benzo[k]fluoranthene H	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0026	NA	NA
Chrysene H, C	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0016	NA	NA
Dibenzo[a,h]anthracene H, C	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0021	NA	NA
Fluoranthene H	22	5	0.016	Location 25	0.0079	NA	NA	22	14	0.021	Location 12	0.0040	NA	NA
Fluorene L	22	14	0.036	Location 05	0.0097	NP	0.0121	22	14	0.09	Location 12	0.0063	Nonparametric	0.0238
Ideno[1,2,3-cd]pyrene H, C	22	0	ND	NA	0.0076	NA	NA	22	0	ND	NA	0.0021	NA	NA
Naphthalene L	22	23	0.51	Location 05	0.0493	NP	0.0894	22	0	ND	NA	0.0026	NA	NA
Phenanthrene L	22	5	0.0205	Location 03	0.0093	NA	NA	22	0	ND	NA	0.0031	NA	NA
Pyrene H	22	0	ND	NA	0.0076	NA	NA	22	14	0.016	Location 12	0.0045	NA	NA
Total LPAHs	22	27	0.6715	Location 05	0.0758	NP	0.2260	22	14	0.42	Location 12	0.0344	Nonparametric	0.1150
Total HPAHs	22	5	0.09975	Location 05	0.0742	NA	NA	22	14	0.027	Location 25	0.0209	NA	NA
Total cPAHs	22	5	0.07225	Location 25	0.0645	NA	NA	22	0	ND	NA	0.0148	NA	NA
Total PAHs	22	27	0.709	Location 05	0.1173	NP	0.2300	22	18	0.441	Location 12	0.0540	Nonparametric	0.1350

Refer to notes at end of this table.

Table 3-5: Summary of Surface Water Data 2002-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE TYPE		Surface Water Statistics Fall 2010 (SPME Passive Sampling - University of Texas)							Surface Water Statistics Fall 2015 (Passive sampling: DGT for metals and polypropylene for organics - Oregon State University)						
CONTAMINANT OF INTEREST		Number of Samples	Detection Frequency (%)	Max Detection	Max Location	Mean Concentration[5]	Data Distribution	95% UCL Value[6]	Number of Samples	Detection Frequency (%)	Max Detection	Max Location	Mean Concentration[5]	Data Distribution	95% UCL Value[6]
Total Dissolved Solids (mg/L)															
Total Suspended Solids (mg/L)															
Dissolved Organic Carbon (mg/L)															
Total Metals (mg/L)															
Arsenic															
Chromium															
Copper															
Zinc															
Dissolved Metals (mg/L)															
Arsenic									12	83	0.00102	MBSW1015-A	0.0018	NA	NA
Chromium									11	0	ND	NA	NA	NA	NA
Copper									11	100	0.000194	MBSW1015-D	0.0001	Normal	0.0002
Zinc									11	81	0.0038	MBSW1015-I	0.0029	Gamma	0.0072
Pentachlorophenol (μg/L)									15	0	NA	NA	NA	NA	NA
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	2	100	0.032225909	Surface Water 2	0.0287	NA	NA	15	100	0.16	MBSW1015-12	0.0267	Gamma	0.0673
Acenaphthylene	L								15	50	0.0021	MBSW1015-12	0.0003	NP	0.0010
Anthracene	L	2	0	NA	NA	NA	NA	NA	15	100	0.0012	MBSW1015-B	0.0004	NP	0.0007
Benz[a]anthracene	H, C	2	0	NA	NA	NA	NA	NA	15	100	0.00032	MBSW1015-J	0.0002	NP	0.0002
Benzo[a]pyrene	H, C	2	0	NA	NA	NA	NA	NA	15	47	0.000049	MBSW1015-J	0.0000	NP	0.0000
Benzo[b]fluoranthene	H, C	2	0	NA	NA	NA	NA	NA	15	100	0.00012	MBSW1015-5	0.0001	Normal	0.0001
Benzo[g,h,i]perylene	H, C								15	100	0.000046	MBSW1015-5	0.0000	Normal	0.0000
Benzo[k]fluoranthene	H	2	0	NA	NA	NA	NA	NA	15	100	0.000055	MBSW1015-5	0.0000	Normal	0.0000
Chrysene	H, C	2	0	NA	NA	NA	NA	NA	15	100	0.00034	MBSW1015-J	0.0002	Normal	0.0002
Dibenzo[a,h]anthracene	H, C								15	0	ND	NA	NA	NA	NA
Fluoranthene	H	2	0	NA	NA	NA	NA	NA	15	100	0.0034	MBSW1015-B	0.0021	Normal	0.0024
Fluorene	L								15	100	0.04	MBSW1015-12	0.0088	NP	0.0242
Ideno[1,2,3-cd]pyrene	H, C								15	100	0.00003	MBSW1015-5	0.0000	Normal	0.0000
Naphthalene	L	2	100	0.044112396	Surface Water 2	0.0306	NA	NA	15	67	0.074	MBSW1015-C	0.0073	NP	0.0293
Phenanthrene	L	2	100	0.005315185	Surface Water 1	0.0052	NA	NA	15	100	0.0041	MBSW1015-5	0.0013	NP	0.0270
Pyrene	H	2	0	NA	NA	NA	NA	NA	15	100	0.0026	MBSW1015-12	0.0016	Normal	0.0018
Total LPAHs		2	100	0.08151173	Surface Water 2	0.0645	NA	NA	15	100	0.20361	MBSW1015-12	0.0450	NP	0.1180
Total HPAHs		2	0	NA	NA	NA	NA	NA	15	100	0.006456	MBSW1015-5	0.0043	Normal	0.0049
Total cPAHs		2	0	NA	NA	NA	NA	NA	15	100	0.00089	MBSW1015-J	0.0005	Normal	0.0006
Total PAHs		2	100	0.08151173	Surface Water 2	0.0645	NA	NA	15	100	0.209052	MBSW1015-12	0.0489	NP	0.1240

Refer to notes at end of this table.

Notes:

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 2 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

[1] The 1996 Record of Decision (ROD) specifies the remedial action objectives of the sediment cap as: 1) preventing human and aquatic organisms from direct contact with contaminated sediment; and 2) minimizing releases of contaminants from sediment that might result in contamination of the Willamette River in excess of Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of 2007 and updated 2015, are included for comparison (see https://www.epa.gov/wqc/national-recommended-water-quality-criteria)

[3] Aquatic Water Quality Criteria (AWQCs) published as of 2011, and updated effective August 4, 2015, are included for comparison (see http://www.deq.state.or.us/wq/standards/docs/tables303140.pdf)

[4] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://water.epa.gov/drink/contaminants/index.cfm).

[5] Mean Concentration includes half of the method detection limit for non-detect values

[6] 95% UCL was calculated using EPA's ProUCL Program; the recommented distribution uis reported. Where there were to few independent values (i.e. 4 or fewer detections), the 95% was not calculated and "NA" is reported.

Key:

C = carcinogenic PAH (cPAH)
Gamma = gamma distribution
H = high molecular weight PAH (HPAH)
J = estimated value
L = low molecular weight PAH (LPAH)
µg/L = micrograms per liter
mg/L = milligrams per liter
MDL = method detection limit
NA = not applicable
Normal = normal distribution
-- = not analyzed
ND = not detected
NP = nonparametric distribution
U = value below MDL (value represents MDL)

Table 3-6: Summary of Inter-Armoring Water Data 2006-2015
2015 O&M Annual Report
McCormick and Baxter Superfund **Site**

SAMPLE TYPE		**Screening Criteria**							**Inter-Armoring Water Spring 2006 (Conventional Sampling)**						
		1996 AWQCs[1]		**2015 NRWQCs[2]**		**DEQ 2011 EPA-Approved AWQCs[3]**		**2011 MCLs[4]**							
CONTAMINANT OF INTEREST		Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Maximum Contaminant Levels (MCLs)	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)									--	--	--	--	--	--	--
Total Suspended Solids (mg/L)									--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		0.19		0.15	**0.00014**	0.15	0.0021	0.01	23	30%	0.00493	Location 5	0.0012	NP	0.0023
Chromium		0.21		0.074		**0.053**		0.1	23	43%	0.0105	Location 12	0.0008	NP	0.0053
Copper		0.012		**0.0049**		0.0065			23	96%	0.0168	Location 12	0.0026	NP	0.0056
Zinc		0.11		0.12	26	**0.066**	2.6		23	78%	0.0392	Location 12	0.0069	NP	0.0154
Dissolved Metals (mg/L)															
Arsenic		0.19		0.15	**0.00014**	0.15	0.0021	0.01							
Chromium		0.21		0.074		**0.053**		0.1							
Copper		0.012		**0.0049**		0.0065									
Zinc		0.11		0.12	26	**0.066**	2.6								
Pentachlorophenol (ug/L)		13		15	**0.04**	8.2	0.3	1	22	0%	ND	NA	0.1200	NA	NA
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	520			**90**		99		22	32%	3.65	Location 5	0.3208	NP	2.3228
Acenaphthylene	L								22	5%	0.0736	Location 10	0.0093	NA	NA
Anthracene	L				**400**		4000		22	5%	0.199	Location 5	0.0148	NA	NA
Benz[a]anthracene	H, C				**0.0013**		0.0018		22	5%	0.0134	Location 5	0.0063	NA	NA
Benzo[b]fluoranthene	H, C				**0.00013**		0.0018	0.2	22	0%	ND	NA	0.0060	NA	NA
Benzo[k]fluoranthene	H				**0.0013**		0.0018		22	0%	ND	NA	0.0060	NA	NA
Benzo[a]pyrene	H, C								22	0%	ND	NA	0.0060	NA	NA
Benzo[g,h,i]perylene	H, C				**0.0013**		0.0018		22	0%	ND	NA	0.0060	NA	NA
Chrysene	H, C				0.13		**0.0018**		22	5%	0.0186	Location 5	0.0066	NA	NA
Dibenzo[a,h]anthracene	H, C				**0.00013**		0.0018		22	0%	ND	NA	0.0120	NA	NA
Fluoranthene	H		54		20		**14**		22	5%	0.253	Location 5	0.0172	NA	NA
Fluorene	L				**70**		530		22	9%	1.99	Location 5	0.0981	NA	NA
Ideno[1,2,3-cd]pyrene	H, C				**0.0013**		0.0018		22	0%	ND	NA	0.0060	NA	NA
Naphthalene	L	**620**							22	50%	1.13	Location 5	0.0850	NP	0.6037
Phenanthrene	L								22	14%	1.73	Location 5	0.0861	NP	0.8651
Pyrene	H				**30**		400		22	5%	0.138	Location 5	0.0120	NA	NA
Total LPAHs									22	55%	8.699	Location 5	0.6011	NP	2.3770
Total HPAHs									22	5%	0.423	Location 5	0.0880	NA	NA
Total cPAHs			**0.031**						22	5%	0.032	Location 5	0.0530	NA	NA
Total PAHs									22	55%	9.122	Location 5	0.6503	NP	2.4900

Refer to notes at end of this table.

Table 3-6: Summary of Inter-Armoring Water Data 2006-2015
2015 O&M Annual Report
McCormick and Baxter Superfund **Site**

SAMPLE TYPE		Inter-Armoring Water Fall 2006 (Conventional Sampling)							Inter-Armoring Water Spring 2007 (Conventional Sampling)							Inter-Armoring Water Fall 2007 (Conventinoal Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals (mg/L)																						
Arsenic		22	100%	0.00206	Location 21	0.0007	NP	0.0008	23	13%	0.00713	Location 5	0.0007	NP	0.0038	22	100%	0.00202	Location 13	0.0010	Normal	0.0012
Chromium		22	64%	0.00216	Location 3	0.0004	NP	0.0015	23	13%	0.0227	Location 5	0.0020	Gamma	0.0040	22	55%	0.00456	Location 16	0.0009	Gamma	0.0014
Copper		22	100%	0.00435	Location 20	0.0017	Lognormal	0.0022	23	100%	0.037	Location 5	0.0053	NP	0.0124	22	86%	0.00858	Location 16	0.0025	Gamma	0.0033
Zinc		22	45%	0.0147	Location 17	0.0032	NP	0.0113	23	4%	0.03325	Location 5	0.0051	NA	NA	22	64%	0.0222	Location 16	0.0068	Gamma	0.0093
Dissolved Metals (mg/L)																						
Arsenic																						
Chromium																						
Copper																						
Zinc																						
Pentachlorophenol (ug/L)		22	14%	0.25	Location 6	0.1351	NP	0.1495	23	0%	ND	NA	0.1228	NA	NA	22	0%	ND	NA	0.1140	NA	NA
Polyaromatic Hydrocarbons (µg/L)																						
Acenaphthene	L	22	23%	1.81	Location 20	0.0961	NP	0.9105	23	13%	0.115	Location 20	0.0143	NP	0.0375	22	0%	ND	NA	0.0280	NA	NA
Acenaphthylene	L	22	18%	0.0506	Location 20	0.0088	NP	0.0126	23	0%	ND	NA	0.0061	NA	NA	22	9%	0.0673	Location 17	0.0091	NA	NA
Anthracene	L	22	14%	0.0161	Location 20	0.0070	NP	0.0080	23	0%	ND	NA	0.0061	NA	NA	22	0%	ND	NA	0.0059	NA	NA
Benz[a]anthracene	H, C	22	14%	0.0187	Location 5	0.0070	NP	0.0082	23	0%	ND	NA	0.0061	NA	NA	22	0%	ND	NA	0.0059	NA	NA
Benzo[b]fluoranthene	H, C	22	14%	0.0125	Location 6	0.0067	NP	0.0075	23	0%	ND	NA	0.0061	NA	NA	22	0%	ND	NA	0.0059	NA	NA
Benzo[k]fluoranthene	H	22	14%	0.0136	Location 5	0.0068	NP	0.0076	23	0%	ND	NA	0.0061	NA	NA	22	0%	ND	NA	0.0059	NA	NA
Benzo[a]pyrene	H, C	22	14%	0.0125	Location 6	0.0067	NP	0.0075	23	0%	ND	NA	0.0061	NA	NA	22	0%	ND	NA	0.0059	NA	NA
Benzo[g,h,i]perylene	H, C	22	9%	0.0125	Location 6	0.0065	NA	NA	23	0%	ND	NA	0.0061	NA	NA	22	0%	ND	NA	0.0059	NA	NA
Chrysene	H, C	22	14%	0.0236	Location 5	0.0073	NP	0.0088	23	0%	ND	NA	0.0061	NA	NA	22	0%	ND	NA	0.0059	NA	NA
Dibenzo[a,h]anthracene	H, C	22	9%	0.025	Location 6	0.0129	NP	0.0140	23	0%	ND	NA	0.0123	NA	NA	22	0%	ND	NA	0.0119	NA	NA
Fluoranthene	H	22	18%	0.111	Location 5	0.0123	NP	0.0333	23	0%	ND	NA	0.0061	NA	NA	22	32%	0.0173	Location 10	0.0084	NP	0.0098
Fluorene	L	22	18%	0.398	Location 20	0.0282	NP	0.2078	23	9%	0.0345	Location 20	0.0078	NA	NA	22	0%	ND	NA	0.0149	NA	NA
Ideno[1,2,3-cd]pyrene	H, C	22	9%	0.0125	Location 6	0.0065	NA	NA	23	0%	ND	NA	0.0061	NA	NA	22	0%	ND	NA	0.0059	NA	NA
Naphthalene	L	22	36%	2.08	Location 20	0.1364	NP	1.0949	23	0%	ND	NA	0.0066	NA	NA	22	0%	ND	NA	0.0474	NA	NA
Phenanthrene	L	22	14%	0.147	Location 20	0.0185	NP	0.0557	23	0%	ND	NA	0.0061	NA	NA	22	0%	ND	NA	0.0089	NA	NA
Pyrene	H	22	23%	0.0601	Location 5	0.0099	NP	0.0208	23	0%	ND	NA	0.0061	NA	NA	22	5%	0.0141	Location 10	0.0063	NA	NA
Total LPAHs		22	36%	4.5017	Location 20	0.2830	NP	1.1750	23	17%	0.1495	Location 20	0.0416	NP	0.0643	22	9%	0.0673	Location 17	0.0779	NA	NA
Total HPAHs		22	18%	0.227	Location 5	0.0718	NP	0.1060	23	0%	ND	NA	0.0678	NA	NA	22	32%	0.0314	Location 10	0.0493	NP	0.0714
Total cPAHs		22	9%	0.0559	Location 5	0.0556	NA	NA	23	0%	ND	NA	0.0553	NA	NA	22	0%	ND	NA	0.0534	NA	NA
Total PAHs		22	41%	4.5469	Location 20	0.3036	NP	1.2090	23	17%	0.1495	Location 20	0.0974	NP	0.1230	22	36%	0.0812	Location 17	0.0854	NP	0.1470

Refer to notes at end of this table.

Table 3-6: Summary of Inter-Armoring Water Data 2006-2015
2015 O&M Annual Report
McCormick and Baxter Superfund **Site**

SAMPLE TYPE		Inter-Armoring Water Spring 2008 (Conventional Sampling)							Inter-Armoring Water Fall 2008 (Conventional Sampling)							Inter-Armoring Water Spring 2009 (Conventional Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	22	100%	100	Location 15	58	Student's T	64.37
Total Suspended Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	22	86%	150	Location 4	15	NP	45.52
Total Metals (mg/L)																						
Arsenic		22	5%	0.00078	Location 14	0.0004	NA	NA	22	95%	0.00257	Location 14	0.0008	Gamma	0.0011	22	100%	0.0071	Location 7	0.0009	NP	0.0022
Chromium		22	91%	0.00229	Location 14	0.0006	Lognormal	0.0008	22	55%	0.0109	Location 14	0.0014	NP	0.0023	22	100%	0.0043	Location 4	0.0018	Student's T	0.0021
Copper		22	82%	0.00528	Location 7	0.0019	Gamma	0.0023	22	100%	0.0236	Location 14	0.0038	Normal	0.0084	22	100%	0.0092	Location 17	0.0038	Gamma	0.0048
Zinc		22	27%	0.172	Location 9	0.0117	NP	0.0879	22	77%	0.058	Location 14	0.0109	Normal	0.0220	22	27%	0.018	Location 4	0.0067	NP	0.0100
Dissolved Metals (mg/L)																						
Arsenic																22	100%	0.0008	Location 14	0.0003	NP	0.0004
Chromium																22	91%	0.0017	Location 10	0.0003	NP	0.0006
Copper																22	82%	0.0029	Location 25	0.0011	NP	0.0017
Zinc																22	18%	0.023	Location 14	0.0046	NP	0.0088
Pentachlorophenol (ug/L)		22	0%	ND	NA	0.1198	NA	NA	22	0%	ND	NA	0.1192	NA	NA	22	0%	0.165	Location 8	0.1602	NA	
Polyaromatic Hydrocarbons (μg/L)																						
Acenaphthene	L	22	14%	0.0582	Location 2	0.0107	NP	0.0233	22	18%	0.184	Location 26	0.0213	NP	0.0363	22	18%	6	Location 20	0.2896	NP	1.4760
Acenaphthylene	L	22	0%	ND	NA	0.0060	NA	NA	22	0%	ND	NA	0.0060	NA	NA	22	0%	0.0048	Location 8	0.0048	NA	NA
Anthracene	L	22	0%	ND	NA	0.0060	NA	NA	22	0%	ND	NA	0.0060	NA	NA	22	5%	0.029	Location 20	0.0059	NA	NA
Benz[a]anthracene	H, C	22	0%	ND	NA	0.0060	NA	NA	22	0%	ND	NA	0.0060	NA	NA	22	5%	0.0095	Location 18	0.0050	NA	NA
Benzo[b]fluoranthene	H, C	22	0%	ND	NA	0.0060	NA	NA	22	0%	ND	NA	0.0060	NA	NA	22	0%	0.0048	Location 8	0.0048	NA	NA
Benzo[k]fluoranthene	H	22	0%	ND	NA	0.0060	NA	NA	22	0%	ND	NA	0.0060	NA	NA	22	0%	0.0048	Location 8	0.0048	NA	NA
Benzo[a]pyrene	H, C	22	0%	ND	NA	0.0060	NA	NA	22	0%	ND	NA	0.0060	NA	NA	22	0%	0.0048	Location 8	0.0048	NA	NA
Benzo[g,h,i]perylene	H, C	22	0%	ND	NA	0.0060	NA	NA	22	0%	ND	NA	0.0060	NA	NA	22	0%	0.0048	Location 8	0.0048	NA	NA
Chrysene	H, C	22	0%	ND	NA	0.0060	NA	NA	22	0%	ND	NA	0.0060	NA	NA	22	14%	0.014	Location 18	0.0056	NP	0.0078
Dibenzo[a,h]anthracene	H, C	22	0%	ND	NA	0.0120	NA	NA	22	0%	ND	NA	0.0119	NA	NA	22	0%	0.0048	Location 8	0.0048	NA	NA
Fluoranthene	H	22	0%	ND	NA	0.0060	NA	NA	22	5%	0.017	Location 7	0.0065	NA	NA	22	14%	0.11	Location 7	0.0125	NP	0.0353
Fluorene	L	22	9%	0.0157	Location 2	0.0067	NA	NA	22	14%	0.0692	Location 26	0.0107	NP	0.0247	22	27%	1.4	Location 20	0.0828	NP	0.3580
Ideno[1,2,3-cd]pyrene	H, C	22	0%	ND	NA	0.0060	NA	NA	22	0%	ND	NA	0.0060	NA	NA	22	0%	0.0048	Location 8	0.0048	NA	NA
Naphthalene	L	22	27%	0.0521	Location 2	0.0112	NP	0.0218	22	14%	0.488	Location 26	0.0312	NP	0.2500	22	23%	0.42	Location 2	0.0407	NP	0.1410
Phenanthrene	L	22	0%	ND	NA	0.0060	NA	NA	22	5%	0.0154	Location 26	0.0064	NA	NA	22	14%	0.016	Location 20	0.0059	NP	0.0087
Pyrene	H	22	0%	ND	NA	0.0060	NA	NA	22	5%	0.0181	Location 7	0.0065	Normal	0.0076	22	18%	0.073	Location 7	0.0101	NP	0.0249
Total LPAHs		22	32%	0.126	Location 2	0.0381	NP	0.0609	22	18%	0.757	Location 26	0.0772	NP	0.0711	22	45%	7.765	Location 20	0.4201	NP	1.9480
Total HPAHs		22	0%	ND	NA	0.0644	NA	NA	22	5%	0.0351	Location 7	0.0625	NA	NA	22	23%	0.183	Location 7	0.0529	NP	0.0827
Total cPAHs		22	0%	ND	NA	0.0527	NA	NA	22	0%	ND	NA	0.0527	NA	NA	22	5%	0.0403	Location 18	0.0368	NA	NA
Total PAHs		22	32%	0.126	Location 2	0.0806	NP	0.1150	22	18%	0.757	Location 26	0.1308	NP	0.2620	22	55%	7.861	Location 20	0.4536	NP	1.9960

Refer to notes at end of this table.

Table 3-6: Summary of Inter-Armoring Water Data 2006-2015
2015 O&M Annual Report
McCormick and Baxter Superfund **Site**

SAMPLE TYPE		Inter-Armoring Water Fall 2009 (Conventional Sampling)							Inter-Armoring Water Spring 2010 (Conventional Sampling)							Inter-Armoring Water Fall 2010 (SPME Passive Sampling - University of Texas)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		22	100%	114	Location 13	64.36363636	Gamma	68.16	22	100%	83	Location 14	62.43	Normal	67.36							
Total Suspended Solids (mg/L)		22	100%	1150	Location 04	117.7954545	Gamma	190.4	22	100%	300	Location 10	295	Gamma	489.6							
Total Metals (mg/L)																						
Arsenic		22	77%	0.004	Location 17	0.0007	NP	0.0014	22	100%	0.0105	Location 06	0.0013	Nonparametric	0.0033							
Chromium		22	68%	0.0027	Location 04	0.0005	Gamma	0.0007	22	100%	0.047	Location 06	0.0044	Nonparametric	0.0136							
Copper		22	100%	0.0102	Location 04	0.0019	NP	0.0037	22	100%	0.0751	Location 06	0.0077	Nonparametric	0.0228							
Zinc		22	100%	0.0303	Location 04	0.0064	NP	0.0085	22	100%	0.162	Location 06	0.0178	Nonparametric	0.0492							
Dissolved Metals (mg/L)																						
Arsenic		22	100%	0.0045	Location 17	0.0007	NP	0.0015	22	100%	0.0077	Location 06	0.0007	Nonparametric	0.0022							
Chromium		22	27%	0.00065	Location 04	0.0003	NP	0.0005	22	73%	0.00086	Location 26	0.0003	Gamma	0.0005							
Copper		22	100%	0.0016	Location 04	0.0009	Normal	0.0010	22	100%	0.0028	Location 06	0.0014	Gamma	0.0015							
Zinc		22	82%	0.0058	Location 12	0.0029	NP	0.0034	22	100%	0.0096	Location 17	0.0034	Normal	0.0040							
Pentachlorophenol (ug/L)		22	0%	ND	NA	0.0003	NA	NA	22	0%	ND	NA	0.0721	NA	NA							
Polyaromatic Hydrocarbons (µg/L)																						
Acenaphthene	L	22	32%	0.14	Location 13	0.0257	NP	0.0379	22	9%	0.56	Location 12	0.0306	NA	NA	21	100%	3.1	Location 5	0.31	NP	1.1
Acenaphthylene	L	22	0%	ND	NA	0.0075	NA	NA	22	0%	ND	NA	0.0021	NA	NA							
Anthracene	L	22	5%	0.016	Location 17	0.0079	NA	NA	22	0%	ND	NA	0.0026	NA	NA	21	14%	0.043	Location 5	0.0052	NA	NA
Benz[a]anthracene	H, C	22	0%	ND	NA	0.0075	NA	NA	22	0%	ND	NA	0.0016	NA	NA	21	14%	0.00062	Location 5	0.00009	NA	NA
Benzo[b]fluoranthene	H, C	22	0%	ND	NA	0.0075	NA	NA	22	0%	ND	NA	0.0016	NA	NA	21	14%	0.00025	Location 11	0.000033	NA	NA
Benzo[k]fluoranthene	H	22	0%	ND	NA	0.0075	NA	NA	22	0%	ND	NA	0.0026	NA	NA	21	14%	0.000325	Location 11	0.000059	NA	NA
Benzo[a]pyrene	H, C	22	0%	ND	NA	0.0075	NA	NA	22	0%	ND	NA	0.0011	NA	NA							
Benzo[g,h,i]perylene	H, C	22	0%	ND	NA	0.0075	NA	NA	22	0%	ND	NA	0.0026	NA	NA	21	19%	0.00013	Location 11	0.000026	NP	0.000052
Chrysene	H, C	22	0%	ND	NA	0.0075	NA	NA	22	0%	ND	NA	0.0016	NA	NA	21	14%	0.00041	Location 11	0.000087	NA	NA
Dibenzo[a,h]anthracene	H, C	22	0%	ND	NA	0.0075	NA	NA	22	0%	ND	NA	0.0021	NA	NA							
Fluoranthene	H	22	9%	0.028	Location 06	0.0089	NA	NA	22	9%	0.014	Location 05	0.0032	NA	NA	21	100%	0.019	Location 15	0.0020	NP	0.0057
Fluorene	L	22	18%	0.09	Location 17	0.0153	NP	0.0347	22	5%	0.12	Location 12	0.0072	NA	NA	4	100%	1.13	Location 5	0.45	NA	NA
Ideno[1,2,3-cd]pyrene	H, C	22	0%	ND	NA	0.0075	NA	NA	22	0%	ND	NA	0.0021	NA	NA	21						
Naphthalene	L	22	32%	0.36	Location 05	0.0310	NP	0.1030	22	0%	ND	NA	0.0026	NA	NA	21	76%	0.96	Location 5	0.080	NP	0.28
Phenanthrene	L	22	9%	0.023	Location 06	0.0111	NA	NA	22	5%	0.018	Location 10	0.0038	NA	NA	21	90%	1.02	Location 12	0.073	NP	0.29
Pyrene	H	22	5%	0.023	Location 06	0.0082	NA	NA	22	9%	0.012	Location 10	0.0039	NA	NA	21	100%	0.025	Location 12	0.0022	NP	0.0077
Total LPAHs		22	45%	0.5115	Location 05	0.0754	NP	0.1880	22	14%	0.68	Location 12	0.0468	Nonparametric	0.1770	21	100%	5.6	Location 5	0.56	NP	1.79
Total HPAHs		22	9%	0.16325	Location 17	0.0815	NA	NA	22	9%	0.026	Location 10	0.0208	NA	NA	21	43%	0.03178	Location 5	0.0044	NP	0.012
Total cPAHs		22	9%	0.088	Location 06	0.0653	NA	NA	22	0%	ND	NA	0.0151	NA	NA	21	14%	0.0015	Location 11	0.00026	NA	NA
Total PAHs		22	45%	0.549	Location 05	0.1186	NP	0.2180	22	18%	0.68	Location 12	0.0655	Nonparametric	0.1920	21	100%	5.6	Location 5	0.57	NP	1.8

Refer to notes at end of this table.

Table 3-6: Summary of Inter-Armoring Water Data 2006-2015
2015 O&M Annual Report
McCormick and Baxter Superfund **Site**

SAMPLE TYPE		**Inter-Armoring Water Spring 2015 (Passive sampling: DGT for metals and polypropylene for organics - Oregon State University)**						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)								
Total Suspended Solids (mg/L)								
Total Metals (mg/L)								
Arsenic								
Chromium								
Copper								
Zinc								
Dissolved Metals (mg/L)								
Arsenic		5	20	**0.0010**	MBIA1015-I	**0.00044**	NA	NA
Chromium		3	67	0.00059	MBIA1015-K	0.00071	NA	NA
Copper		3	67	0.0051	MBIA1015-C	0.0019	NA	NA
Zinc		3	67	0.0075	MBIA1015-C	0.0034	NA	NA
Pentachlorophenol (ug/L)		14	0	NA	NA	NA	NA	NA
Polyaromatic Hydrocarbons (µg/L)								
Acenaphthene	L	14	93	6.0	MBIA1015-12	0.92	NP	24
Acenaphthylene	L	14	14	0.016	MBIA1015-12	0.0022	NA	NA
Anthracene	L	14	71	0.057	MBIA1015-B	0.0050	NP	0.021
Benz[a]anthracene	H, C	14	29	0.00012	MBIA1015-12	0.000030	NP	0.000069
Benzo[b]fluoranthene	H, C	14	0	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	H	14	43	0.000066	MBIA1015-B	0.000018	NP	0.000038
Benzo[a]pyrene	H, C	14	21	0.000024	MBIA1015-I	0.0000056	NP	0.000012
Benzo[g,h,i]perylene	H, C	14	14	0.000028	MBIA1015-B	0.0000070	NA	NA
Chrysene	H, C	14	50	0.00016	MBIA1015-12	0.000037	NP	0.000088
Dibenzo[a,h]anthracene	H, C	14	0	NA	NA	NA	NA	NA
Fluoranthene	H	14	100	0.034	MBIA1015-B	0.0035	NP	0.013
Fluorene	L	14	100	1.9	MBIA1015-B	0.20	NP	0.74
Ideno[1,2,3-cd]pyrene	H, C	14	0	NA	NA	NA	NA	NA
Naphthalene	L	14	29	0.020	MBIA1015-12	0.0026	NP	0.0090
Phenanthrene	L	14	100	0.60	MBIA1015-B	0.048	NP	0.22
Pyrene	H	14	100	0.012	MBIA1015-B	0.0018	NP	0.0051
Total LPAHs		14	100	8.2	MBIA1015-B	1.18	NP	3.97
Total HPAHs		14	100	0.046	MBIA1015-B	0.0054	NP	0.018
Total cPAHs		14	57	0.00033	MBIA1015-D	0.00012	NP	0.00026
Total PAHs		14	100	8.2	MBIA1015-B	1.2	NP	3.98

Refer to notes at end of this table.

Notes:

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 2 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

[1] The 1996 Record of Decision (ROD) specifies the remedial action objectives of the sediment cap as: 1) preventing human and aquatic organisms from direct contact with contaminated sediment; and 2) minimizing releases of contaminants from sediment that might result in contamination of the Willamette River in excess of Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of 2007 and updated 2015, are included for comparison (see https://www.epa.gov/wqc/national-recommended-water-quality-criteria)

[3] Aquatic Water Quality Criteria (AWQCs) published as of 2011, and updated effective August 4, 2015, are included for comparison (see http://www.deq.state.or.us/wq/standards/docs/tables303140.pdf)

[4] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://water.epa.gov/drink/contaminants/index.cfm).

[5] Mean Concentration includes half of the method detection limit for non-detect values

[6] 95% UCL was calculated using EPA's ProUCL Program; the recommented distribution uis reported. Where there were to few independent values (i.e. 4 or fewer detections), the 95% was not calculated and "NA" is reported.

Key:

C = carcinogenic PAH (cPAH)
Gamma = gamma distribution
H = high molecular weight PAH (HPAH)
J = estimated value
L = low molecular weight PAH (LPAH)
µg/L = micrograms per liter
mg/L = milligrams per liter
MDL = method detection limit
NA= not applicable
Normal = normal distribution
-- = not analyzed
ND = not detected
NP = nonparametric distribution
U = value below MDL (value represents MDL)

Table 3-7: Summary of Sub-Armoring Water Data 2005-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE TYPE		Screening Criteria							Sub-Armoring Water Fall 2005 (Conventional Sampling)						
		1996 AWQCs[1]		**2015 NRWQCs[2]**		**DEQ 2011 EPA-Approved AWQCs[3]**		**2011 MCLs[4]**							
CONTAMINANT OF INTEREST		Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Maximum Contaminant Levels (MCLs)	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)									--	--	--	--	--	--	--
Total Suspended Solids (mg/L)									--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		0.19		0.15	**0.00014**	0.15	0.0021	0.01	23	100%	0.0332	MBPWPR05-26	0.0053	Gamma	0.0084
Chromium		0.21		0.074		**0.053**		0.1	23	39%	0.0144	MBPWPR05-09	0.0014	NP	0.0041
Copper		0.012		**0.0049**		0.0065			23	70%	0.0282	MBPWPR05-09	0.0027	NP	0.0146
Zinc		0.11		0.12	26	**0.066**	2.6		23	100%	0.113	MBPWPR05-09	0.0202	Gamma	0.0280
Dissolved Metals (mg/L)															
Arsenic		0.19		0.15	**0.00014**	0.15	0.0021	0.01	--	--	--	--	--	--	--
Chromium		0.21		0.074		**0.053**		0.1	--	--	--	--	--	--	--
Copper		0.012		**0.0049**		0.0065			--	--	--	--	--	--	--
Zinc		0.11		0.12	26	**0.066**	2.6		--	--	--	--	--	--	--
Pentachlorophenol (ug/L)		13		15	**0.04**	8.2	0.3	1	23	4%	0.469	MBPWPR05-17 1	0.8562	NA	NA
Polyaromatic Hydrocarbons (µg/L)															
Acenaphthene	L	520			**90**		99		23	57%	131	MBPWPR05-20	16.983	NP	32.650
Acenaphthylene	L								23	13%	1.22	MBPWPR05-23	0.1160	NP	0.6744
Anthracene	L				**400**		4000		23	39%	3.42	MBPWPR05-09	0.5349	NP	2.876
Benzo[a]anthracene	H, C				**0.0013**		0.0018		23	17%	0.959	MBPWPR05-09	0.0668	NP	0.4855
Benzo[a]pyrene	H, C				**0.00013**		0.0018	0.2	23	0%	ND	NA	0.0146	NA	NA
Benzo[b]fluoranthene	H, C				**0.0013**		0.0018		23	4%	0.284	MBPWPR05-09	0.0216	NA	NA
Benzo[g,h,i]perylene	H, C								23	4%	0.369	MBPWPR05-09	0.0252	NA	NA
Benzo[k]fluoranthene	H				**0.0013**		0.0018		23	9%	0.355	MBPWPR05-09	0.0251	NA	NA
Chrysene	H, C				0.13		**0.0018**		23	22%	1.05	MBPWPR05-09	0.0713	NP	0.5283
Dibenzo[a,h]anthracene	H, C				**0.00013**		0.0018		23	0%	ND	NA	0.0337	NA	NA
Fluoranthene	H		54		20		**14**		23	61%	7.4	MBPWPR05-07	0.8853	NP	5.259
Fluorene	L				**70**		530		23	61%	53.9	MBPWPR05-20	5.861	NP	11.587
Ideno[1,2,3-cd]pyrene	H, C				**0.0013**		0.0018		23	0%	ND	NA	0.0146	NA	NA
Naphthalene	L	**620**							23	61%	772	MBPWPR05-09	74.567	NP	522
Phenanthrene	L								23	61%	41	MBPWPR05-20	4.796	NP	8.902
Pyrene	H				**30**		400		23	65%	4.49	MBPWPR05-09	0.5216	NP	3.190
Total LPAHs									23	78%	886	MBPWPR05-10	103	NP	547
Total HPAHs									23	65%	14.257	MBPWPR05-09	1.590	NP	5.104
Total cPAHs			**0.031**						23	22%	3.017	MBPWPR05-09	0.2390	NP	0.8040
Total PAHs									23	78%	886	MBPWPR05-10	104	NP	550

Refer to notes at end of this table.

Table 3-7: Summary of Sub-Armoring Water Data 2005-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE TYPE		Sub-Armoring Water Spring 2006 (Conventional Sampling)							Sub-Armoring Water Fall 2006 (Conventional Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		23	91%	0.037	Location 3	0.0103	Gamma	0.0154	22	95%	0.0386	Location 18	0.0089	Gamma	0.0142
Chromium		23	78%	0.0169	Location 11	0.0013	Log	0.0027	22	23%	0.00106	Location 25	0.0002	NP	0.0004
Copper		23	70%	0.0352	Location 19	0.0055	Gamma	0.0107	22	82%	0.00281	Location 15	0.0008	Gamma	0.0012
Zinc		23	87%	0.388	Location 11	0.0366	Log	0.0718	22	50%	0.0263	Location 14	0.0059	NP	0.0207
Dissolved Metals (mg/L)															
Arsenic		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol (ug/L)		23	4%	18.5	Location 6	0.9662	NA	NA	22	14%	0.25	Location 6	0.1409	NP	0.1578
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	23	74%	22.1	Location 20	4.520	Gamma	11.201	22	73%	19	Location 20	3.401	Gamma	8.510
Acenaphthylene	L	23	4%	0.3065	Location 20	0.0271	NA	NA	22	14%	3.27	Location 17	0.3053	NP	2.2921
Anthracene	L	23	61%	0.709	Location 5	0.1116	NP	0.514	22	50%	0.458	Location 9	0.0616	NP	0.299
Benzo[a]anthracene	H, C	23	17%	0.0995	Location 5	0.0146	NP	0.0348	22	18%	0.055	Location 7	0.0110	NP	0.0225
Benzo[a]pyrene	H, C	23	0%	ND	NA	0.0086	NA	NA	22	9%	0.0187	Location 17	0.0070	NA	NA
Benzo[b]fluoranthene	H, C	23	9%	0.06	Location 16	0.0099	NA	NA	22	9%	0.0125	Location 4	0.0068	NA	NA
Benzo[g,h,i]perylene	H, C	23	0%	ND	NA	0.0084	NA	NA	22	14%	0.0125	Location 4	0.0070	NP	0.0079
Benzo[k]fluoranthene	H	23	9%	0.0894	Location 5	0.0130	NA	NA	22	9%	0.0125	Location 6	0.0068	NA	NA
Chrysene	H, C	23	22%	0.101	Location 5	0.0158	NP	0.0366	22	27%	0.0503	Location 7	0.0121	NP	0.0242
Dibenzo[a,h]anthracene	H, C	23	0%	ND	NA	0.0167	NA	NA	22	14%	0.025	Location 6	0.0141	NP	0.0158
Fluoranthene	H	23	65%	1.67	Location 7	0.2263	NP	1.122	22	59%	10.4	Location 7	0.6263	NP	5.312
Fluorene	L	23	65%	10.5	Location 5	1.117	NP	6.480	22	59%	10.3	Location 17	1.134	NP	6.446
Ideno[1,2,3-cd]pyrene	H, C	23	0%	0.06	Location 16	0.0084	NA	NA	22	5%	0.0144	Location 17	0.0066	NA	NA
Naphthalene	L	23	74%	726	Location 16	47.516	NP	297	22	73%	229	Location 5	13.323	NP	118
Phenanthrene	L	23	52%	6.91	Location 5	0.612	NP	4.180	22	59%	6.4	Location 17	0.539	NP	3.735
Pyrene	H	23	48%	0.716	Location 7	0.1075	NP	0.506	22	68%	3.14	Location 7	0.2309	NP	1.663
Total LPAHs		23	87%	738	Location 16	53	NP	205	22	91%	232	Location 5	18	NP	66
Total HPAHs		23	65%	2.4248	Location 7	0.402	NP	1.039	22	64%	13.6453	Location 7	0.890	NP	3.580
Total cPAHs		23	22%	0.3217	Location 5	0.0889	NP	0.1980	22	23%	0.1053	Location 7	0.0563	NP	0.0710
Total PAHs		23	91%	738	Location 16	56	NP	205	22	91%	232	Location 5	19	Gamma	51

Refer to notes at end of this table.

Table 3-7: Summary of Sub-Armoring Water Data 2005-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE TYPE		Sub-Armoring Water Spring 2007 (Conventional Sampling)							Sub-Armoring Water Fall 2007 (Conventinoal Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		23	100%	0.0522	Location 3	0.0080	Gamma	0.0123	22	100%	0.0322	Location 4	0.0126	Normal	0.0162
Chromium		23	30%	0.00255	Location 15	0.0006	NP	0.0022	22	9%	0.00143	Location 3	0.0003	NP	0.0006
Copper		23	96%	0.544	Location 15	0.0253	NP	0.2600	22	86%	0.00476	Location 15	0.0008	NP	0.0018
Zinc		23	57%	0.0526	Location 15	0.0098	NP	0.0350	22	91%	0.0335	Location 16	0.0113	Gamma	0.0154
Dissolved Metals (mg/L)															
Arsenic		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol (ug/L)		23	0%	ND	NA	0.3854	NA	NA	22	5%	3.27	Location 16	0.2621	NP	0.8864
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	23	78%	47.5	Location 8	8.431	Gamma	23.018	22	59%	67.6	Location 9	10.814	Gamma	27.062
Acenaphthylene	L	23	13%	0.605	Location 16	0.0581	NP	0.3423	22	0%	0.119	Location 6	0.0262	NP	0.0951
Anthracene	L	23	52%	1.32	Location 5	0.0938	NP	0.667	22	18%	1.14	Location 9	0.1284	NP	0.699
Benzo[a]anthracene	H, C	23	13%	0.3065	Location 5	0.0218	NP	0.0787	22	9%	0.153	Location 7	0.0140	NP	0.0434
Benzo[a]pyrene	H, C	23	4%	0.3065	Location 5	0.0204	NA	NA	22	0%	0.00595	Location 4	0.0059	NP	0.0059
Benzo[b]fluoranthene	H, C	23	4%	0.3065	Location 5	0.0199	NA	NA	22	0%	0.00595	Location 4	0.0059	NP	0.0059
Benzo[g,h,i]perylene	H, C	23	4%	0.3065	Location 5	0.0202	NA	NA	22	0%	0.00595	Location 4	0.0059	NP	0.0059
Benzo[k]fluoranthene	H	23	4%	0.3065	Location 5	0.0200	NA	NA	22	5%	0.0128	Location 7	0.0062	NP	0.0068
Chrysene	H, C	23	13%	0.3065	Location 5	0.0222	NP	0.0790	22	18%	0.151	Location 7	0.0152	NP	0.0448
Dibenzo[a,h]anthracene	H, C	23	4%	0.615	Location 5	0.0397	NA	NA	22	0%	0.0119	Location 4	0.0119	NP	0.0119
Fluoranthene	H	23	57%	2.75	Location 7	0.1935	NP	1.434	22	36%	12.2	Location 7	0.6482	NP	6.132
Fluorene	L	23	65%	20.3	Location 5	1.903	NP	12.450	22	36%	25.5	Location 9	3.114	Max	25.500
Ideno[1,2,3-cd]pyrene	H, C	23	4%	0.3065	Location 5	0.0205	NA	NA	22	0%	0.00595	Location 4	0.0059	NP	0.0059
Naphthalene	L	23	30%	848	Location 5	69.124	NP	150	22	18%	407	Location 16	24.132	NP	325
Phenanthrene	L	23	39%	17	Location 5	0.990	NP	8.538	22	14%	14.4	Location 9	1.112	NP	8.217
Pyrene	H	23	43%	1.31	Location 7	0.0895	NP	0.658	22	36%	5.53	Location 7	0.3260	NP	2.810
Total LPAHs		23	87%	928	Location 5	80	NP	160	22	59%	446	Location 16	39	Gamma	101
Total HPAHs		23	57%	4.1375	Location 7	0.308	NP	1.090	22	45%	18.0468	Location 7	1.015	NP	4.559
Total cPAHs		23	13%	0.2105	Location 10	0.1789	NP	0.6910	22	18%	0.1658	Location 7	0.0552	NP	0.0821
Total PAHs		23	91%	929	Location 5	81	NP	161	22	73%	446	Location 16	40	Gamma	102

Refer to notes at end of this table.

Table 3-7: Summary of Sub-Armoring Water Data 2005-2015
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McCormick and Baxter Superfund Site

SAMPLE TYPE		Sub-Armoring Water Spring 2008 (Conventional Sampling)							Sub-Armoring Water Fall 2008 (Conventinoal Sampling)						
CONTAMINANT OF INTEREST		Number of Samples	Detection Frequency	Max Detection	Max Location	Mean Concentration[5]	Data Distribution	95% UCL Value[6]	Number of Samples	Detection Frequency	Max Detection	Max Location	Mean Concentration[5]	Data Distribution	95% UCL Value[6]
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		22	95%	0.0296	Location 9	0.0090	Gamma	0.0140	22	100%	0.0806	Location 5	0.0091	Gamma	0.0156
Chromium		22	55%	0.00122	Location 12	0.0003	NP	0.0011	22	64%	0.00577	Location 4	0.0008	Gamma	0.0012
Copper		22	45%	0.00421	Location 17	0.0007	NP	0.0029	22	86%	0.0135	Location 4	0.0021	Gamma	0.0033
Zinc		22	64%	0.0219	Location 2	0.0077	NP	0.0132	22	64%	0.0328	Location 4	0.0082	NP	0.0154
Dissolved Metals (mg/L)															
Arsenic		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Zinc		--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol (ug/L)		22	0%	ND	NA	0.1200	NA	NA	22	0%	ND	NA	0.1192	NA	NA
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	22	73%	50.5	Location 9	7.034	Gamma	18.920	22	59%	48	Location 12	7.814	NP	12.870
Acenaphthylene	L	22	18%	0.0647	Location 5	0.0255	NP	0.0927	22	5%	0.569	Location 12	0.0429	NA	NA
Anthracene	L	22	50%	1.27	Location 9	0.1168	NP	0.723	22	36%	1.52	Location 9	0.1369	NP	0.254
Benzo[a]anthracene	H, C	22	9%	0.176	Location 16	0.0163	NA	NA	22	18%	0.0912	Location 9	0.0158	NP	0.0388
Benzo[a]pyrene	H, C	22	5%	0.0131	Location 16	0.0063	NA	NA	22	5%	0.0242	Location 8	0.0068	NA	NA
Benzo[b]fluoranthene	H, C	22	5%	0.0375	Location 16	0.0074	NA	NA	22	9%	0.0321	Location 8	0.0075	NA	NA
Benzo[g,h,i]perylene	H, C	22	5%	0.0437	Location 16	0.0077	NA	NA	22	14%	0.0267	Location 8	0.0076	Normal	0.0095
Benzo[k]fluoranthene	H	22	5%	0.0458	Location 16	0.0078	NA	NA	22	14%	0.0368	Location 8	0.0084	Normal	0.0112
Chrysene	H, C	22	9%	0.146	Location 16	0.0151	NA	NA	22	18%	0.0986	Location 9	0.0173	NP	0.0420
Dibenzo[a,h]anthracene	H, C	22	0%	ND	NA	0.0120	NA	NA	22	0%	ND	NA	0.0119	NA	NA
Fluoranthene	H	22	64%	2.16	Location 9	0.2574	NP	1.474	22	41%	2.19	Location 9	0.2399	NP	0.428
Fluorene	L	22	64%	18.9	Location 9	2.199	NP	12.600	22	55%	17.7	Location 9	2.632	NP	4.346
Ideno[1,2,3-cd]pyrene	H, C	22	0%	ND	NA	0.0060	NA	NA	22	5%	0.0202	Location 8	0.0066	NA	NA
Naphthalene	L	22	41%	232	Location 5	12.168	NP	117	22	55%	83.5	Location 9	4.793	NP	11
Phenanthrene	L	22	41%	13.1	Location 9	1.135	NP	7.508	22	36%	13.7	Location 9	1.205	NP	2.337
Pyrene	H	22	59%	1.06	Location 9	0.1554	NP	0.815	22	36%	1.39	Location 9	0.1517	NP	0.271
Total LPAHs		22	77%	253	Location 5	23	NP	77	22	64%	157	Location 9	17	NP	51
Total HPAHs		22	68%	3.3488	Location 9	0.453	NP	1.244	22	41%	3.8	Location 9	0.455	NP	1.338
Total cPAHs		22	9%	0.4621	Location 16	0.0747	NA	NA	22	18%	0.218	Location 9	0.0760	NP	0.1260
Total PAHs		22	86%	253	Location 5	23	Gamma	63	22	68%	161	Location 9	17	NP	52

Refer to notes at end of this table.

Table 3-7: Summary of Sub-Armoring Water Data 2005-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

SAMPLE TYPE		Sub-Armoring Water Spring 2009 (Conventinoal Sampling)							Sub-Armoring Water Fall 2009 (Conventional Sampling)						
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**	**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		22	1	6700	Location 11	449	NP	1754	22	1	1110	Location 16	256.6818182	Lognormal	391.7
Total Suspended Solids (mg/L)		22	0.91	220	Location 11	35	Lognormal	95.61	22	1	615	Location 16	189.4590909	Gamma	298.3
Total Metals (mg/L)															
Arsenic		22	100%	0.057	Location 5	0.0080	Gamma	0.0139	22	95%	0.0451	Location 04	0.0093	Gamma	0.0145
Chromium		22	95%	0.01	Location 16	0.0015	Lognormal	0.0031	22	50%	0.0022	Location 18	0.0005	NP	0.0010
Copper		22	73%	0.019	Location 16	0.0026	Gamma	0.0042	22	95%	0.007	Location 02	0.0018	Gamma	0.0026
Zinc		22	27%	0.081	Location 11	0.0101	NP	0.0264	22	73%	0.0379	Location 18	0.0075	Gamma	0.0111
Dissolved Metals (mg/L)															
Arsenic		22	100%	0.057	Location 5	0.0078	Gamma	0.0141	22	100%	0.0439	Location 04	0.0097	Gamma	0.0155
Chromium		22	68%	0.0016	Location 15	0.0003	Gamma	0.0004	22	32%	0.00036	Location 14	0.0002	NP	0.0002
Copper		22	32%	0.003	Location 15	0.0007	NP	0.0014	22	41%	0.0022	Location 02	0.0005	NP	0.0007
Zinc		22	9%	0.0086	Location 3	0.0038	NA	NA	22	27%	0.0075	Location 02	0.0024	NP	0.0044
Pentachlorophenol (ug/L)		22	5%	0.74	Location 5	0.1868	NA	NA	22	0%	ND	NA	0.0003	NA	NA
Polyaromatic Hydrocarbons (μg/L)															
Acenaphthene	L	22	55%	19	Location 5	2.282	NP	7.418	22	82%	45.1	Location 16	6.153	Gamma	16.200
Acenaphthylene	L	22	14%	0.35	Location 12	0.0268	NP	0.0990	22	27%	0.28	Location 12	0.0308	NP	0.0511
Anthracene	L	22	23%	0.22	Location 5	0.0259	NP	0.076	22	27%	0.58	Location 09	0.0582	NP	0.105
Benzo[a]anthracene	H, C	22	14%	0.066	Location 11	0.0091	NP	0.0218	22	9%	0.024	Location 17	0.0086	NA	NA
Benzo[a]pyrene	H, C	22	5%	0.013	Location 4	0.0051	NA	NA	22	0%	ND	NA	0.0075	NA	NA
Benzo[b]fluoranthene	H, C	22	9%	0.07	Location 11	0.0084	NA	NA	22	9%	0.021	Location 13	0.0087	NA	NA
Benzo[g,h,i]perylene	H, C	22	5%	0.028	Location 11	0.0058	NA	NA	22	0%	ND	NA	0.0075	NA	NA
Benzo[k]fluoranthene	H	22	9%	0.026	Location 11	0.0063	NA	NA	22	0%	ND	NA	0.0075	NA	NA
Chrysene	H, C	22	14%	0.077	Location 11	0.0098	NA	NA	22	9%	0.038	Location 07	0.0095	NA	NA
Dibenzo[a,h]anthracene	H, C	22	0%	0.00485	Location 6	0.0048	NA	NA	22	0%	ND	NA	0.0075	NA	NA
Fluoranthene	H	22	32%	0.79	Location 7	0.0633	NP	0.223	22	41%	1.4	Location 07	0.1200	NP	0.227
Fluorene	L	22	68%	10	Location 5	0.808	NP	5.610	22	64%	13	Location 09	1.733	NP	3.006
Ideno[1,2,3-cd]pyrene	H, C	22	5%	0.03	Location 11	0.0059	NA	NA	22	0%	ND	NA	0.0075	NA	NA
Naphthalene	L	22	41%	0.2	Location 2	0.030	NP	0	22	45%	0.93	Location 16	0.156	NP	0
Phenanthrene	L	22	50%	1.2	Location 5	0.085	NP	0.322	22	32%	3.5	Location 09	0.354	NP	0.677
Pyrene	H	22	27%	0.49	Location 7	0.0440	NP	0.145	22	41%	0.79	Location 07	0.0733	NP	0.132
Total LPAHs		22	86%	31	Location 5	3	NP	20	22	86%	52	Location 16	8	Gamma	22
Total HPAHs		22	32%	1.328	Location 7	0.153	NP	0.434	22	55%	2.228	Location 07	0.208	NP	0.393
Total cPAHs		22	14%	0.297	Location 11	0.0528	NP	0.1050	22	18%	0.082	Location 13	0.0330	Student's T	0.0617
Total PAHs		22	86%	31	Location 5	3	Lognormal	9	22	86%	53	Location 16	9	NP	14

Refer to notes at end of this table.

Table 3-7: Summary of Sub-Armoring Water Data 2005-2015
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McCormick and Baxter Superfund Site

SAMPLE TYPE		Sub-Armoring Water Spring 2010 (Conventional Sampling)							Sub-Armoring Water Fall 2010 (SPME Passive Sampling - University of Texas)						
CONTAMINANT OF INTEREST		Number of Samples	Detection Frequency	Max Detection	Max Location	Mean Concentration[5]	Data Distribution	95% UCL Value[6]	Number of Samples	Detection Frequency	Max Detection	Max Location	Mean Concentration[5]	Data Distribution	95% UCL Value[6]
Total Dissolved Solids (mg/L)		22	100%	899	Location 05	233	Gamma	317.5	--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		22	95%	592	Location 16	106	Gamma	578.8	--	--	--	--	--	--	--
Total Metals (mg/L)															
Arsenic		22	100%	0.036	Location 02	0.0073	Gamma	0.0115	--	--	--	--	--	--	--
Chromium		22	59%	0.0061	Location 14	0.0009	Nonparametric	0.0021	--	--	--	--	--	--	--
Copper		22	68%	0.0095	Location 14	0.0017	Gamma	0.0030	--	--	--	--	--	--	--
Zinc		22	91%	0.0232	Location 14	0.0069	Gamma	0.0096	--	--	--	--	--	--	--
Dissolved Metals (mg/L)															
Arsenic		22	100%	0.0354	Location 02	0.0071	Gamma	0.0115	--	--	--	--	--	--	--
Chromium		22	45%	0.00043	Location 19	0.0002	Normal	0.0002	--	--	--	--	--	--	--
Copper		22	68%	0.0023	Location 03	0.0005	Gamma	0.0007	--	--	--	--	--	--	--
Zinc		22	100%	0.0157	Location 07	0.0041	Gamma	0.0054	--	--	--	--	--	--	--
Pentachlorophenol (ug/L)		22	5%	0.32	Location 19	0.0850	NA	NA	--	--	--	--	--	--	--
Polyaromatic Hydrocarbons (µg/L)															
Acenaphthene	L	22	68%	61.5	Location 12	6.6	Nonparametric	28	21	100%	22	Location 5	2.245	NP	2.4
Acenaphthylene	L	22	18%	0.4	Location 12	0.036	Nonparametric	0.13							
Anthracene	L	22	36%	0.16	Location 12	0.017	Nonparametric	0.049	21	48%	0.41	Location 5	0.0389	NA	
Benzo[a]anthracene	H, C	22	9%	0.03	Location 12	0.0039	NA	NA	21	24%	0.0057	Location 5	0.0006	NP	0.0015
Benzo[a]pyrene	H, C	22	5%	0.015	Location 21	0.0022	NA	NA	21	25%	0.00046	Location 5	0.0001	NA	
Benzo[b]fluoranthene	H, C	22	9%	0.03	Location 21	0.0048	NA	NA	21	19%	0.0017	Location 5	0.0002	NP	0.00047
Benzo[g,h,i]perylene	H, C	22	0%	ND	NA	0.0011	NA	NA							
Benzo[k]fluoranthene	H	22	9%	0.014	Location 12	0.0037	NA	NA	21	29%	0.00036	Location 5	0.0001	NP	0.0001
Chrysene	H, C	22	14%	0.025	Location 21	0.0041	Nonparametric	0.011	21	24%	0.0027	Location 5	0.0003	NP	0.00073
Dibenzo[a,h]anthracene	H, C	22	0%	ND	NA	0.0021	NA	NA							
Fluoranthene	H	22	50%	0.46	Location 08	0.052	Nonparametric	0.15	21	33%	0.22	Location 5	0.0228	NP	0.060
Fluorene	L	22	68%	12.9	Location 12	1.3	Gamma	3.6	4	100%	5.0	Location 5	2.186	NA	NA
Ideno[1,2,3-cd]pyrene	H, C	22	0%	ND	NA	0.0021	NA	NA							
Naphthalene	L	22	32%	16.1	Location 17	1.7	Nonparametric	6	21	81%	69	Location 5	6.052	NP	18
Phenanthrene	L	22	41%	10.4	Location 07	0.53	Nonparametric	2.6	21	95%	2.9	Location 5	0.271	NP	0.75
Pyrene	H	22	55%	0.24	Location 08	0.037	Nonparametric	0.089	21	52%	0.10	Location 5	0.0123	NP	0.031
Total LPAHs		22	77%	76	Location 12	10	Gamma	26	21	100%	99	Location 5	9	NP	26
Total HPAHs		22	55%	0.7	Location 08	0.10	Nonparametric	0.25	21	52%	0.33	Location 5	0.036	NP	0.093
Total cPAHs		22	14%	0.109	Location 21	0.023	Nonparametric	0.046	21	29%	0.011	Location 5	0.0011	NP	0.0029
Total PAHs		22	82%	77	Location 12	10	Gamma	25	21	100%	100	Location 5	9	NP	26

Refer to notes at end of this table.

Table 3-7: Summary of Sub-Armoring Water Data 2005-2015
2015 O&M Annual Report
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SAMPLE TYPE	**Sub-Armoring Water Spring 2015 (Passive sampling: DGT for metals and polypropylene for organics - Oregon State University)**							
CONTAMINANT OF INTEREST		**Number of Samples**	**Detection Frequency**	**Max Detection**	**Max Location**	**Mean Concentration[5]**	**Data Distribution**	**95% UCL Value[6]**
Total Dissolved Solids (mg/L)		--	--	--	--	--	--	--
Total Suspended Solids (mg/L)		--	--	--	--	--	--	--
Total Metals (mg/L)								
Arsenic		--	--	--	--	--	--	--
Chromium		--	--	--	--	--	--	--
Copper		--	--	--	--	--	--	--
Zinc		--	--	--	--	--	--	--
Dissolved Metals (mg/L)								
Arsenic		--	--	--	--	--	--	--
Chromium		--	--	--	--	--	--	--
Copper		--	--	--	--	--	--	--
Zinc		--	--	--	--	--	--	--
Pentachlorophenol (ug/L)		4	0	NA	NA	NA	NA	NA
Polyaromatic Hydrocarbons (µg/L)								
Acenaphthene	L	4	100%	2.7	MBSA1015-12	0.89	NA	NA
Acenaphthylene	L	4	100%	0.006	MBSA1015-12	0.0019	NA	NA
Anthracene	L	4	100%	0.0017	MBSA1015-12	0.00079	NA	NA
Benzo[a]anthracene	H, C	4	50%	0.00013	MBSA1015-12	0.00005	NA	NA
Benzo[a]pyrene	H, C	4	25%	0.000031	MBSA1015-12	0.000015	NA	NA
Benzo[b]fluoranthene	H, C	4	75%	0.000065	MBSA1015-12	0.000033	NA	NA
Benzo[g,h,i]perylene	H, C	4	50%	0.000014	MBSA1015-12	0.0000071	NA	NA
Benzo[k]fluoranthene	H	4	25%	0.000027	MBSA1015-12	0.000010	NA	NA
Chrysene	H, C	4	100%	0.00016	MBSA1015-12	0.000064	NA	NA
Dibenzo[a,h]anthracene	H, C	4	0%	NA	NA	NA	NA	NA
Fluoranthene	H	4	100%	0.0015	MBSA1015-12	0.00074	NA	NA
Fluorene	L	4	100%	0.12	MBSA1015-12	0.054	NA	NA
Ideno[1,2,3-cd]pyrene	H, C	4	25%	0.000012	MBSA1015-12	0.0000042	NA	NA
Naphthalene	L	4	50%	0.026	MBSA1015-12	0.0068	NA	NA
Phenanthrene	L	4	100%	0.0077	MBSA1015-12	0.0035	NA	NA
Pyrene	H	4	100%	0.0024	MBSA1015-12	0.00091	NA	NA
Total LPAHs		4	100%	2.9	MBSA1015-12	1.0	NA	NA
Total HPAHs		4	100%	0.0043	MBSA1015-12	0.0018	NA	NA
Total cPAHs		4	100%	0.00041	MBSA1015-12	0.00016	NA	NA
Total PAHs		4	100%	2.9	MBSA1015-12	1.0	NA	NA

Refer to notes at end of this table.

Notes:

The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 2 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.

[1] The 1996 Record of Decision (ROD) specifies the remedial action objectives of the sediment cap as: 1) preventing human and aquatic organisms from direct contact with contaminated sediment; and 2) minimizing releases of contaminants from sediment that might result in contamination of the Willamette River in excess of Ambient Water Quality Criteria (AWQCs).

[2] National Recommended Water Quality Criteria (NRWQCs) published as of 2007 and updated 2015, are included for comparison (see https://www.epa.gov/wqc/national-recommended-water-quality-criteria)

[3] Aquatic Water Quality Criteria (AWQCs) published as of 2011, and updated effective August 4, 2015, are included for comparison (see http://www.deq.state.or.us/wq/standards/docs/tables303140.pdf)

[4] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://water.epa.gov/drink/contaminants/index.cfm).

[5] Mean Concentration includes half of the method detection limit for non-detect values

[6] 95% UCL was calculated using EPA's ProUCL Program; the recommented distribution uis reported. Where there were to few independent values (i.e. 4 or fewer detections), the 95% was not calculated and "NA" is reported.

Key:

C = carcinogenic PAH (cPAH)
Gamma = gamma distribution
H = high molecular weight PAH (HPAH)
J = estimated value
L = low molecular weight PAH (LPAH)
µg/L = micrograms per liter
mg/L = milligrams per liter
MDL = method detection limit
NA= not applicable
Normal = normal distribution
-- = not analyzed
ND = not detected
NP = nonparametric distribution
U = value below MDL (value represents MDL)

Table 3-8: Comparison Criteria Exceedance Summary 2005-2015
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Analyte	Comparison Criteria[1]	2005			
		Surface Water		Sub-armoring Water	
		Total Exceedances	Sampling Location	Total Exceedances	Sampling Location
Total Arsenic	0.00014 mg/L	25	All	25	All
Total Chromium	0.074 mg/L				
Total Copper	0.009 mg/L			1	9
Total Zinc	0.11 mg/L			1	9
PCP	1 µg/L				
Acenaphthene	520 µg/L				
Anthracene	40,000 µg/L				
Benz (a) anthracene	0.018 µg/L			4	7, 9, 20, 26
Benzo (a) pyrene	0.02 µg/L			1	9
Benzo (b) fluoranthene	0.018 µg/L			1	9
Benzo (k) fluoranthene	0.018 µg/L			1	9
Chrysene	0.018 µg/L			3	9, 20, 26
Dibenz (a,h) anthracene	0.018 µg/L				
Fluoranthene	54 µg/L				
Fluorene	5,300 µg/L				
Indeno (1,2,3-cd) pyrene	0.018 µg/L				
Naphthalene	620 µg/L			2	9, 10
Pyrene	4,000 µg/L				
Total CPAHs	0.031 µg/L			4	7, 9, 20, 26
Total AWQC Exceedances		25		43	

Analyte	Comparison Criteria[1]	Spring 2006						Fall 2006					
		Surface Water		Inter-armoring Water		Sub-armoring Water		Surface Water		Inter-armoring Water		Sub-armoring Water	
		Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location
Total Arsenic	0.00014 mg/L	6	4, 15, 24, 25, 27	7	5, 7, 12, 13, 17, 20, 25	20	Multiple	23	Multiple	22		22	Multiple
Total Chromium	0.074 mg/L												
Total Copper	0.009 mg/L	3	9, 18, 27	1	12	4	11, 14, 15, 19						
Total Zinc	0.11 mg/L												
PCP	1 µg/L												
Acenaphthene	520 µg/L												
Anthracene	40,000 µg/L												
Benz (a) anthracene	0.018 µg/L					3	5, 7, 9,			1	5		
Benzo (a) pyrene	0.02 µg/L					1	5						
Benzo (b) fluoranthene	0.018 µg/L					2	5, 9						
Benzo (k) fluoranthene	0.018 µg/L												
Chrysene	0.018 µg/L	1	25	1	5	3	5, 9, 11			1	5		
Dibenz (a,h) anthracene	0.018 µg/L												
Fluoranthene	54 µg/L												
Fluorene	5,300 µg/L												
Indeno (1,2,3-cd) pyrene	0.018 µg/L												
Naphthalene	620 µg/L					1	16						
Pyrene	4,000 µg/L												
Total CPAHs	0.031 µg/L	1	13	1	5	5	5, 7, 9, 10, 11			1	5	4	7, 9, 10, 17
Total AWQC Exceedances		11		10		39		23		25			

Table 3-8: Comparison Criteria Exceedance Summary 2005-2015
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Analyte	Comparison Criteria[1]	Spring 2007						Fall 2007					
		Surface Water		Inter-armoring Water		Sub-armoring Water		Surface Water		Inter-armoring Water		Sub-armoring Water	
		Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location
Total Arsenic	0.00014 mg/L	25	All	3	3, 5, 21	23	All	12	Multiple	18	Multiple	22	All
Total Chromium	0.074 mg/L												
Total Copper	0.009 mg/L			4	4, 5, 6, 21	2	12, 15						
Total Zinc	0.11 mg/L												
PCP	1 µg/L											1	16
Acenaphthene	520 µg/L												
Anthracene	40,000 µg/L												
Benz (a) anthracene	0.018 µg/L					2	7, 12					2	7, 10
Benzo (a) pyrene	0.02 µg/L					1	10						
Benzo (b) fluoranthene	0.018 µg/L					1	10						
Benzo (k) fluoranthene	0.018 µg/L					1	10						
Chrysene	0.018 µg/L					3	7, 10, 13					2	7, 10
Dibenz (a,h) anthracene	0.018 µg/L					1	10						
Fluoranthene	54 µg/L												
Fluorene	5,300 µg/L												
Indeno (1,2,3-cd) pyrene	0.018 µg/L					1	10						
Naphthalene	620 µg/L					1	5						
Pyrene	4,000 µg/L												
Total CPAHs	0.031 µg/L					3	7, 10, 13					2	7,10
Total AWQC Exceedances		25		7		39		12		18		29	

Analyte	Comparison Criteria[1]	Spring 2008						Fall 2008					
		Surface Water		Inter-armoring Water		Sub-armoring Water		Surface Water		Inter-armoring Water		Sub-armoring Water	
		Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location
Total Arsenic	0.00014 mg/L			1	14	21	All but 15	22	Multiple	21	All but 20		
Total Chromium	0.074 mg/L												
Total Copper	0.009 mg/L									2	5, 14	1	4
Total Zinc	0.11 mg/L			1	9								
PCP	1 µg/L												
Acenaphthene	520 µg/L												
Anthracene	40,000 µg/L												
Benz (a) anthracene	0.018 µg/L					2	9, 16					3	6, 7, 8
Benzo (a) pyrene	0.02 µg/L					1	16					1	8
Benzo (b) fluoranthene	0.018 µg/L					1	16					2	6, 8
Benzo (k) fluoranthene	0.018 µg/L					1	16					1	8
Chrysene	0.018 µg/L					2	9, 16					4	6, 7, 8, 9
Dibenz (a,h) anthracene	0.018 µg/L												
Fluoranthene	54 µg/L												
Fluorene	5,300 µg/L												
Indeno (1,2,3-cd) pyrene	0.018 µg/L											1	8
Naphthalene	620 µg/L												
Pyrene	4,000 µg/L												
Total CPAHs	0.031 µg/L						9, 16						
Total AWQC Exceedances				2		28		22		23		13	

Table 3-8: Comparison Criteria Exceedance Summary 2005-2015
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McCormick and Baxter Superfund Site

Analyte	Comparison Criteria[1]	Spring 2009						Fall 2009					
		Surface Water		Inter-armoring Water		Sub-armoring Water		Surface Water		Inter-armoring Water		Sub-armoring Water	
		Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location
Total Arsenic	0.00014 mg/L	24	All	22	All	22	All	18	Multiple	17	Multiple	21	Multiple
Total Chromium	0.074 mg/L												
Total Copper	0.009 mg/L	1	19	1	17	2	11, 16			1	4		
Total Zinc	0.11 mg/L												
PCP	1 µg/L												
Acenaphthene	520 µg/L												
Anthracene	40,000 µg/L												
Benz (a) anthracene	0.018 µg/L					3	4, 7, 11					1	17
Benzo (a) pyrene	0.02 µg/L												
Benzo (b) fluoranthene	0.018 µg/L					2	4, 11					2	13, 16
Benzo (k) fluoranthene	0.018 µg/L					1	11						
Chrysene	0.018 µg/L					3	4, 7, 11					2	7, 17
Dibenz (a,h) anthracene	0.018 µg/L												
Fluoranthene	54 µg/L												
Fluorene	5,300 µg/L												
Indeno (1,2,3-cd) pyrene	0.018 µg/L												
Naphthalene	620 µg/L												
Pyrene	4,000 µg/L												
Total CPAHs	0.031 µg/L	1	15			3	4, 7, 11					4	7, 13, 16, 17
Total AWQC Exceedances		26		23		36		18		18		30	

Analyte	Comparison Criteria[1]	Spring 2010						Fall 2010 (Passive Sampling)					
		Surface Water		Inter-armoring Water		Sub-armoring Water		Surface Water		Inter-armoring Water		Sub-armoring Water	
		Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location
Total Arsenic	0.00014 mg/L	24	All	22	All	22	All	NS					
Total Chromium	0.074 mg/L							NS					
Total Copper	0.009 mg/L			4	6,7,10,15,	1	14	NS					
Total Zinc	0.11 mg/L			1	6			NS					
PCP	1 µg/L							NS					
Acenaphthene	520 µg/L												
Anthracene	40,000 µg/L												
Benz (a) anthracene	0.018 µg/L					2	12, 21						
Benzo (a) pyrene	0.02 µg/L												
Benzo (b) fluoranthene	0.018 µg/L					2	12, 21						
Benzo (k) fluoranthene	0.018 µg/L												
Chrysene	0.018 µg/L					2	12, 21						
Dibenz (a,h) anthracene	0.018 µg/L												
Fluoranthene	54 µg/L												
Fluorene	5,300 µg/L												
Indeno (1,2,3-cd) pyrene	0.018 µg/L												
Naphthalene	620 µg/L												
Pyrene	4,000 µg/L												
Total cPAHs	0.031 µg/L					2	12, 21						
Total AWQC Exceedances		24		27		31							

Table 3-8: Comparison Criteria Exceedance Summary 2005-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

Analyte	Comparison Criteria[2]	Fall 2015 (Passive Sampling)					
		Surface Water		Inter-armoring Water		Sub-armoring Water	
		Total Exceedances	Sampling Location	Total Exceedances	Sampling Location	Total Exceedances	Sampling Location
Total Arsenic	0.00014 mg/L	1	A	1	I		
Total Chromium	0.053 mg/L						
Total Copper	0.0049 mg/L						
Total Zinc	0.066 mg/L						
PCP	0.04 µg/L						
Acenaphthene	90 µg/L						
Anthracene	400 µg/L						
Benz (a) anthracene	0.0013 µg/L						
Benzo (a) pyrene	0.00013 µg/L						
Benzo (b) fluoranthene	0.0013 µg/L						
Benzo (k) fluoranthene	0.0013 µg/L						
Chrysene	0.13 µg/L						
Dibenz (a,h) anthracene	0.00013 µg/L						
Fluoranthene	14 µg/L						
Fluorene	70 µg/L						
Indeno (1,2,3-cd) pyrene	0.0013 µg/L						
Naphthalene	620 µg/L						
Pyrene	30 µg/L						
Total CPAHs	0.031 µg/L						
Total AWQC Exceedances		1		1			

Notes:

[1]Most conservative values from the 1996 AWQCs, 2007 AWQCs, NRWQCs, and NPDWRs

[2] Criteria were revised with the 2011 AWQCs updated in 2015 and the NRWQCs updated in 2015

AWQCs = Ambient Water Quality Criteria
µg/L = micrograms per liter
mg/L = milligrams per liter
NPDWRs = National Primary Drinking Water Regulations or Maximum Contaminant Levels (MCLs)
NRWQCs = National Recommended Water Quality Criteria
PCP = Pentachlorophenol
cPAH = Carcinogenic Polynuclear Aromatic Hydrocarbons

Table 3-9: Maximum Concentration Summary 2002-2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

Sampling Event	Maximum Detected Concentration													
	2002	**2003**	**2005**	**Spring 2006**	**Fall 2006**	**Spring 2007**	**Fall 2007**	**Spring 2008**	**Fall 2008**	**Spring 2009**	**Fall 2009**	**Spring 2010**	**Fall 2010**	**Fall 2015[1]**
Surface Water														
Total Arsenic mg/L	0.001	0.002	0.001	0.002	0.007	0.0004	0.001	ND	0.0013	0.0018	0.0007	0.001	--	0.001
Total Chromium mg/L	0.002	0.005	ND	0.005	0.002	0.002	0.001	0.00097	0.00257	0.00950	0.00046	0.00130	--	ND
Total Copper mg/L	0.021	0.021	0.003	0.017	0.003	0.003	0.002	0.00283	0.00282	0.01500	0.00150	0.00250	--	0.00019
Total Zinc mg/L	0.018	0.019	0.008	0.040	0.005	0.022	0.004	0.0125	0.0111	0.0320	0.0065	0.006	--	0.004
PCP µg/L	0.079	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.320	--	ND
Acenaphthene µg/L	9.800	ND	0.097	ND	0.166	0.013	0.411	0.066	0.704	0.020	0.098	0.330	0.030	0.160
Fluoranthene µg/L	11.900	0.078	ND	0.040	0.014	0.013	0.027	ND	0.024	0.012	0.016	0.021	ND	0.003
Naphthalene µg/L	3.300	ND	0.911	0.190	0.930	0.025	1.330	0.093	2.930	0.110	0.510	ND	0.044	0.074
Total CPAHs µg/L	4.220	0.101	ND	0.053	ND	ND	ND	ND	ND	0.060	ND	ND	ND	0.00089
Total PAHs µg/L	61.500	0.282	1.044	0.281	1.188	0.111	1.990	0.148	3.980	0.116	0.754	0.441	0.082	0.210
Inter-Armoring Water														
Arsenic mg/L	--	--	--	0.005	0.002	0.007	0.020	0.00078	0.00257	0.00710	0.00400	0.011	--	0.001
Chromium mg/L	--	--	--	0.011	0.002	0.023	0.005	0.002	0.011	0.004	0.003	0.047	--	0.001
Copper mg/L	--	--	--	0.017	0.004	0.037	0.009	0.005	0.024	0.009	0.010	0.075	--	0..0051
Zinc mg/L	--	--	--	0.039	0.015	0.067	0.022	0.172	0.058	0.018	0.030	0.162	--	0.008
PCP µg/L	--	--	--	ND	0.250	ND	ND	ND	ND	0.165	ND	ND	--	ND
Acenaphthene µg/L	--	--	--	3.650	1.810	0.115	ND	0.058	0.184	6.000	0.140	0.560	3.100	6.0
Fluoranthene µg/L	--	--	--	0.253	0.111	ND	0.017	ND	0.017	0.110	0.028	0.014	0.019	0.034
Naphthalene µg/L	--	--	--	1.130	2.080	ND	ND	0.052	ND	0.420	0.360	ND	0.960	0.020
Total cPAHs µg/L	--	--	--	0.032	0.056	ND	ND	ND	ND	0.024	ND	ND	0.002	0.00033
Total PAHs µg/L	--	--	--	9.122	4.457	0.150	0.081	0.126	0.757	7.861	0.594	0.680	5.600	8.2
Sub-Armoring Water														
Arsenic mg/L	--	--	0.033	0.037	0.039	0.052	0.032	0.030	0.081	0.057	0.045	0.038	--	--
Chromium mg/L	--	--	0.014	0.017	0.001	0.003	0.001	0.001	0.006	0.010	0.002	0.006	--	--
Copper mg/L	--	--	0.028	0.035	0.003	0.544	0.005	0.004	0.014	0.019	0.007	0.010	--	--
Zinc mg/L	--	--	0.113	0.388	0.026	0.053	0.036	0.022	0.033	0.081	0.038	0.023	--	--
PCP µg/L	--	--	0.469	18.500	0.250	ND	3.270	ND	ND	0.740	ND	0.320	--	ND
Acenaphthene µg/L	--	--	131.000	22.100	19.000	47.500	67.600	50.5	48.0	19.0	45.1	61.5	22.0	2.7
Fluoranthene µg/L	--	--	7.400	1.670	10.400	2.750	12.200	2.16	2.19	0.790	1.400	0.46	0.22	0.0015
Naphthalene µg/L	--	--	772.000	726.000	229.000	848.000	407.000	232	5	0.200	0.930	16.10	69	0.026
Total CPAHs µg/L	--	--	3.017	0.322	0.105	0.211	0.166	0.462	0.218	0.297	0.082	0.109	0.011	0.00041
Total PAHs µg/L	--	--	885.000	738.000	232.000	929.150	445.890	253	161	30.8	52.6	76.5	100	2.9

Notes:

mg/L = milligrams per liter
µg/L = micrograms per liter
PCP = Pentachlorophenol
PAH = Polynuclear Aromatic Hydrocarbons
cPAH = Carcinogenic Polynuclear Aromatic Hydrocarbons
ND = Not Detected
-- = Not Sampled

Footnotes:

[1] Metals represent freely-dissolved phase, not totals

Table 3-10: Detection Frequency Summary 2002–2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

Sampling Event	Detection Frequency												
	2002	2003	2005	Spring 2006	Fall 2006	Spring 2007	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Fall 2015
Surface Water														
Total Arsenic	27%	81%	100%	22%	95%	100%	48%	0%	91%	100%	73%	100%	--	8%
Total Chromium	33%	100%	0%	74%	52%	58%	52%	77%	36%	100%	45%	100%	--	0%
Total Copper	100%	100%	81%	74%	100%	100%	88%	77%	100%	95%	100%	100%	--	100%
Total Zinc	100%	100%	88%	87%	27%	35%	64%	9%	27%	23%	73%	95%	--	82%
Total PAHs	60%	43%	19%	30%	23%	8%	68%	18%	14%	59%	27%	14%	100%	100%
Inter-Armoring Water														
Total Arsenic	--	--	--	30%	100%	13%	78%	5%	95%	100%	77%	100%	--	20%
Total Chromium	--	--	--	43%	64%	17%	52%	91%	55%	100%	68%	100%	--	67%
Total Copper	--	--	--	96%	100%	100%	83%	82%	100%	100%	100%	100%	--	67%
Total Zinc	--	--	--	78%	45%	4%	60%	27%	77%	27%	100%	100%	--	67%
Total PAHs	--	--	--	55%	41%	17%	35%	32%	18%	55%	45%	18%	100%	100%
Sub-Armoring Water														
Total Arsenic	--	--	100%	91%	95%	100%	100%	95%	100%	100%	95%	100%	--	--
Total Chromium	--	--	0%	78%	23%	28%	8%	55%	64%	95%	50%	59%	--	--
Total Copper	--	--	70%	70%	82%	96%	88%	45%	86%	73%	95%	68%	--	--
Total Zinc	--	--	100%	87%	50%	52%	92%	64%	64%	27%	73%	91%	--	--
Total PAHs	--	--	78%	91%	91%	88%	75%	86%	68%	86%	86%	82%	100%	100%

Notes:
PAHs = Polynuclear Aromatic Hydrocarbons
-- = Not Sampled

Table 3-11: Organophilic Clay Analytical Results
2015 O&M Annual Report
McCormick and Baxter Superfund Site

Sample Location		Sediment Cap Performance Goals	Units	Organophilic Clay Core 1 (C1)		Organophilic Clay Core 2 (C2)	
Client Sample ID				MB0C2015-01-1-3.5	MB0C2015-01-3.5-6	MB0C2015-02-0.5-3.5	MB0C2015-02-3.5-6.5
Date Collected				09/14/2015	09/14/2015	09/14/2015	09/14/2015
Contaminant of Interest				Result	Result	Result	Result
Conventionals							
Total Solids		--	mg/,%	67.8	68.3	63	65.6
Total Organic Carbon (TOC)		--	mg/kg	36700	38000	37300	43400
Fractional Organic Carbon (FOC)		--	g C/g soil,mg/g soil	0.0466	0.0497	0.0451	0.0572
Fractional Organic Matter (FOM)		--	%,mg/	8.04	8.57	7.78	9.85
Polyaromatic Hydrocarbons (PAHs)							
Acenaphthene	L	--	mg/kg	**0.00427** J	**0.00259** J	**0.0241** J	**0.0285** J
Acenaphthylene	L	--	mg/kg	**0.0038** J	**0.0231**	**0.00603** J	**0.053**
Anthracene	L	--	mg/kg	**0.00228** J	**0.00239** J	**0.0134** J	**0.0114** J
Benzo(a)anthracene	H,C	--	mg/kg	0.012 U	0.012 U	0.012 U	0.012 U
Benzo(a)pyrene	H,C	--	mg/kg	0.012 U	0.012 U	0.0872 J	0.012 U
Benzo(b)fluoranthene	H,C	--	mg/kg	0.012 U	0.012 U	0.012 U	0.012 U
Benzo(g,h,i)perylene	H,C	--	mg/kg	**0.03** J	**0.0324** J	**0.0489** J	**0.0248** J
Benzo(k)fluoranthene	H,C	--	mg/kg	0.012 U	0.012 U	0.012 U	0.012 U
Chrysene	H,C	--	mg/kg	0.012 U	0.012 U	0.012 U	0.012 U
Dibenz(a,h)anthracene	H,C	--	mg/kg	0.012 U	**0.141** J	**0.323**	**0.0448** J
Fluoranthene	H	--	mg/kg	**0.00748** J	**0.00588** J	**0.0409** J	**0.0278** J
Fluorene	L	--	mg/kg	**0.00641** J	**0.00309** J	**0.0235** J	**0.0264** J
Indeno(1,2,3-cd)pyrene	H,C	--	mg/kg	0.012 U	0.012 U	0.012 U	0.012 U
Naphthalene	L	--	mg/kg	**0.0521** J	**0.0294** J	**0.0925** J	**0.0942** J
Phenanthrene	L	--	mg/kg	**0.0171** J	**0.0106** J	**0.0649**	**0.0619**
Pyrene	H	--	mg/kg	**0.0181** J	0.012 U	**0.0481** J	**0.0402** J
Total LPAHs		--	mg/kg	**0.08596**	**0.07117**	**0.22443**	**0.2754**
Total HPAHs		--	mg/kg	**0.05558**	**0.17928**	**0.5481**	**0.1376**
Total cPAHs		2	mg/kg	**0.03**	**0.1734**	**0.4591**	**0.0696**
Total PAHs		--	mg/kg	**0.14154**	**0.25045**	**0.77253**	**0.413**

Notes:
Bold Values indicate detected concentrations.
J: The identification of the analyte is acceptable; the reported value is an estimate.
U: Analyte was not detected above the associated method detection limit (MDL). Value shown is the Reporting Detection Limit (RDL).

Table 4-1: Groundwater and NAPL Elevations: June 9, 2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
EW-1s	6/9/2015	12:40	40.1		26.7	37.2	Trace	10.8	13.4
EW-2s	6/9/2015	9:30	42.4		32.3		Trace		10.0
EW-8s	6/9/2015	12:20	40.5		27.6	52.9		1.8	12.8
EW-10s	6/9/2015	11:10	29.4		20.0	42.0	Trace	0.6	9.5
EW-15s	6/9/2015	11:30	43.0	31.5	35.3	48.6	3.9	Trace	11.5
EW-18s	6/9/2015	12:00	40.7		27.1	42.7		2.0	13.7
EW-19s	6/9/2015	10:55	25.9		16.4				9.5
EW-23s	6/9/2015	11:45	37.6	26.5	30.8		4.3	Trace	11.1
MW-1r	6/9/2015	14:00	37.6		26.0				11.6
MW-7 WC	6/9/2015	11:38	36.7		24.8				11.9
MW-10r	6/9/2015	13:20	41.9	30.9	31.2		0.3		10.9
MW-15s	6/9/2015	10:03	43.3		30.8				12.5
MW-17s	6/9/2015	10:23	41.3		28.9				12.3
MW-20i	6/9/2015	10:00	41.4		32.3	71.5	Trace	3.2	9.1
MW-22i	6/9/2015	13:45	42.3		32.6	51.0		7.9	9.7
MW-23d	6/9/2015	10:45	41.1		31.1				10.0
MW-32i	6/9/2015	9:30	39.3		27.8				11.6
MW-34i	6/9/2015	10:29	32.7		23.3				9.3
MW-35r	6/9/2015	9:08	32.3		21.8				10.5
MW-36d	6/9/2015	9:34	30.5		21.5				8.9
MW-36i	6/9/2015	--	30.2		NM				--
MW-36s	6/9/2015	9:11	30.7		19.4				11.3
MW-37d	6/9/2015	10:46	26.1		16.6				9.4
MW-37i	6/9/2015	9:39	25.9		17.1				8.8
MW-37s	6/9/2015	10:00	24.9		15.6				9.3
MW-38d	6/9/2015	9:52	31.8		22.8				9.0
MW-38i	6/9/2015	9:50	32.1		23.0				9.0
MW-38s	6/9/2015	9:47	32.3		21.1				11.3
MW-39d	6/9/2015	9:59	29.8		20.8				9.1
MW-39i	6/9/2015	10:02	30.1		21.1				9.0
MW-39s	6/9/2015	10:04	29.8		20.5				9.3
MW-40d	6/9/2015	10:35	28.7		19.4				9.3
MW-40i	6/9/2015	10:33	28.7		19.8				8.9
MW-40s	6/9/2015	10:30	28.3		16.5				11.9
MW-41d	6/9/2015	10:37	27.4		18.1				9.3
MW-41i	6/9/2015	10:39	27.1		17.9				9.2
MW-41s	6/9/2015	10:40	27.8		18.4				9.3
MW-42d	6/9/2015	11:09	32.2		22.7				9.5
MW-42i	6/9/2015	11:05	32.7		23.3				9.4
MW-42s	6/9/2015	11:02	32.4		19.8				12.6
MW-43d	6/9/2015	10:52	28.3		18.9				9.4
MW-43i	6/9/2015	10:55	30.3		21.0				9.3
MW-43s	6/9/2015	10:58	31.1		21.9				9.2
MW-44d	6/9/2015	11:26	29.6		19.7				9.9
MW-44i	6/9/2015	11:32	29.3		20.2				9.1
MW-44s	6/9/2015	11:30	29.6		16.8				12.7
MW-45d	6/9/2015	11:19	27.9		18.3				9.6
MW-45i	6/9/2015	11:16	28.0		18.6				9.4
MW-45s	6/9/2015	11:22	28.2		18.9				9.3
MW-46s	6/9/2015	11:40	35.5		22.7				12.8
MW-47s	6/9/2015	11:44	35.5		25.8				9.7
MW-48s	6/9/2015	13:35	38.7		25.2				13.5

Table 4-1: Groundwater and NAPL Elevations: June 9, 2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
MW-49s	6/9/2015	13:32	37.6		19.5				18.0
MW-50s	6/9/2015	10:54	39.3		26.0				13.3
MW-51s	6/9/2015	10:56	39.5		21.6				17.9
MW-52s	6/9/2015	11:24	40.7		28.0				12.7
MW-53s	6/9/2015	11:20	40.4		23.6				16.9
MW-54s	6/9/2015	9:50	41.8		29.1				12.7
MW-55s	6/9/2015	9:47	41.0		27.2				13.8
MW-56s	6/9/2015	8:43	43.5	31.7	32.1		0.4		11.8
MW-57s	6/9/2015	9:58	42.0		31.4				10.6
MW-58d	6/9/2015	9:04	41.4		32.6				8.8
MW-58i	6/9/2015	9:02	41.0		32.4				8.6
MW-58s	6/9/2015	9:00	41.5		31.7				9.8
MW-59s	6/9/2015	14:02	35.9		21.1				14.8
MW-60d	6/9/2015	9:28	40.1		31.2				8.8
MW-61s	6/9/2015	11:48	43.6		29.5				14.1
MW-62i	6/9/2015	10:20	42.6		33.3				9.3
MW-As	6/9/2015	--	39.3		22.1				17.2
MW-Ds	6/9/2015	9:10	42.9		32.8	36.6	Trace	2.0	10.1
MW-Gs	6/9/2015	10:30	40.2		30.4	42.9	Trace	1.8	9.8
MW-Os	6/9/2015	11:05	40.9		22.9				18.0
PW-1d	6/9/2015	11:12	44.0		32.5				11.5
PW-2d	6/9/2015	11:03	41.8		30.2				11.6

Notes:
ft = feet
NAVD88 = North American Vertical Datum of 1988
NM = not measured
-- = not available
LNAPL specific gravity estimated as 0.981 grams per cubic centimeter (g/cm^3)
Corrected groundwater elevation = [LNAPL thickness * LNAPL specific gravity] + groundwater

Table 4-2: Groundwater and NAPL Elevations: October 2, 2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID[a]	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
EW-1s	10/2/2015	11:55	40.1		28.0	38.5		9.5	12.1
EW-2s	10/2/2015	10:15	42.4		33.8				8.6
EW-8s	10/2/2015	12:17	40.5		29.0	51.9		2.9	11.5
EW-10s	10/2/2015	9:35	29.4		20.7	41.6		1.1	8.7
EW-15s	10/2/2015	10:57	43.0	32.9	39.6	48.6	6.7	Trace	10.0
EW-18s	10/2/2015	12:05	40.7	29.2	29.3	42.7	Trace	2.0	11.5
EW-19s	10/2/2015	9:20	25.9		17.5				8.5
EW-23s	10/2/2015	10:40	37.6	27.8	33.8	34.1	6.0	5.2	9.7
MW-1r	10/2/2015	12:30	37.6		27.9				9.8
MW-7 WC	10/2/2015	11:12	36.7		26.8				9.9
MW-10r	10/2/2015	11:30	41.9	30.4	30.6		0.2		11.4
MW-15s	10/2/2015	11:46	43.3		32.1				11.2
MW-17s	10/2/2015	12:15	41.3		30.3				11.0
MW-20i	10/2/2015	10:00	41.4		32.5	70.0		4.6	9.0
MW-22i	10/2/2015	11:40	42.3		33.6	51.1		7.8	8.7
MW-23d	10/2/2015	12:34	41.1		32.5				8.6
MW-32i	10/2/2015	13:13	39.3		29.5				9.9
MW-34i	10/2/2015	12:20	32.7		24.4				8.2
MW-35r	10/2/2015	11:07	32.3		23.3				9.0
MW-36d	10/2/2015	9:42	30.5		21.6				8.8
MW-36i	10/2/2015	9:38	30.2		21.3				8.9
MW-36s	10/2/2015	9:35	30.7		20.0				10.8
MW-37d	10/2/2015	9:54	26.1		17.1				9.0
MW-37i	10/2/2015	9:49	25.9		16.9				9.0
MW-37s	10/2/2015	9:46	24.9		16.5				8.4
MW-38d	10/2/2015	10:10	31.8		22.8				9.0
MW-38i	10/2/2015	10:08	32.1		23.5				8.5
MW-38s	10/2/2015	10:03	32.3		22.4				9.9
MW-39d	10/2/2015	10:20	29.8		20.8				9.0
MW-39i	10/2/2015	10:16	30.1		21.1				9.0
MW-39s	10/2/2015	10:13	29.8		21.4				8.4
MW-40d	10/2/2015	10:32	28.7		19.8				8.9
MW-40i	10/2/2015	10:35	28.7		20.2				8.5
MW-40s	10/2/2015	10:39	28.3		18.2				10.1
MW-41d	10/2/2015	10:48	27.4		18.6				8.8
MW-41i	10/2/2015	10:44	27.1		18.2				8.9
MW-41s	10/2/2015	10:41	27.8		19.3				8.5
MW-42d	10/2/2015	11:01	32.2		23.6				8.6
MW-42i	10/2/2015	10:57	32.7		23.9				8.8
MW-42s	10/2/2015	10:54	32.4		21.2				11.2
MW-43d	10/2/2015	11:11	28.3		19.7				8.6
MW-43i	10/2/2015	11:08	30.3		21.6				8.7
MW-43s	10/2/2015	11:05	31.1		22.5				8.5
MW-44d	10/2/2015	11:24	29.6		20.8				8.9
MW-44i	10/2/2015	11:20	29.3		21.0				8.3
MW-44s	10/2/2015	11:17	29.6		18.2				11.4
MW-45d	10/2/2015	11:34	27.9		19.4				8.5
MW-45i	10/2/2015	11:30	28.0		19.4				8.6
MW-45s	10/2/2015	11:27	28.2		19.7				8.4
MW-46s	10/2/2015	11:45	35.5		24.1				11.5
MW-47s	10/2/2015	11:49	35.5		27.0				8.5
MW-48s	10/2/2015	12:35	38.7		26.3				12.3

Table 4-2: Groundwater and NAPL Elevations: October 2, 2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID[a]	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
MW-49s	10/2/2015	12:31	37.6		22.3				15.3
MW-50s	10/2/2015	12:39	39.3		27.0				12.2
MW-51s	10/2/2015	12:41	39.5		24.3				15.3
MW-52s	10/2/2015	13:06	40.7		29.3				11.4
MW-53s	10/2/2015	13:03	40.4		26.0				14.4
MW-54s	10/2/2015	11:34	41.8		30.4				11.4
MW-55s	10/2/2015	11:32	41.0		29.6				11.5
MW-56s	10/2/2015	11:13	43.5	33.1	33.5		0.3		10.4
MW-57s	10/2/2015	11:41	42.0		33.1				9.0
MW-58d	10/2/2015	10:42	41.4		32.6				8.8
MW-58i	10/2/2015	10:41	41.0		32.4				8.6
MW-58s	10/2/2015	10:40	41.5		32.9				8.6
MW-59s	10/2/2015	12:21	35.9		23.7				12.3
MW-60d	10/2/2015	9:22	40.1		31.2				8.8
MW-61s	10/2/2015	11:22	43.6		32.4				11.2
MW-62i	10/2/2015	12:11	42.6		34.5				8.1
MW-As	10/2/2015	13:15	39.3		23.4				15.9
MW-Ds	10/2/2015	10:25	42.9	34.3	34.3	36.4	Trace	2.2	8.6
MW-Gs	10/5/2015	16:25	40.2	32.3	32.3	42.8	Trace	1.9	7.9
MW-Os	10/2/2015	12:48	40.9		25.6				15.3
PW-1d	10/2/2015	12:53	44.0		34.2				9.8
PW-2d	10/2/2015	12:46	41.8		31.9				9.9

Notes:
ft = feet
NAVD88 = North American Vertical Datum of 1988
LNAPL specific gravity estimated as 0.981 grams per cubic centimeter (g/cm^3)
Corrected groundwater elevation = [LNAPL thickness * LNAPL specific gravity] + groundwater
[a] MW-Gs was re-measured on October 5, 2015 due to suspect DNAPL measurements. Original depth to water measurement from October 2, 2015, are used for groundwater elevation contours in Figure 4-3.

Table 4-3: Groundwater O&M Activities in 2015
2015 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency
NAPL Monitoring:	
Manual gauging of Site wells	June, October
Groundwater Monitoring:	
Downloading continuous water level data	June, October
Manual water level measurements from Site	June, October
Routine Maintenance of Equipment:	
Transducers	June, October
Non-Routine Maintenance:	
MW-59s Groundwater Quality Assessment	October

Table 7-1: Soil Cap O&M Activities Planned through 2021
2015 O&M Annual Report
McCormick and Baxter Superfund Site

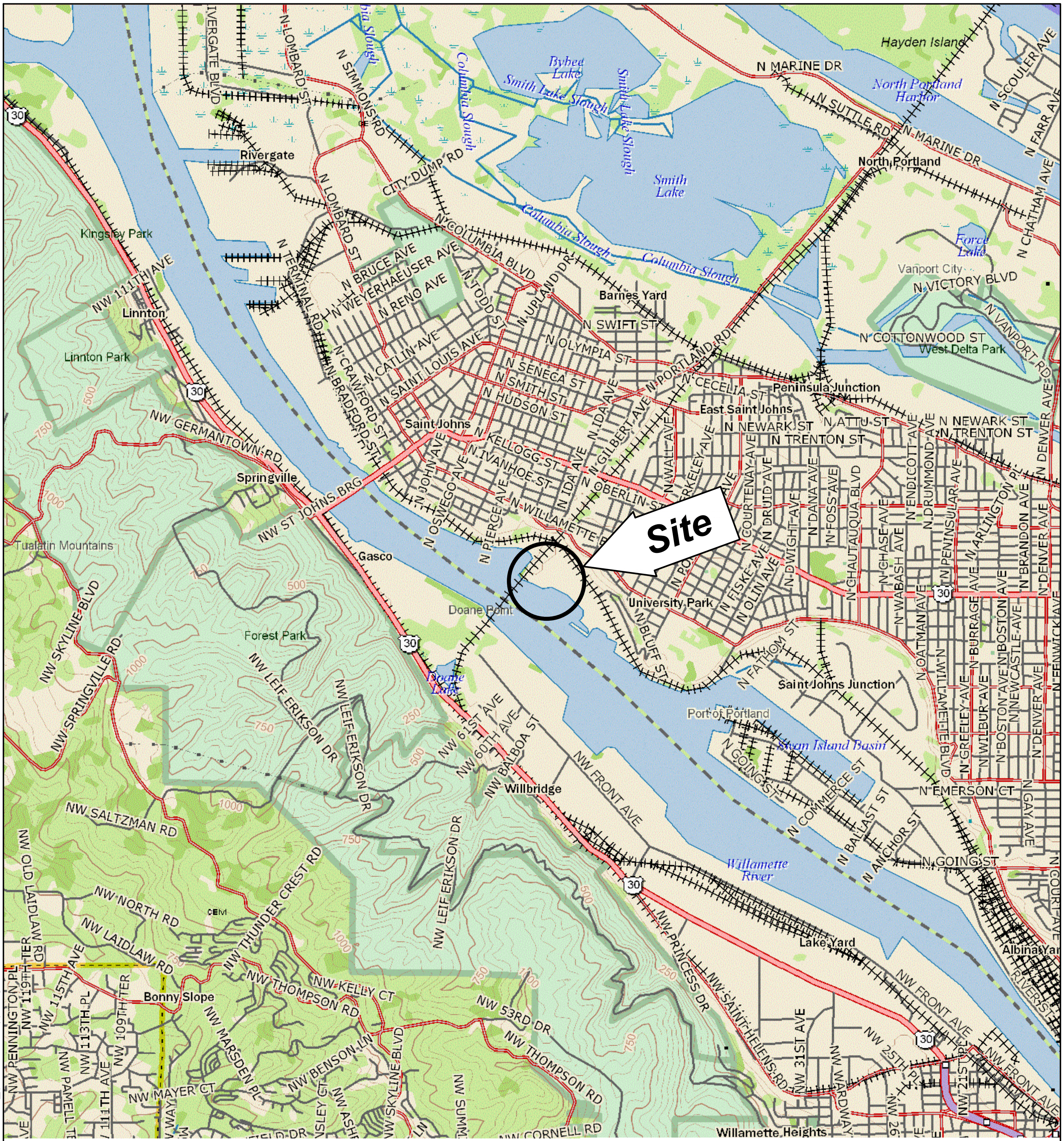
O&M Activity	Frequency
Visual Inspections:	
Cap surface	Quarterly
Subsidence near EW-1s	Quarterly
Stormwater conveyance system	Quarterly
Security fencing	Quarterly
Warning signs	Quarterly
Abundance and survival of vegetation	Quarterly
Routine Maintenance and Monitoring:	
Manual removal of invasive plant	Semiannually, if necessary
Targeted application of herbicides	Semiannually, if necessary
Non-Routine Maintenance:	
Repairs of fence	As needed
Replacement of warning signs	As needed
Repairs of gravel roads	As needed
Filling of potential animal burrow into the earthen cap	As needed
Remove sediments from manholes	As needed
Vegetation irrigation	As needed
Replanting unsuccessful trees and shrubs	As needed
Utilities Service:	
Water, electric, phone, alarm, solid waste, toilet	Continuous

Table 7-2: Sediment Cap O&M Activities Planned through 2021
2015 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency
Visual Inspections (from shore):	
Warning buoys	Quarterly
Cap surface	Quarterly
Habitat quality	Annually
Routine Monitoring:	
Water column and inter-armoring water sampling	Every 5 years (starting in 2015)
Organoclay Core Sampling	In 2015, then determine frequency
Non-Routine Monitoring:	
Multibeam bathymetric surveys, side-scan sonar survey	Every 10 years, starting in 2020; perform as needed (unforeseen natural event)
Diver inspection	If necessary, will be conducted every 10 years starting in 2020, after bathymetry
Non-Routine Maintenance:	
Replacement of buoys	As needed
Additional armoring placement	Schedule for 2020, if needed After unforeseen event, if needed
Additional organoclay capping	As needed
ACB grouting or armoring void space maintenance (habitat gravel)	Every 5 years , or as needed based on site inspections

Table 7-3: Groundwater O&M Activities Planned through 2021
2015 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency
NAPL Monitoring:	
Manual gauging of site wells	Semiannually
Manual extraction from exterior wells	Not recommended
Groundwater Monitoring:	
Downloading continuous water level data from transducers	June, September, and December
Manual water level measurements from site wells	Semiannually
Groundwater Sampling:	
Site-wide	2020, Subsequent frequency to be determined
Infiltration pond (MW-59s)	Every 5 years
Routine Maintenance of Equipment:	
Interface probes, pumps, vehicle, data loggers / transducers, etc.	As needed



0 4,000 8,000

Scale in Feet

N

McCormick and Baxter Superfund Site

6900 N Edgewater Street, Portland, Oregon

Site Location Map

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Figure

1

Source: DeLorme Topo USA.

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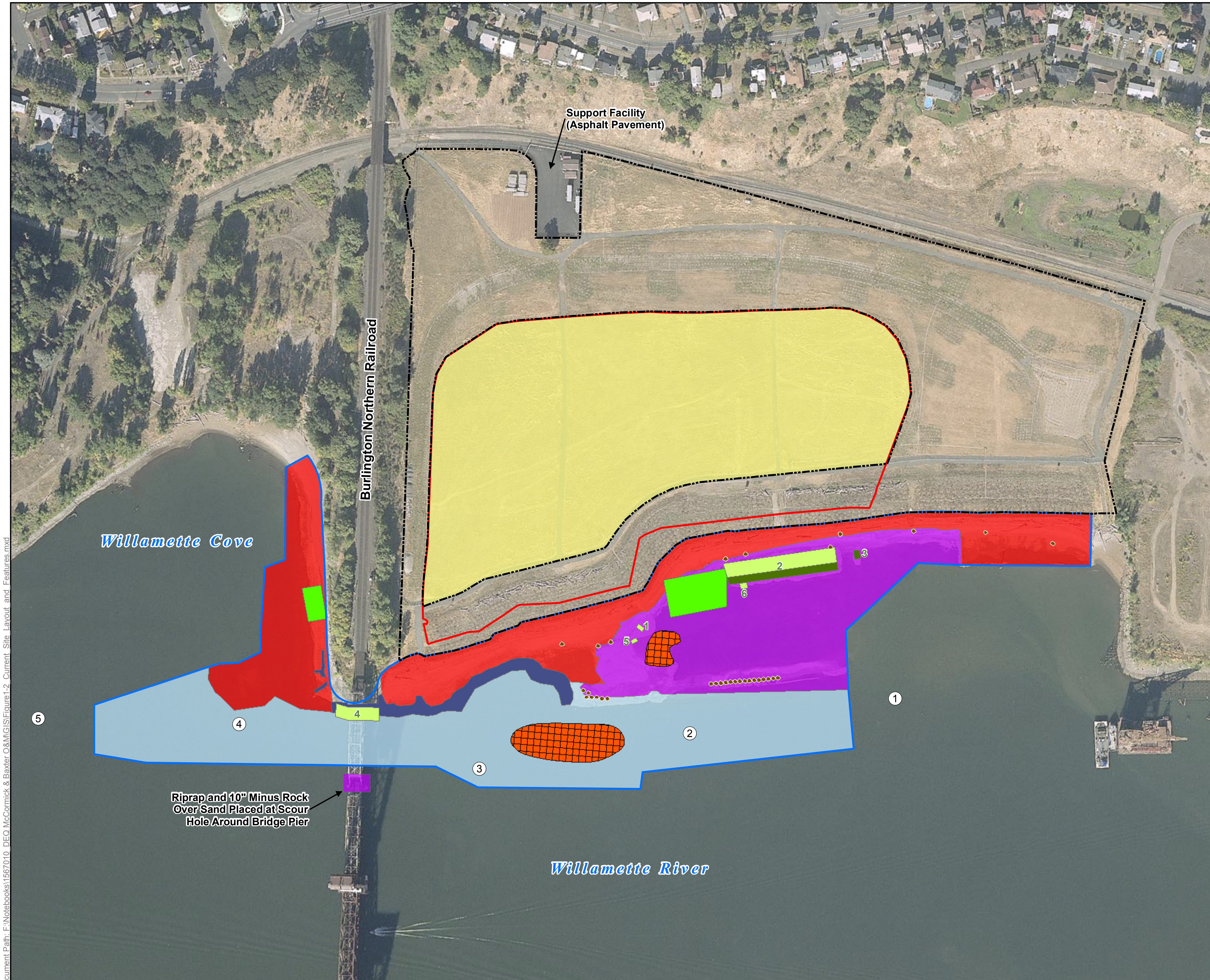

LEGEND

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Granular Organophilic Clay
- Organoclay™ Reactive Core Mats (Double)
- Organoclay™ Reactive Core Mats (Single)
- Thickened Sand Layer
- Boulder Clusters
- Buoy Locations
- Riprap Armor
- Articulated Concrete Block
- 6" Minus Rock Armor
- 10" Minus Rock Armor
- Impermeable Cap Earthen
- Soil Cap Boundary

NOTE:
Aerial photo taken on September 22, 2006.

0 250 500
Scale in feet

McCormick and Baxter Superfund
Site Portland, Oregon

Current Site Layout and Features

6/16

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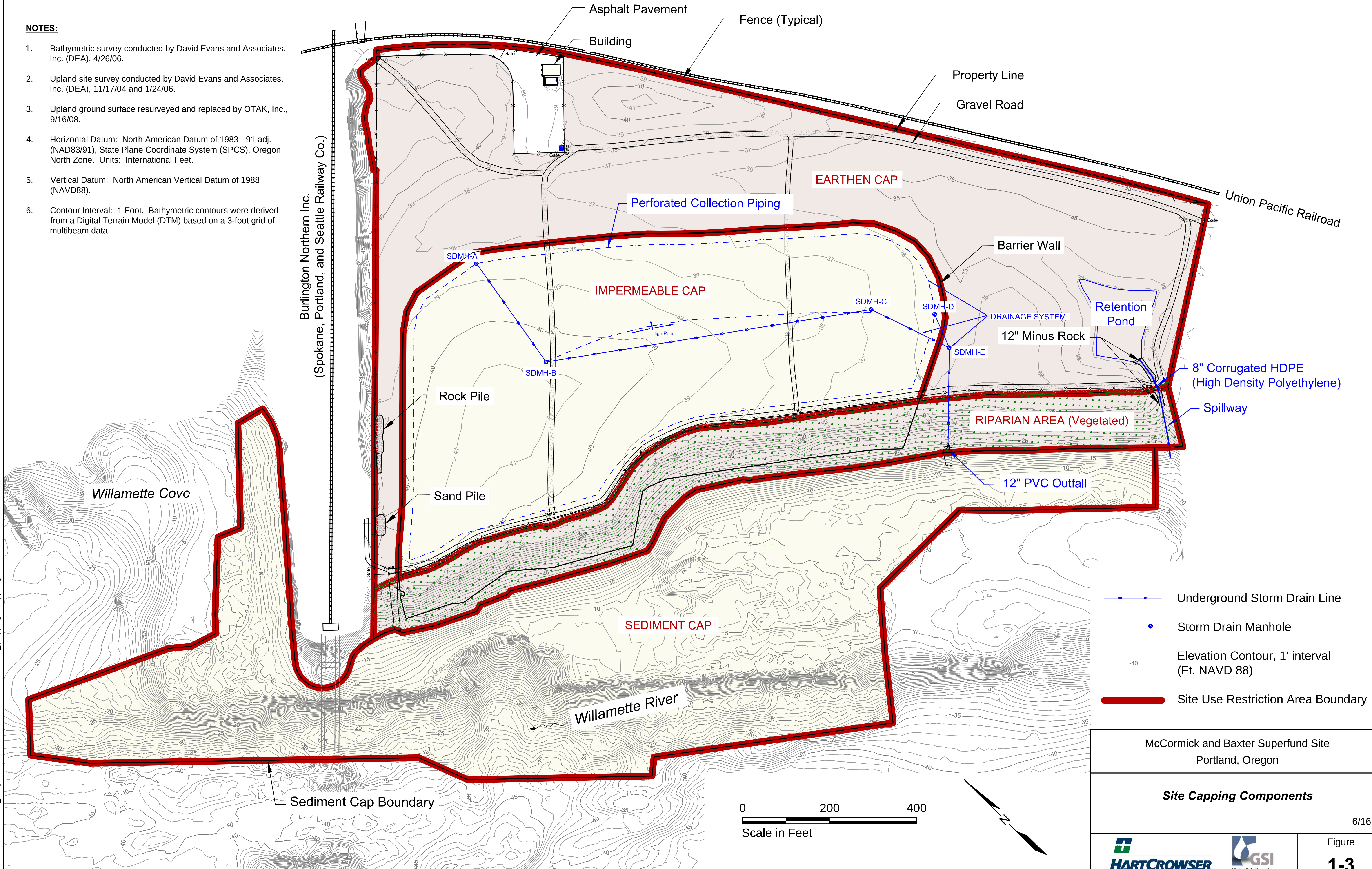
Figure
1-2

Document Path: F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\GIS\Figure1-2_Current_Site_Layout_and_Features.mxd

NOTES:

1. Bathymetric survey conducted by David Evans and Associates, Inc. (DEA), 4/26/06.
2. Upland site survey conducted by David Evans and Associates, Inc. (DEA), 11/17/04 and 1/24/06.
3. Upland ground surface resurveyed and replaced by OTAK, Inc., 9/16/08.
4. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System (SPCS), Oregon North Zone. Units: International Feet.
5. Vertical Datum: North American Vertical Datum of 1988 (NAVD88).
6. Contour Interval: 1-Foot. Bathymetric contours were derived from a Digital Terrain Model (DTM) based on a 3-foot grid of multibeam data.



McCormick and Baxter Superfund Site
Portland, Oregon

Site Capping Components

6/16

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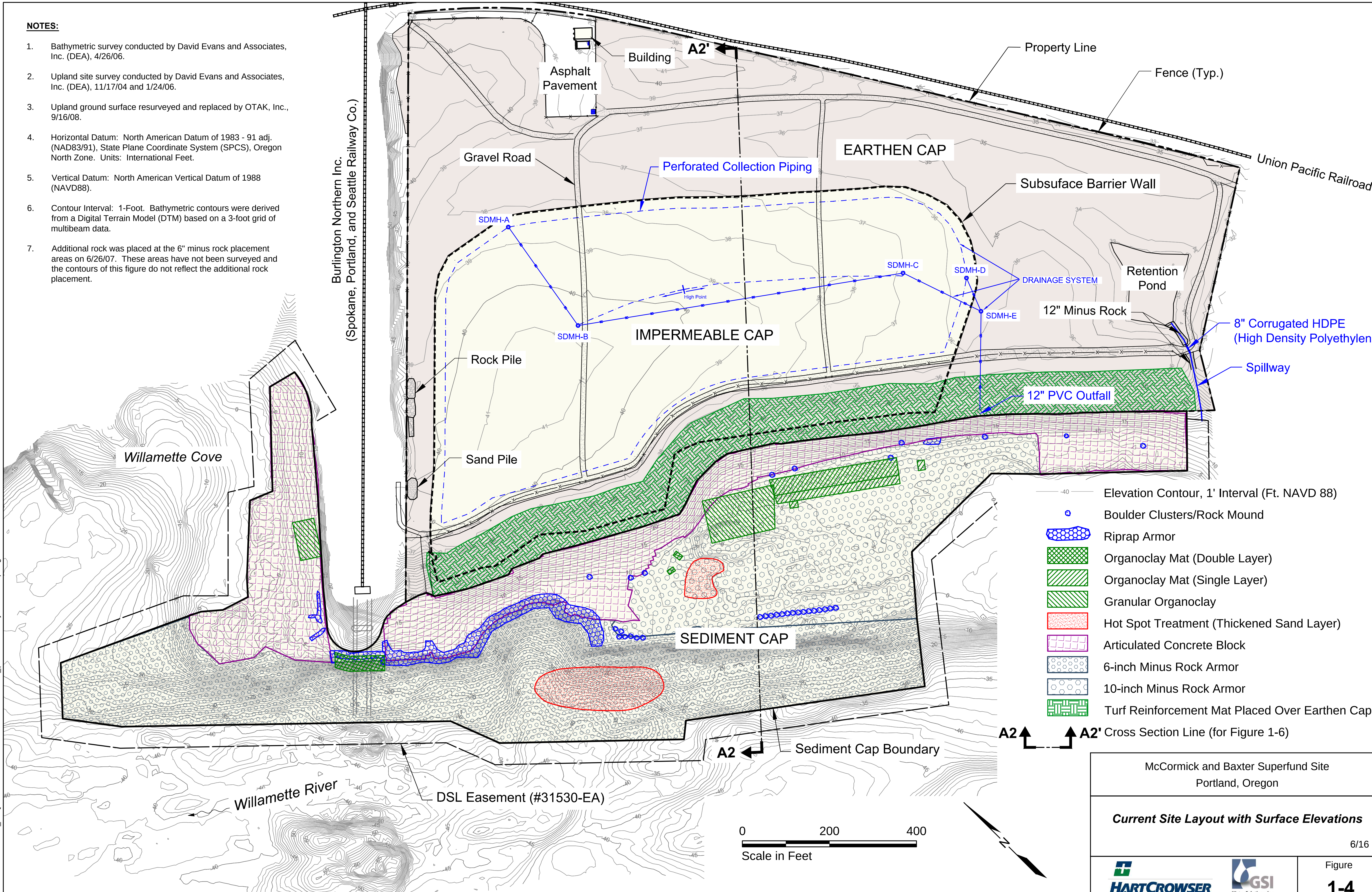
Figure **1-3**

F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\1567010_(Capping Comp).dwg

NOTES:

1. Bathymetric survey conducted by David Evans and Associates, Inc. (DEA), 4/26/06.
2. Upland site survey conducted by David Evans and Associates, Inc. (DEA), 11/17/04 and 1/24/06.
3. Upland ground surface resurveyed and replaced by OTAK, Inc., 9/16/08.
4. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System (SPCS), Oregon North Zone. Units: International Feet.
5. Vertical Datum: North American Vertical Datum of 1988 (NAVD88).
6. Contour Interval: 1-Foot. Bathymetric contours were derived from a Digital Terrain Model (DTM) based on a 3-foot grid of multibeam data.
7. Additional rock was placed at the 6" minus rock placement areas on 6/26/07. These areas have not been surveyed and the contours of this figure do not reflect the additional rock placement.



McCormick and Baxter Superfund Site
Portland, Oregon

Current Site Layout with Surface Elevations

6/16

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Figure **1-4**

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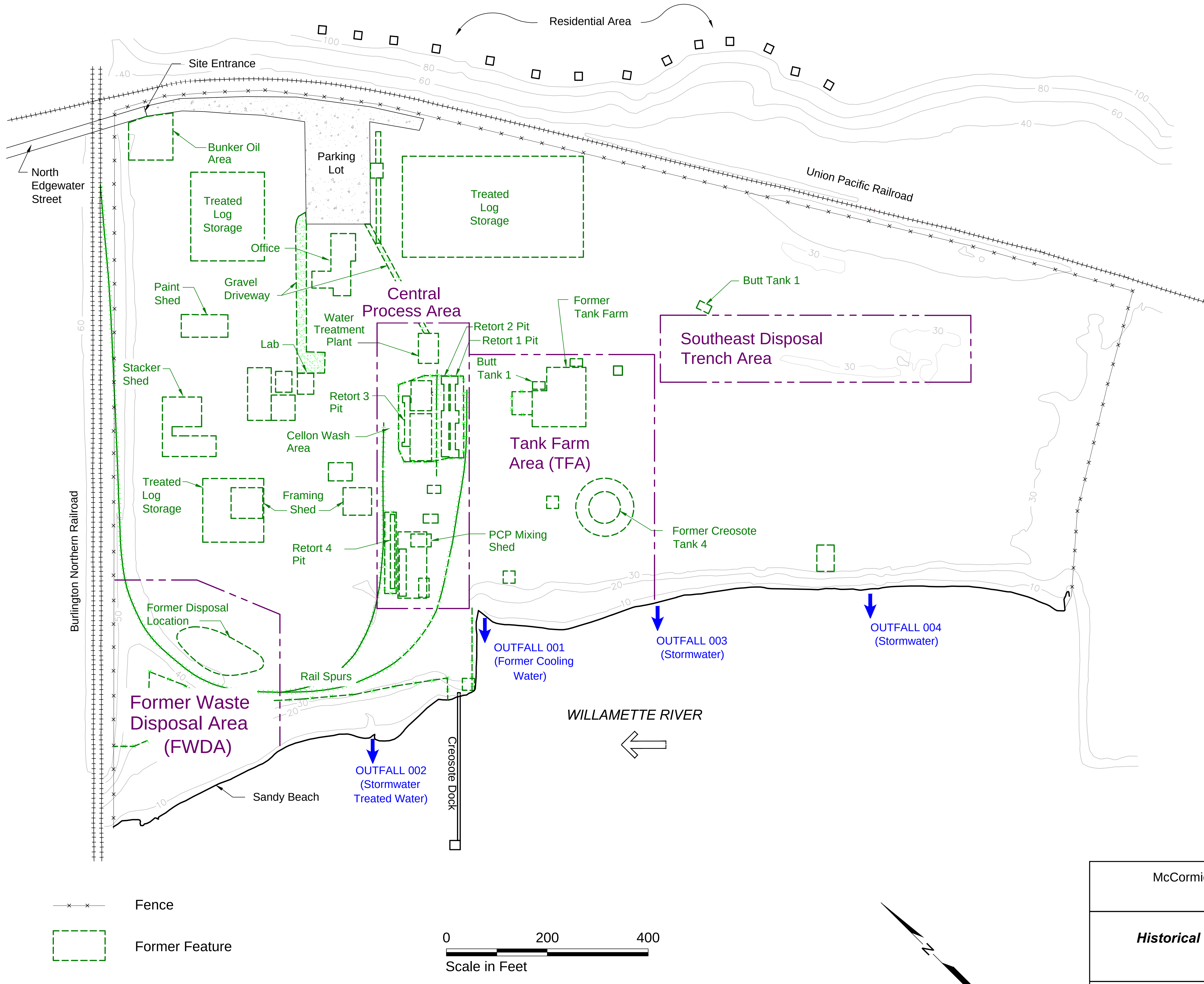

McCormick and Baxter Superfund Site
Portland, Oregon

Historical Contaminant Source Areas

6/16

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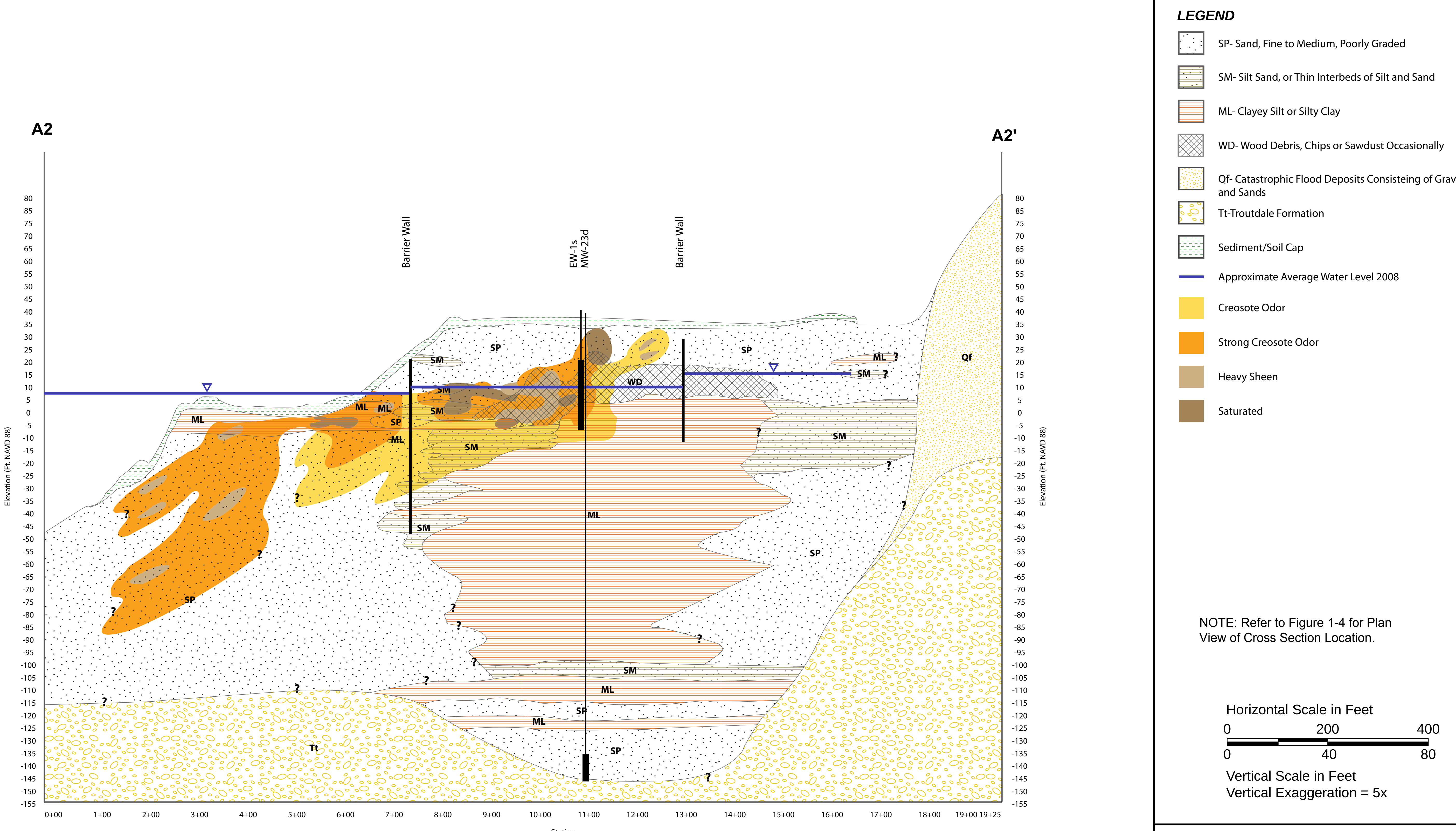
Figure
1-5

F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\1567010_(Historic Contamination).dwg



McCormick and Baxter Superfund Site
Portland, Oregon

Historical NAPL Distribution Cross Section

6/16

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Figure
1-6

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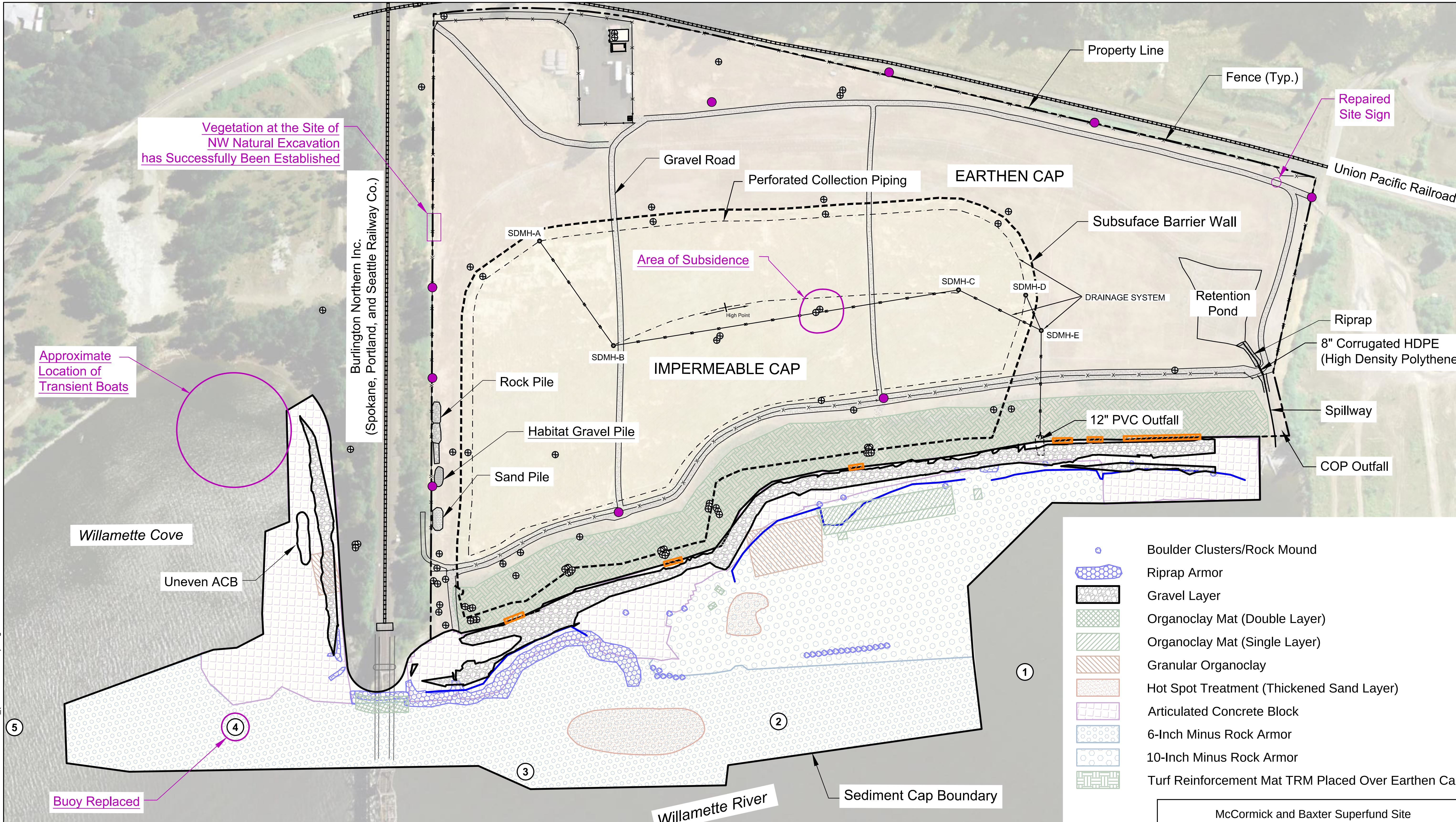

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		Longitude			Latitude		
Location ID Figure 2.5	Buoy Label	Degree	Minute	Second	Degree	Minute	Second
1	Danger Rocks	-122	44	27.9115188	45	34	33.7505887
2	Danger Rocks	-122	44	34.6730244	45	34	36.3603940
3	Danger Rocks	-122	44	41.5979124	45	34	39.0343156
4	Danger Rocks	-122	44	47.5345212	45	34	43.8265931
5	Danger Rocks	-122	44	53.2295880	45	34	47.1865397
Coordinate projection: GCS_North_American_1983							

(1) Buoy
⊕ Monitoring Well
● Animal Burrow
Repaired Shoreline Areas

0 200 400
Scale in Feet

N

McCormick and Baxter Superfund Site
Portland, Oregon

Site Observation Summary

6/16

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Figure
2-1

LEGEND

- Actual O&M Sampling Locations

Target O&M Sampling Locations

- Compliance Monitoring Area
- Compliance Monitoring Sample
- Early Warning Sample
- Background Sample

Site Features

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Organoclay Granular
- Organoclay Mats (Double)
- Organoclay Mats (Single)
- Hot Spot Treatment (thickened sand layer)
- MW-37; DGPS Reference Location
- Boulder Clusters
- Lowest Willamette River Level During Sampling Event[3]

NOTES:

1) Aerial photo taken on September 22, 2006.
2) The surface water sample at the early warning station will serve as the compliance monitoring point for monitoring area F while the inter-armoring and sub-armoring samples will serve as early warning samples.
3) The passive sampler deployment period was from September 15, 2015 to October 6, 2015. The lowest river stage during deployment was 5.32 ft NAVD 88, recorded on September 22, 2015 at 9:30 am.

0 250 500

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Target versus Actual Surface, Inter-Armoring, and Sub-Armoring Water Sampling Locations

6/16

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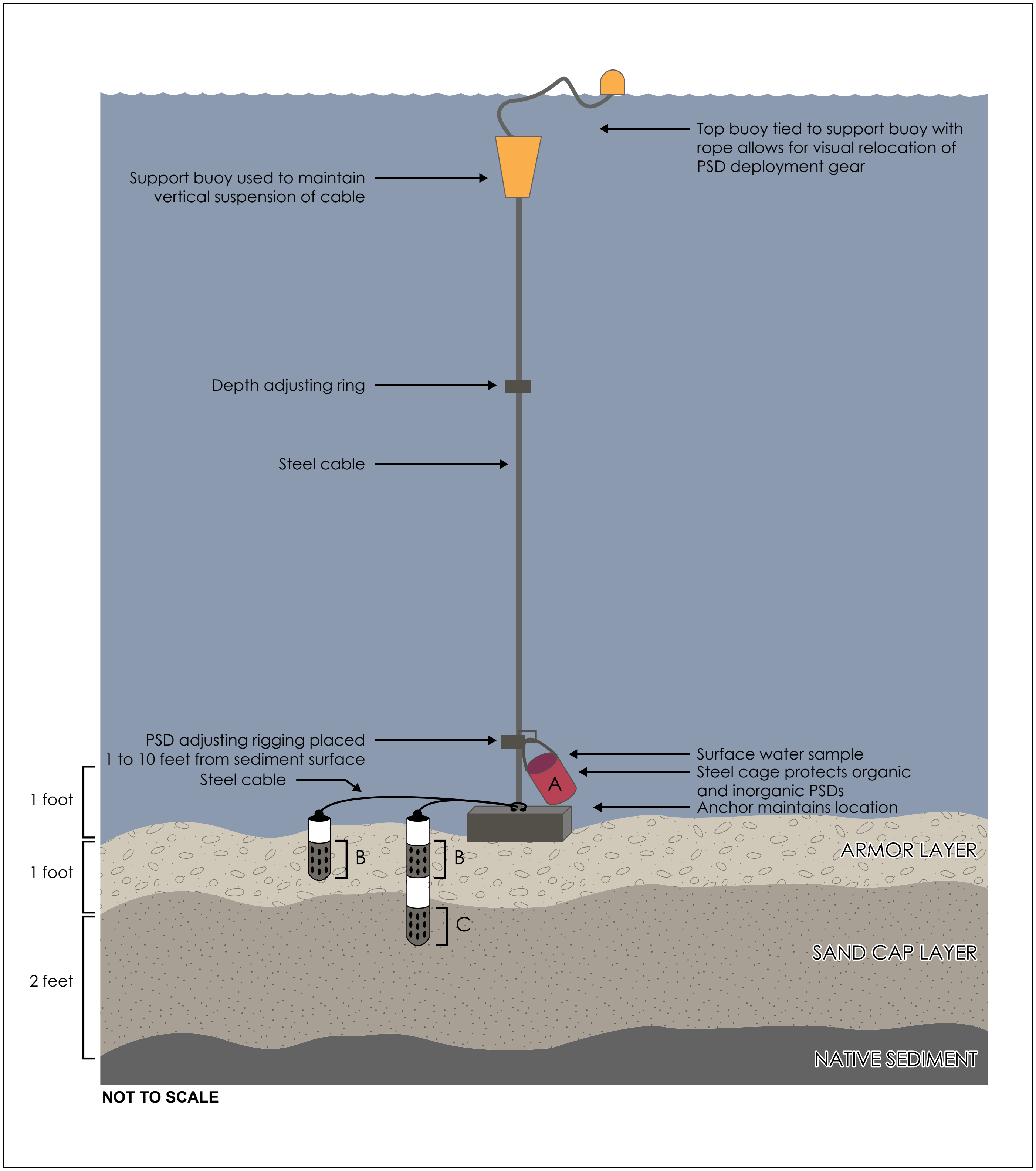
Figure
3-1

Document Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2015 Annual Report\Figure3-1 Target vs Actual Samples.mxd



Adjustable aquatic system Passive Sampling Device (PSD) deployment set-up includes top buoy attached by rope to support buoy, steel cable, adjusting rigging, anchor, and PSD cage deployed at 1 to 10 feet from sediment bottom.

A. Surface Water Sample Depth: 1 foot above armoring
B. Armoring Layer Sample Depth: 3-9” below surface of armoring
C. Early Warning Sediment Cap Sample Depth: 15-21” below surface of armoring (which should be within the sand cap)

Data Source: Anderson, K.A. Schematic of PSD deployment gear and setup in aquatic sytems

FIGURE 3-2

Passive Sampling Device Setup

McCormick and Baxter
2015 Annual Report

GSI Water Solutions, Inc.

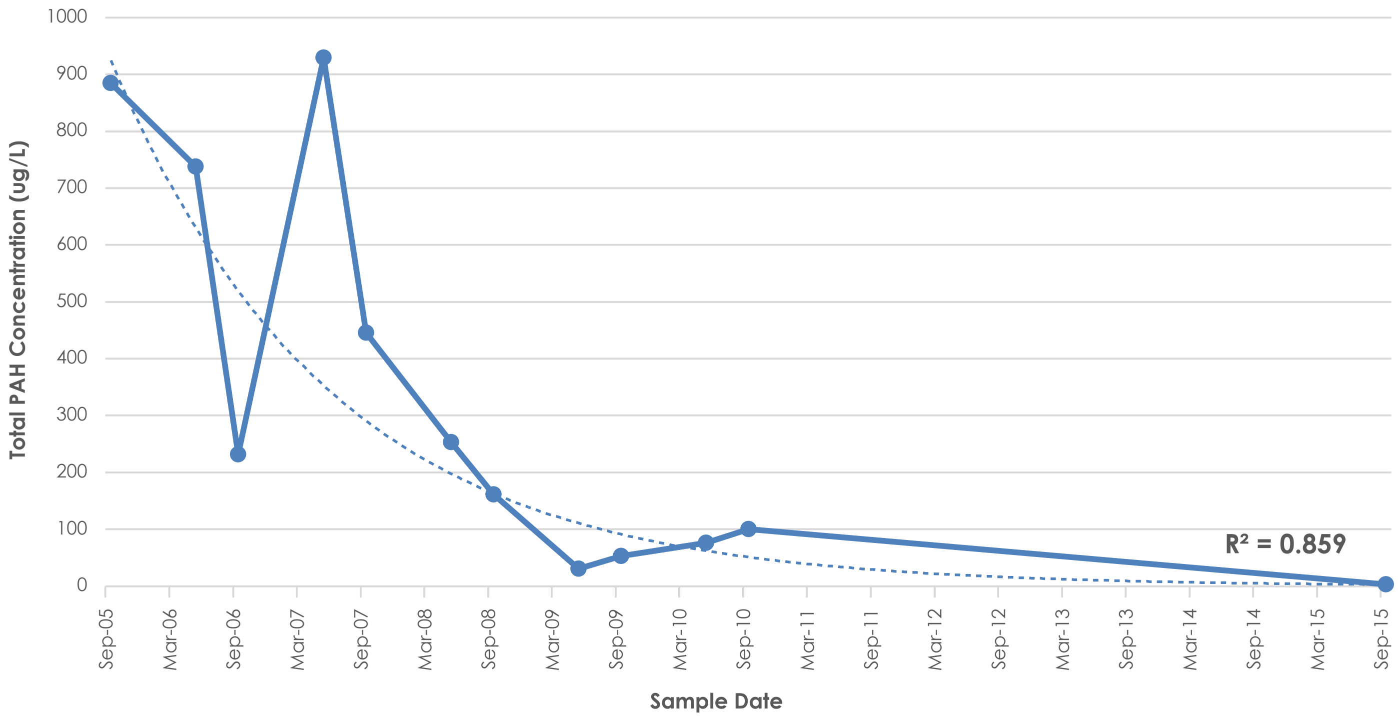


FIGURE 3-3

Maximum Total PAH Time-Series Plot: Sub-Armoring Water

McCormick and Baxter
2015 Annual Report

GSI Water Solutions, Inc.

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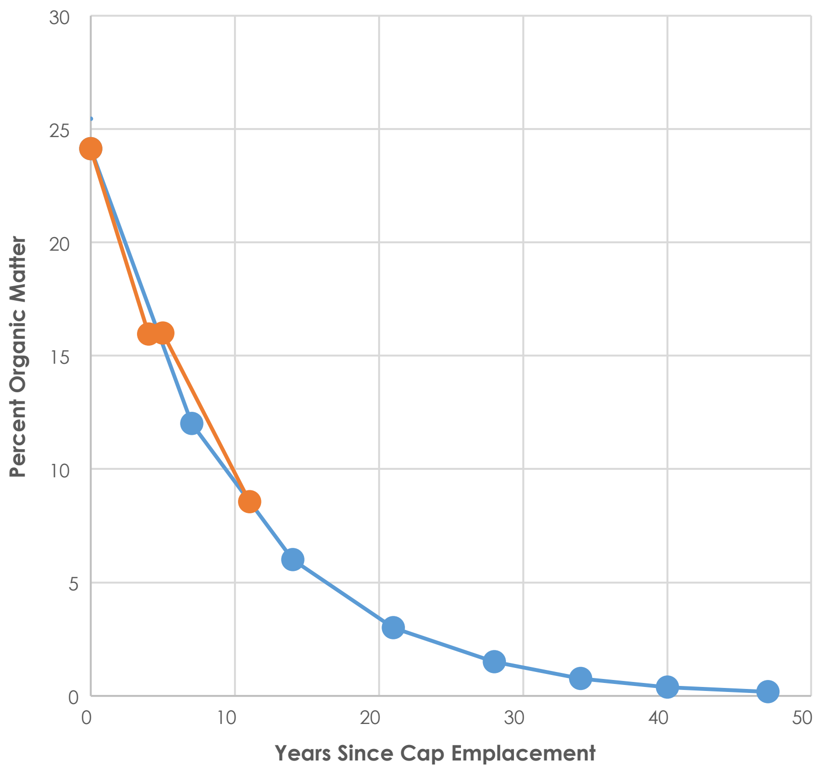

FIGURE 3-4

Actual Data versus Predicted Half Life of Organophilic Clay

McCormick and Baxter
2015 Annual Report

LEGEND

- Predicted 7-Year Half-Life
- Actual Site Data

GSI Water Solutions, Inc.

P:\Portland\205 - OR DEQ\020-M&B O&M 2014\Figures\2015_Annual_Report

Document Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project GIS\Project mxds\2015 Annual Report\Figure4-1 Monitoring Well Location Map.mxd

LEGEND

- Groundwater Monitoring Wells
- Groundwater Monitoring Wells with Transducers
- Subsurface Barrier Wall

NOTE:
Aerial photo taken on September 22, 2006.

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Monitoring Well Location Map

6/16

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GSI Water Solutions, Inc.

Figure
4-1

NOTES:
1) Elevations shown in NAVD 88.
2) Aerial photo taken on September 22, 2006.
3) Water levels measured between 8:43 and 14:02.
4) Willamette River low tide at 8:00 at 8.7 feet NAVD 88.

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Contour Map for June 9, 2015 Sampling Event

6/16

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Figure
4-2

Document Path: P:\Portland\205 - OR DEQ\003-003 M&B\Project_GIS\Project_mxds\2015_Annual_Report\Figure4-2_GW_Elevations_June9_2015.mxd

LEGEND

- Groundwater Monitoring Wells (Groundwater Elevation)
- Groundwater Monitoring Wells with Transducers (Groundwater Elevation)
- Groundwater Elevation Contours (dashed where inferred)
- Willamette River Level During Sampling Event (5.2 feet)
- Subsurface Barrier Wall

NOTES:

1) Elevations shown in NAVD 88.
2) Aerial photo taken on September 22, 2006.
3) Water levels measured between 9:20 and 13:15.
4) Willamette River low tide at 8:45 at 5.2 feet NAVD 88.

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Contour Map for October 2, 2015 Sampling Event

6/16

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Figure
4-3

Document Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2015_Annual_Report\Figure4-3_GW_Elevations_Oct2_2015.mxd

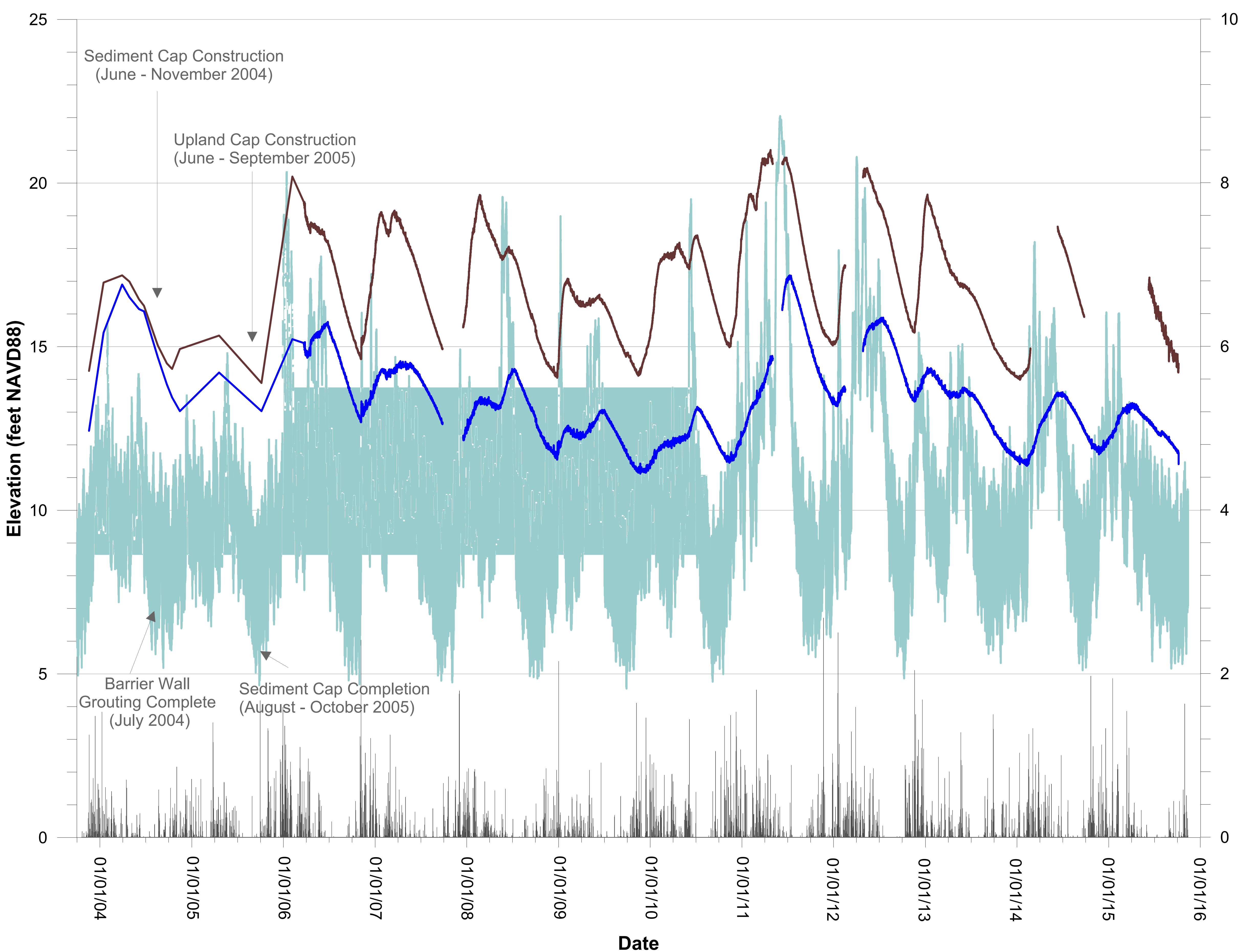

Figure 4-4:
Post-Barrier Wall Groundwater Elevations
Monitoring Wells MW-52s and MW-53s

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

MW-52s (Interior)
MW-53s (Exterior)
River
Precipitation

Notes:
MW-52s is located inside the barrier wall and MW-53s is located outside the barrier wall.

Top of Barrier wall (not shown) is about 31 ft NAVD.

Prior to March 23, 2006 water level measurements are manual and intermittent.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

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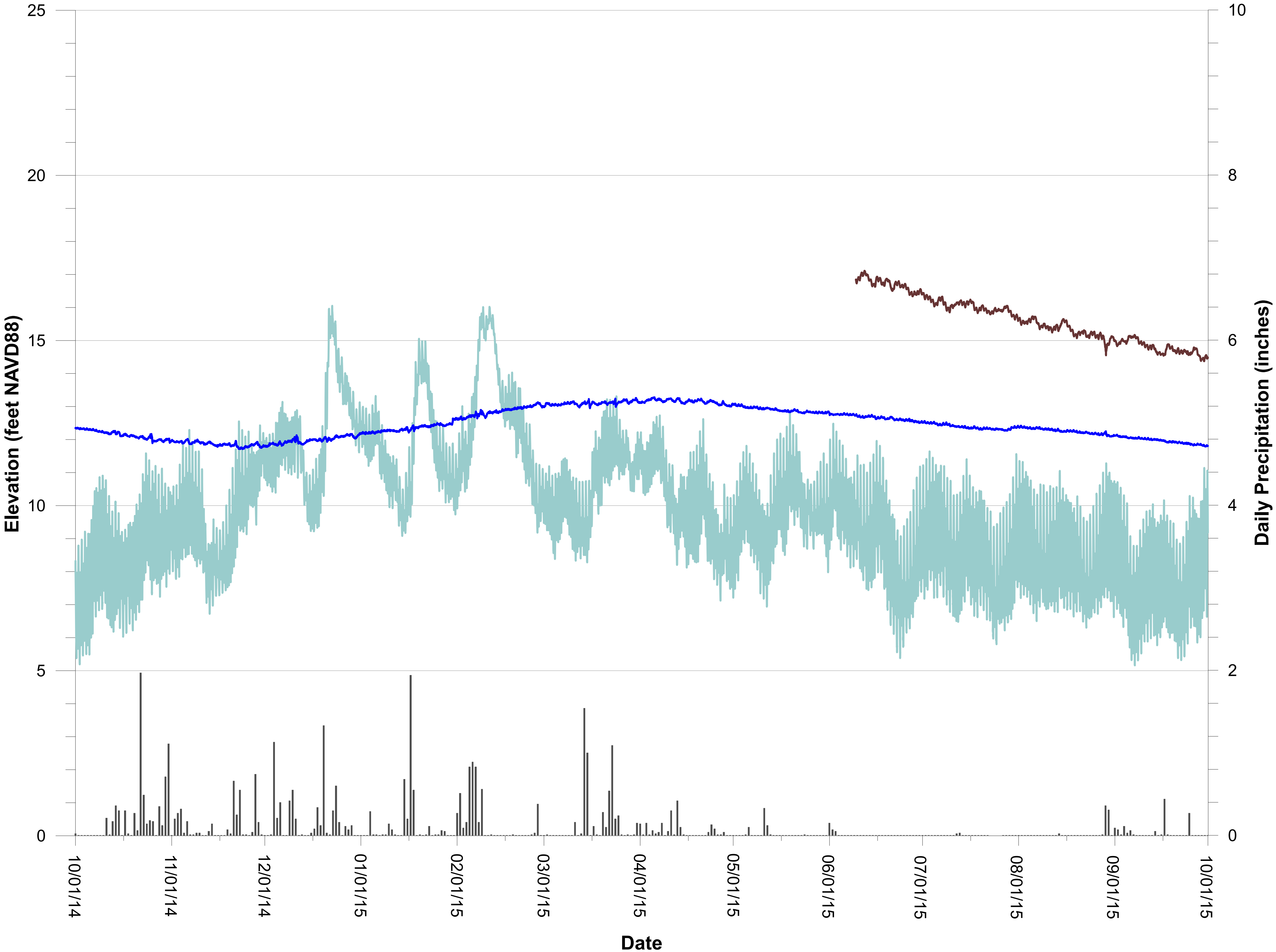

Figure 4-5:
2015 Groundwater Elevations
Monitoring Wells MW-52s and MW-53s

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- MW-52s (Interior)
- MW-53s (Exterior)
- River
- Precipitation

Notes:
MW-52s is located inside the barrier wall and MW-53s is located outside the barrier wall.

Top of Barrier wall (not shown) is about 31 ft NAVD.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

HARTCROWSER

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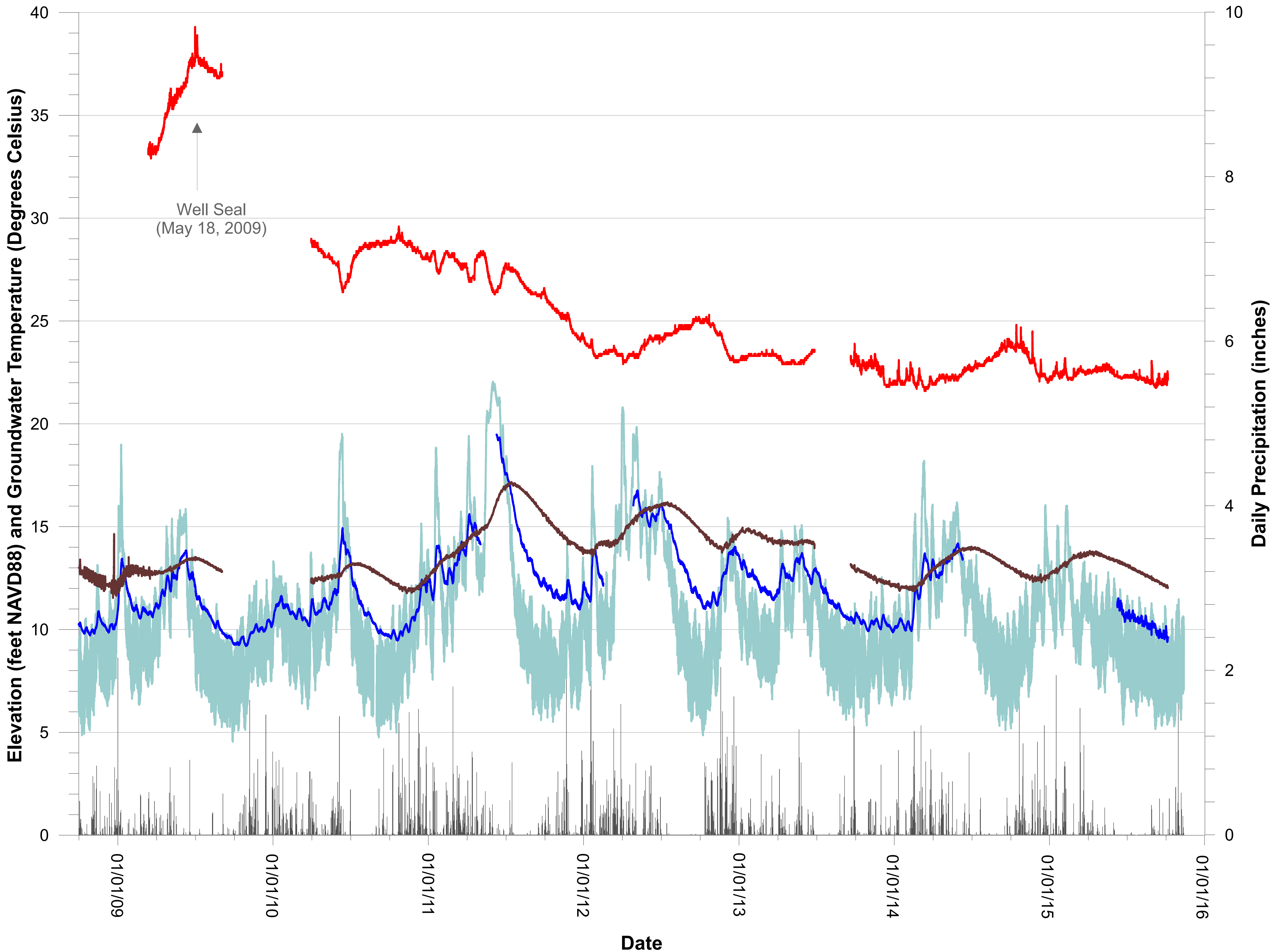

Figure 4-6:
2008 to 2015 Groundwater Temperature in Montoring Well EW-1s and Groundwater Elevations Monitoring Wells MW-36s and EW-1s

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- EW-1s Temperature
- EW-1s Water Elevation
- MW-36s Water Elevation
- River Elevation
- Precipitation

Notes:
Monitoring wells EW-1s and MW-36s are located inside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

Groundwater elevation manually adjusted 0.25 ft up between 17:00 on May 6, 2010 and 14:00 on June 15, 2010 due to apparent displacement from field activities.

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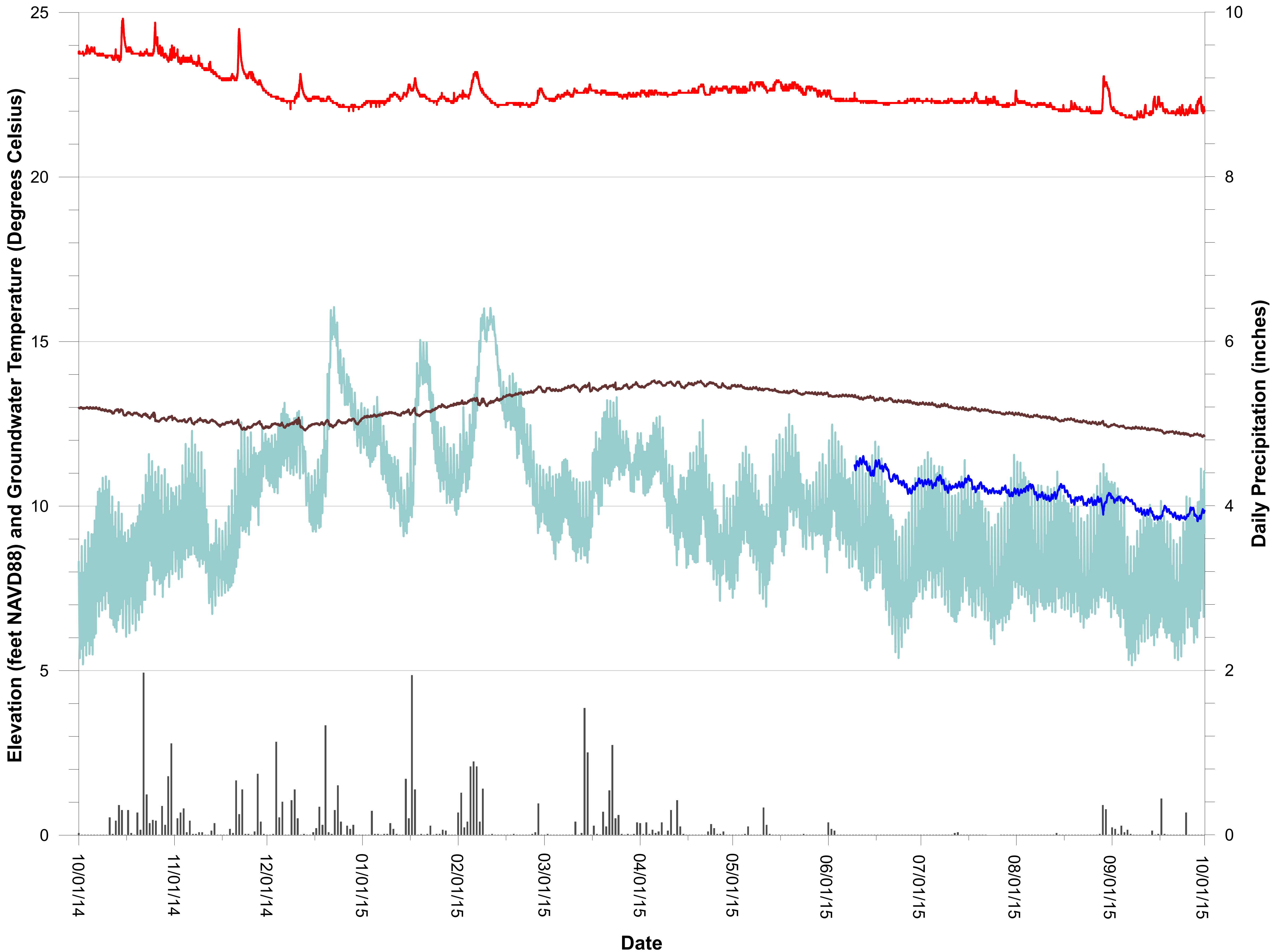


Figure 4-7:
2015 Groundwater Temperature in Montoring Well EW-1s and Groundwater Elevations Monitoring Wells MW-36s and EW-1s

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- EW-1s Temperature
- EW-1s (Interior)
- MW-36s (Interior)
- River
- Precipitation

Notes:
Monitoring wells EW-1s and MW-36s are located inside the barrier wall.

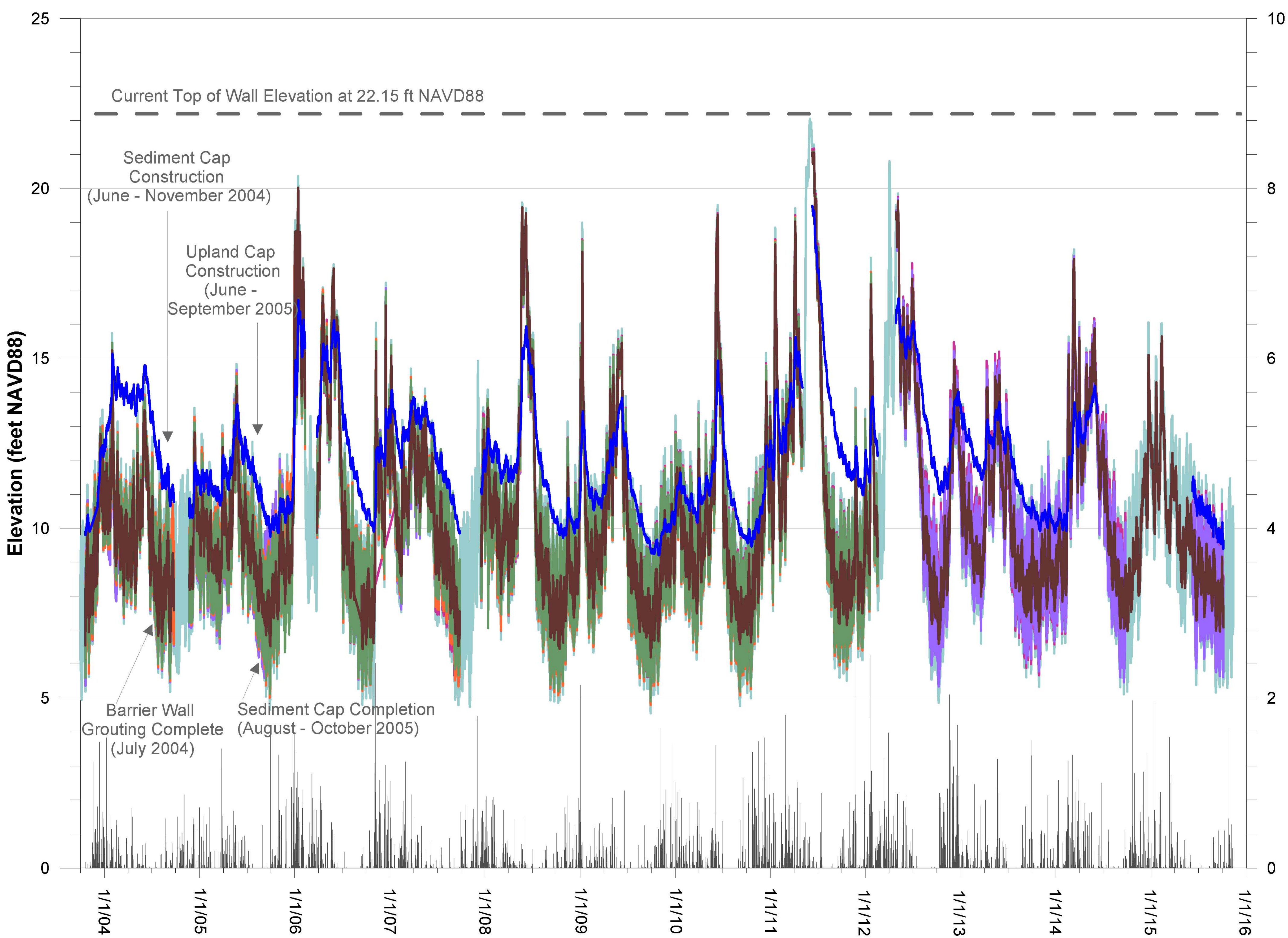
Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

Figure 4-8:
Post-Barrier Wall Groundwater Elevations in Monitoring Wells MW-36 and MW-37

McCormick and Baxter Superfund Site
Portland, OR



LEGEND

- MW-36s (Interior)
- MW-36i (Interior)
- MW-36d (Interior)
- MW-37s (Exterior)
- MW-37i (Exterior)
- MW-37d (Exterior)
- River
- Precipitation

Notes:
MW-36 wells are located inside the barrier wall and MW-37 wells are located outside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer that was not collecting accurate pressure readings. Transducers in MW-36i and MW-37i were removed on February 16, 2012.

HARTCROWSER

GSI Water Solutions, Inc.

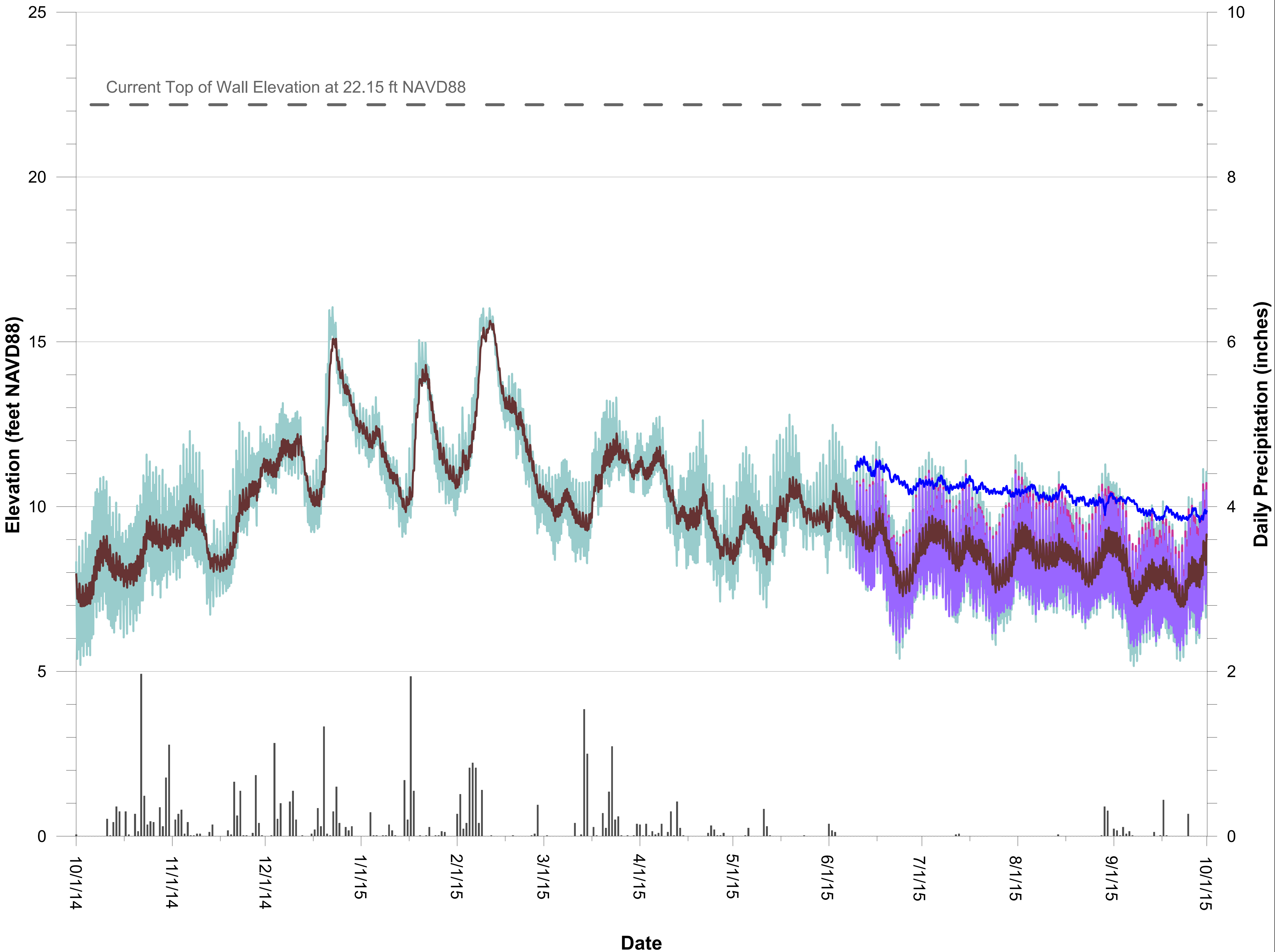


Figure 4-9:
2015 Groundwater Elevations
in Monitoring Wells MW-36 and MW-37

McCormick and Baxter Superfund Site
Portland, OR

LEGEND
- MW-36s (Interior)
- MW-36d (Interior)
- MW-37s (Exterior)
- MW-37d (Exterior)
- River
- Precipitation

Notes:
MW-36 wells are located inside the barrier wall and MW-37 wells are located outside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

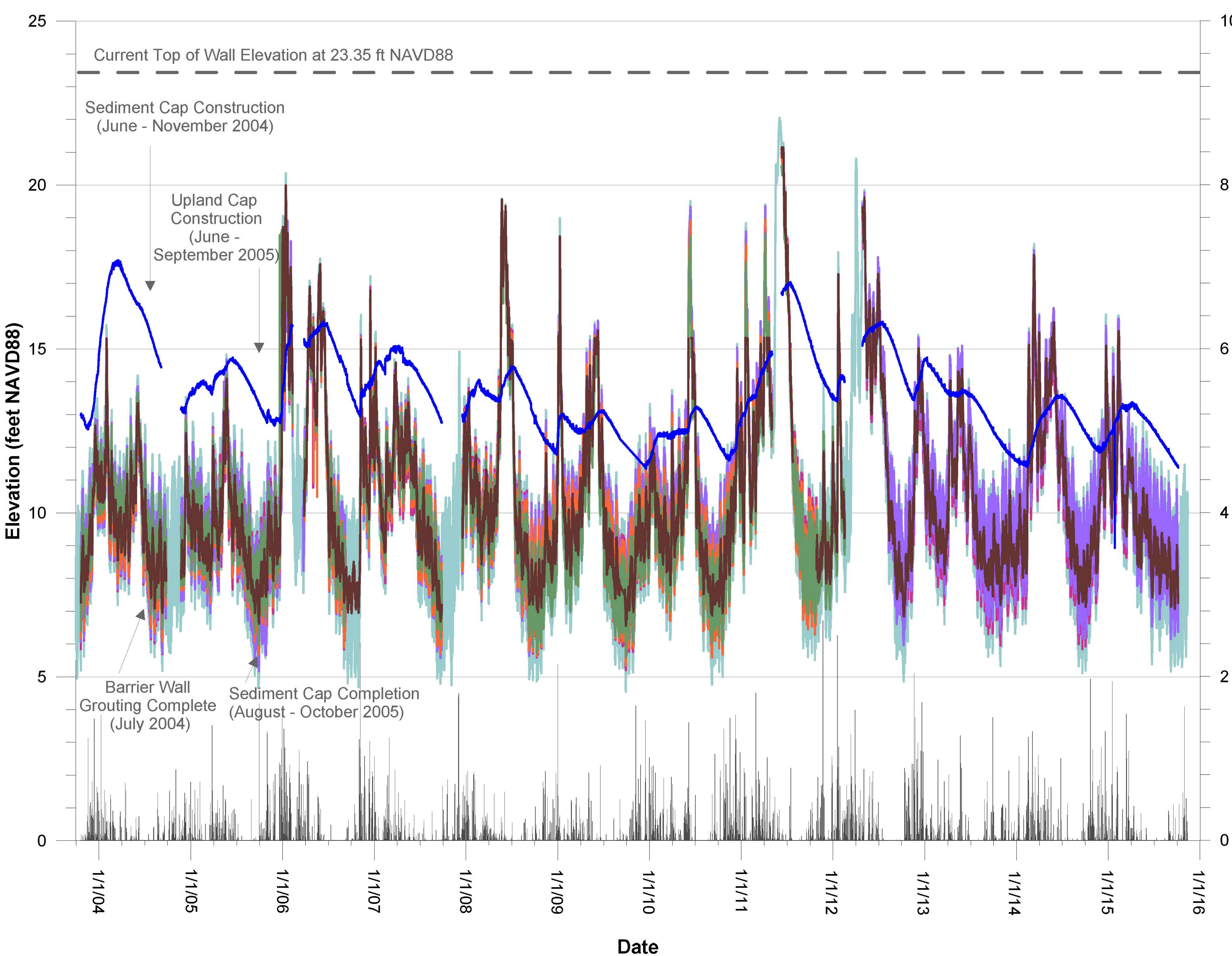


Figure 4-10:
Post-Barrier Wall Groundwater Elevations in Monitoring Wells MW-44 and MW-45

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- MW-44s (Interior)
- MW-44i (Interior)
- MW-44d (Interior)
- MW-45s (Exterior)
- MW-45i (Exterior)
- MW-45d (Exterior)
- River
- Precipitation

Notes:
MW-44 well cluster is located inside the barrier wall and MW-45 well cluster is located outside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings. Transducers were removed from MW-44i and MW-45i on February 16, 2012.

HARTCROWSER

GSI Water Solutions, Inc.

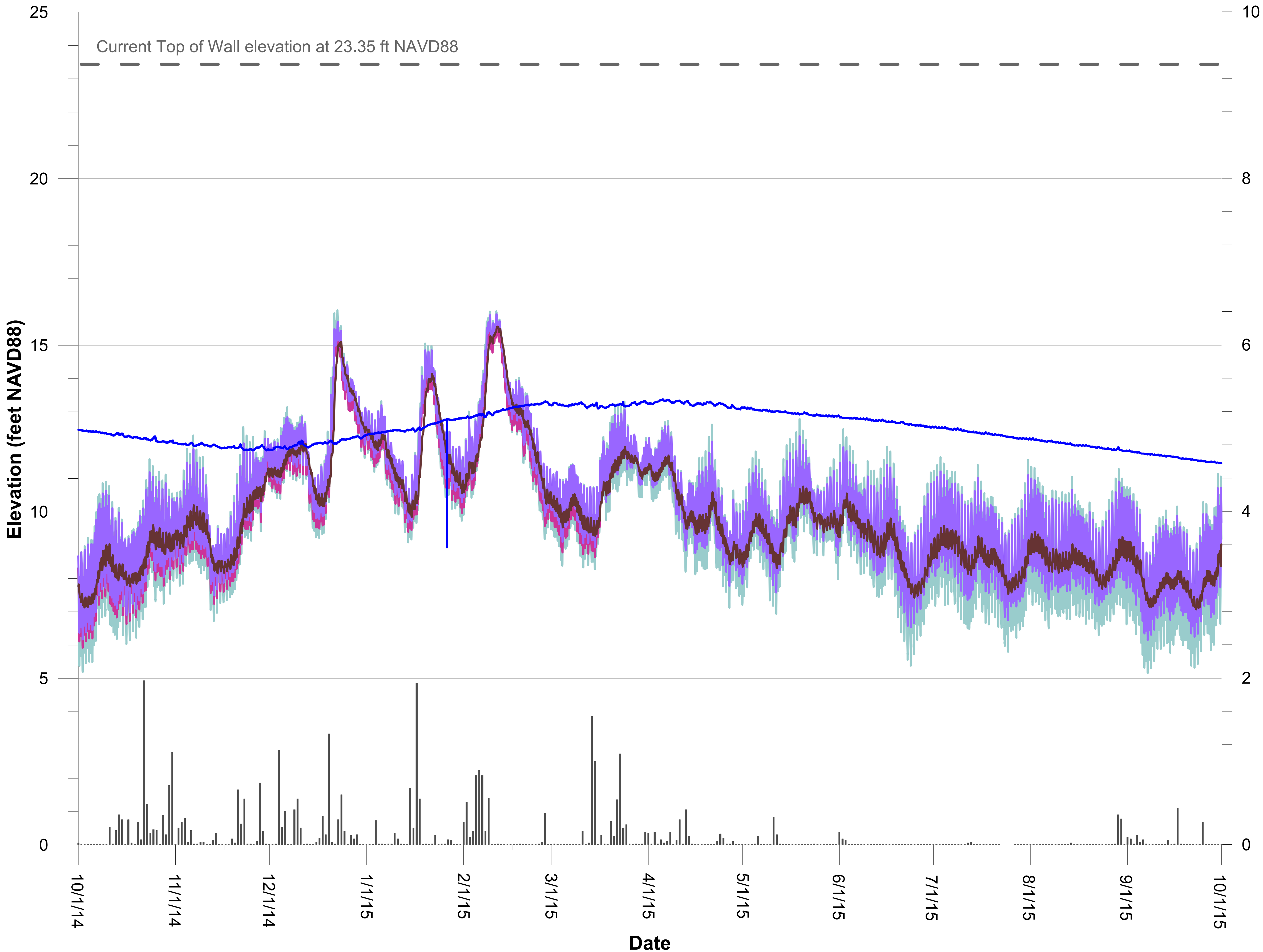


Figure 4-11:
2015 Groundwater Elevations in Monitoring Wells MW-44 and MW-45

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- MW-44s (Interior)
- MW-44d (Interior)
- MW-45s (Exterior)
- MW-45d (Exterior)
- River
- Precipitation

Notes:
MW-44 well cluster is located inside the barrier wall and MW-45 well cluster is located outside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

LEGEND

Groundwater Monitoring Wells (Thickness of LNAPL or DNAPL)

- Wells with LNAPL
- Wells with DNAPL
- Wells without LNAPL or DNAPL
- Subsurface Barrier Wall

NOTE:
Aerial photo taken on September 22, 2006.

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

LNAPL and DNAPL Distribution Map for June 9, 2015 Sampling Event

6/16

HARTCROWSER GSI Water Solutions, Inc.

Figure
4-12

Document Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2015 Annual Report\Figure4-12_LNAPL_and_DNAPL_Map_June9_2015.mxd

LEGEND

Groundwater Monitoring Wells (Thickness of LNAPL or DNAPL)

- ▲ Wells with LNAPL
- ■ Wells with DNAPL
- ☆ Wells with LNAPL or DNAPL
- ⊕ Wells without LNAPL or DNAPL
- Subsurface Barrier Wall

NOTES:

1) Aerial photo taken on September 22, 2006
2) Due to an erroneous DNAPL measurement in MW-Gs on October 2, 2015, the well was re-measured on October 5, 2015 and that DNAPL thickness is show.

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

LNAPL and DNAPL Distribution Map for October 2, 2015 Sampling Event

6/16

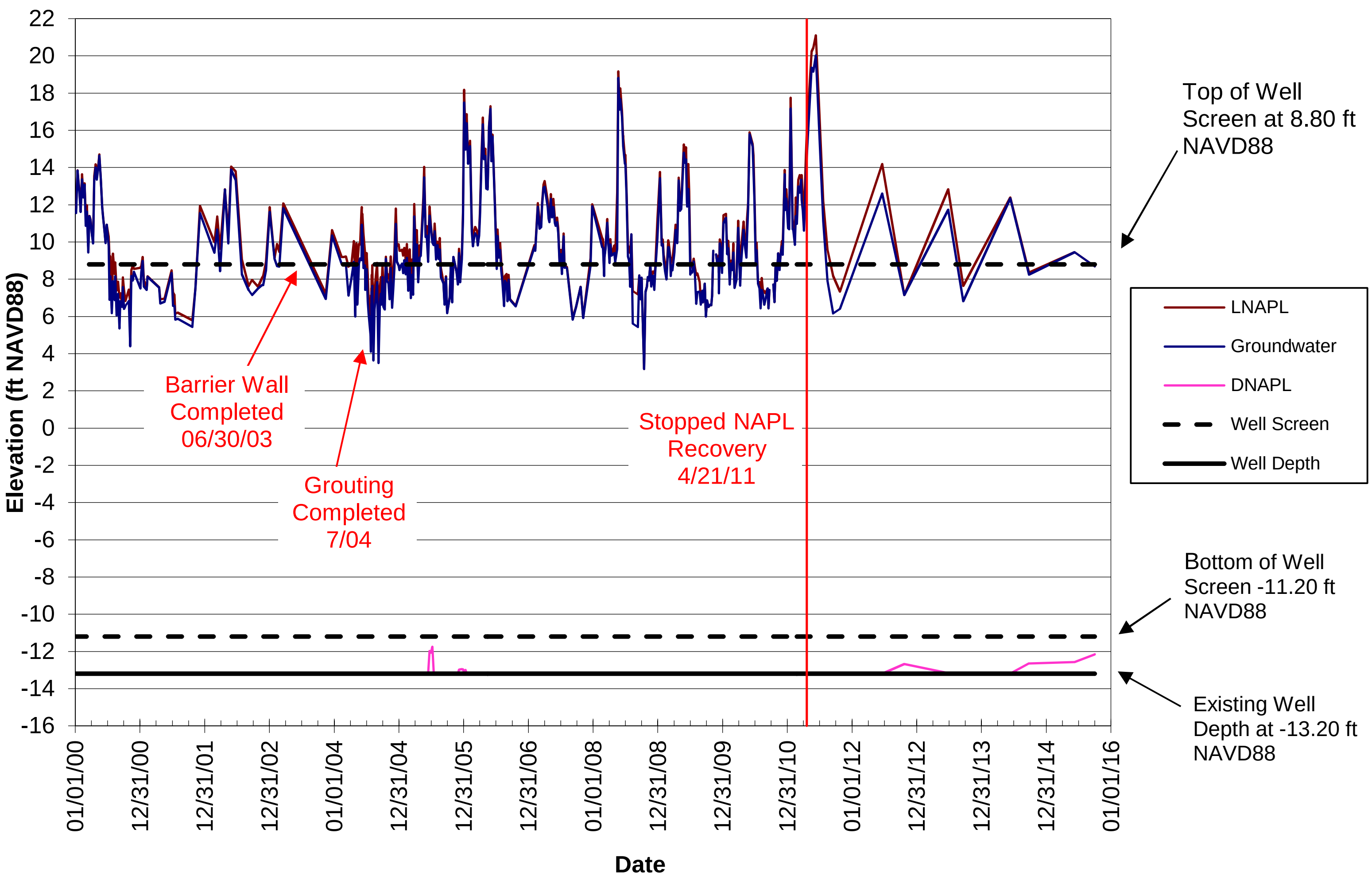
HARTCROWSER

GSI Water Solutions, Inc.

Figure

4-13

Document Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2015 Annual Report\Figure4-13_LNAPL_and_DNAPL_Map_Oct2_2015.mxd



McCormick and Baxter Superfund Site
Portland, Oregon

1999 to 2015 NAPL Thickness Plot for Well EW-10s

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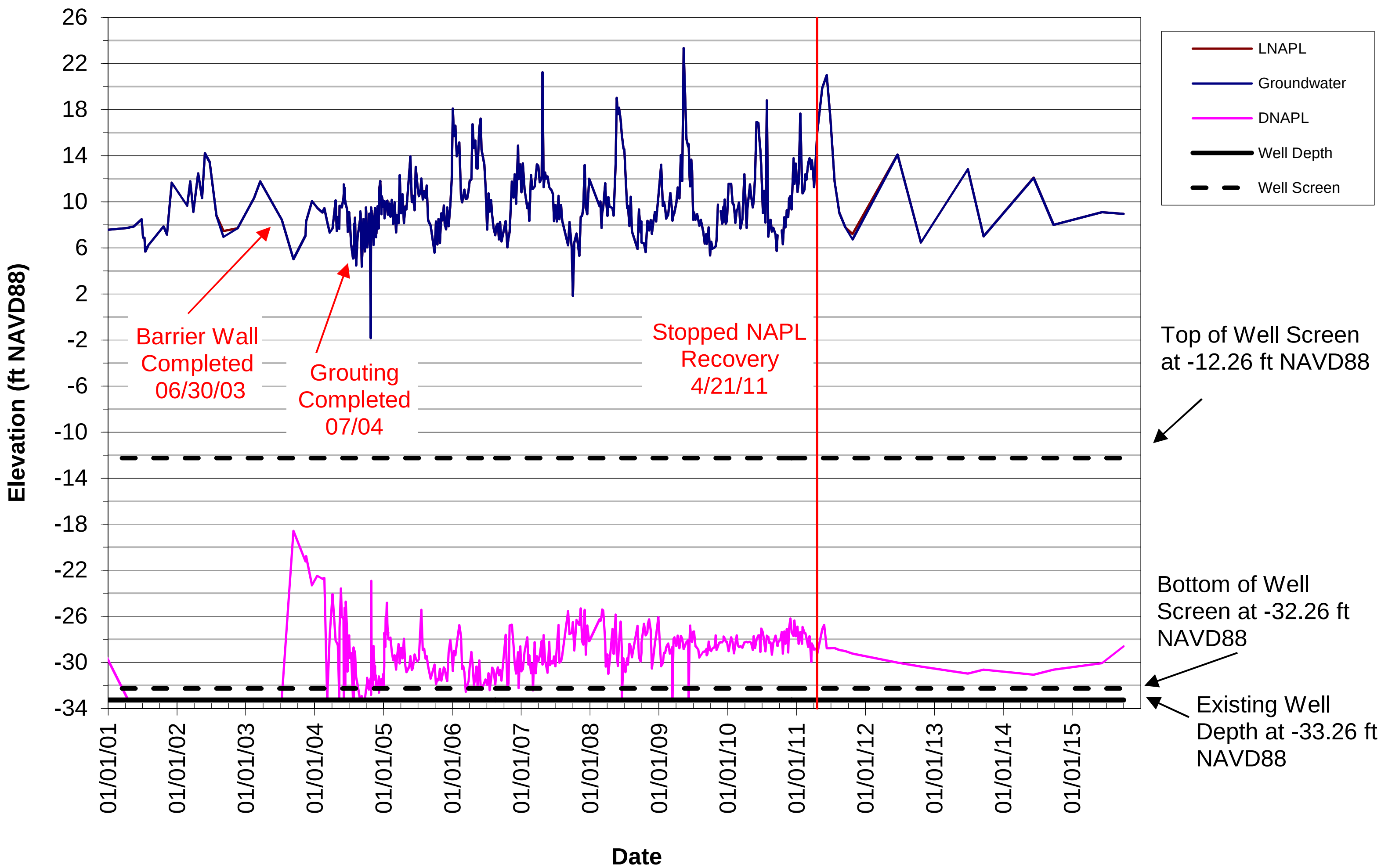
HARTCROWSER

GSI Water Solutions, Inc.

Figure

4-14



Note: DNAPL recovery was attempted in July 2007 but the extracted liquid appeared to be water with speck sized globules of DNAPL (with a creosote odor), rather than a distinct layer, suggesting that the DNAPL thicknesses measured may not accurately reflect the amount of DNAPL in the well.

McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2015 NAPL Thickness Plot for Well MW-20i

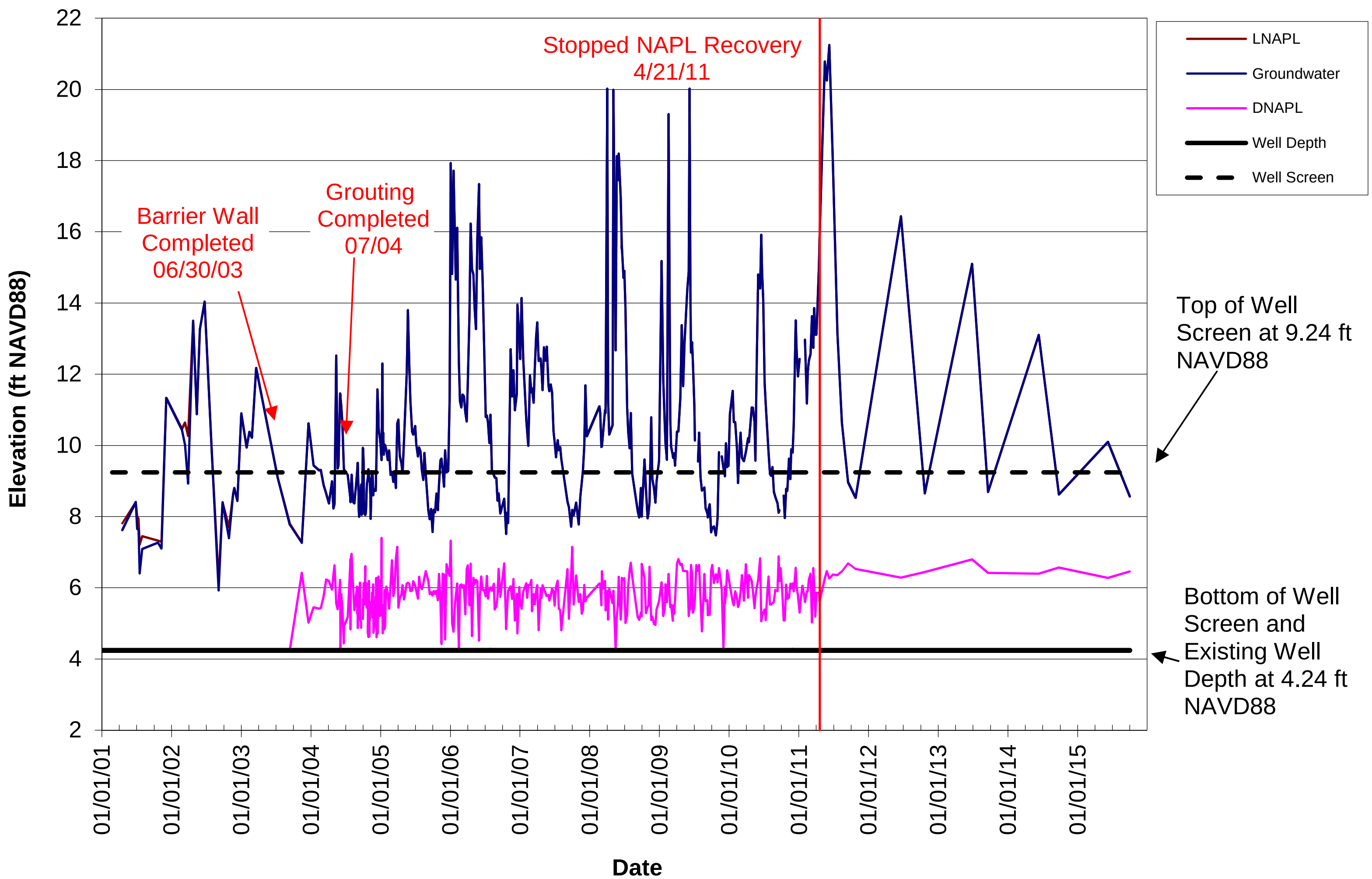
6/16

HARTCROWSER

GSI Water Solutions, Inc.

Figure

4-15



McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2015 NAPL Thickness Plot for Well MW-Ds

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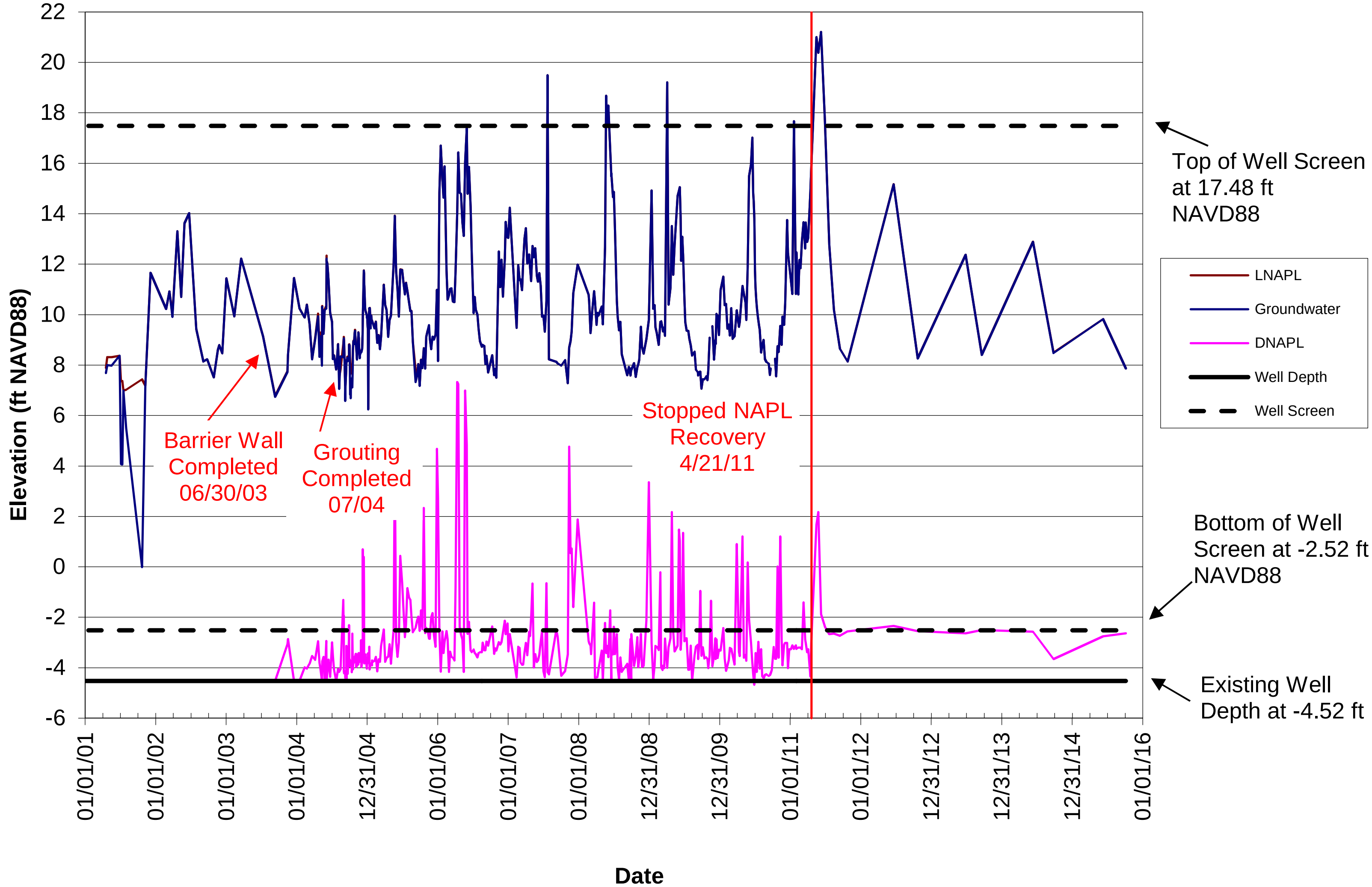
Figure
4-16



HARTCROWSER

GSI Water Solutions, Inc.

McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2015 NAPL Thickness Plot for Well MW-Gs

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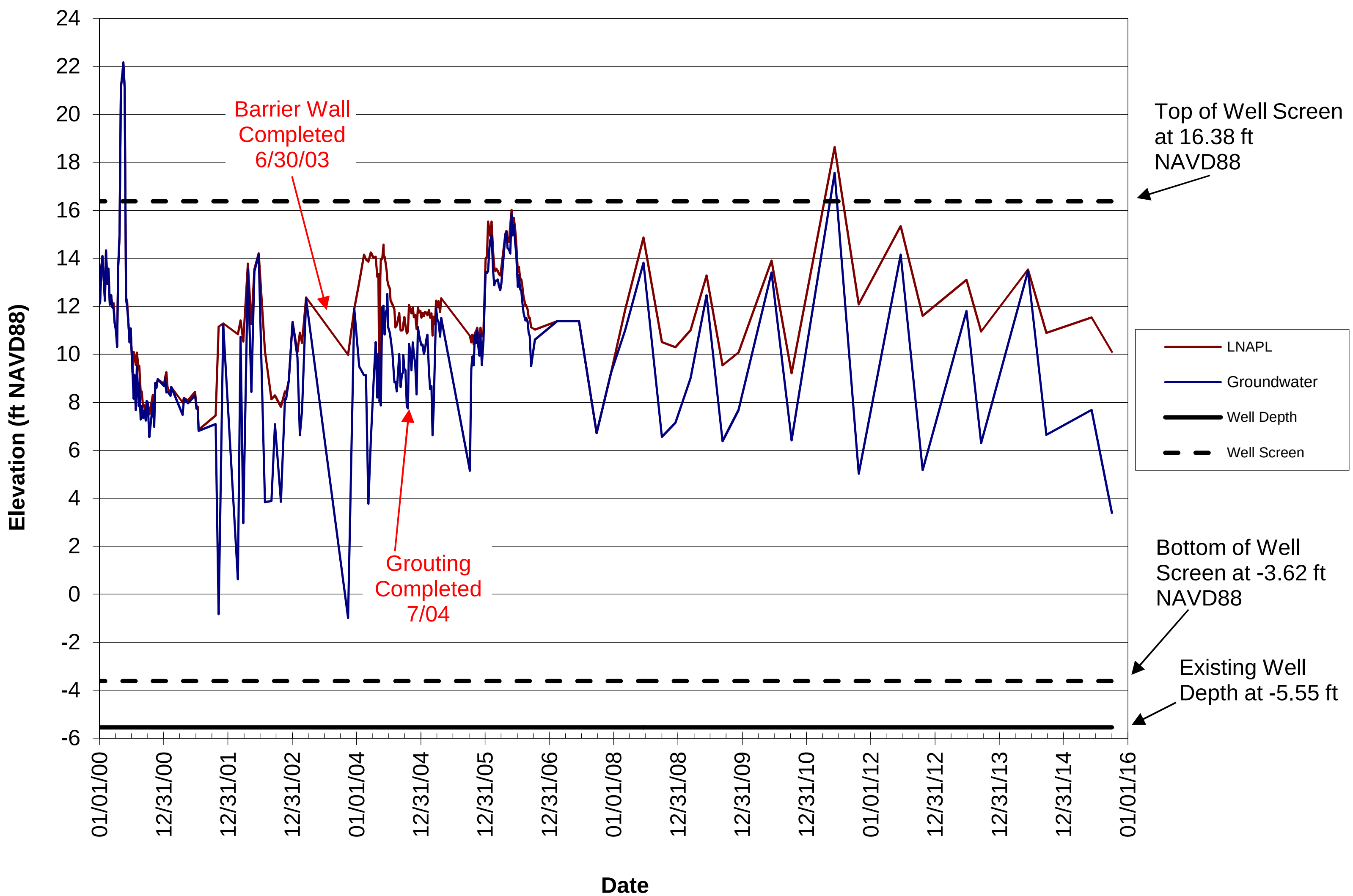
Figure

4-17



McCormick and Baxter Superfund Site
Portland, Oregon

1999 to 2015 NAPL Thickness Plot for Well EW-15s

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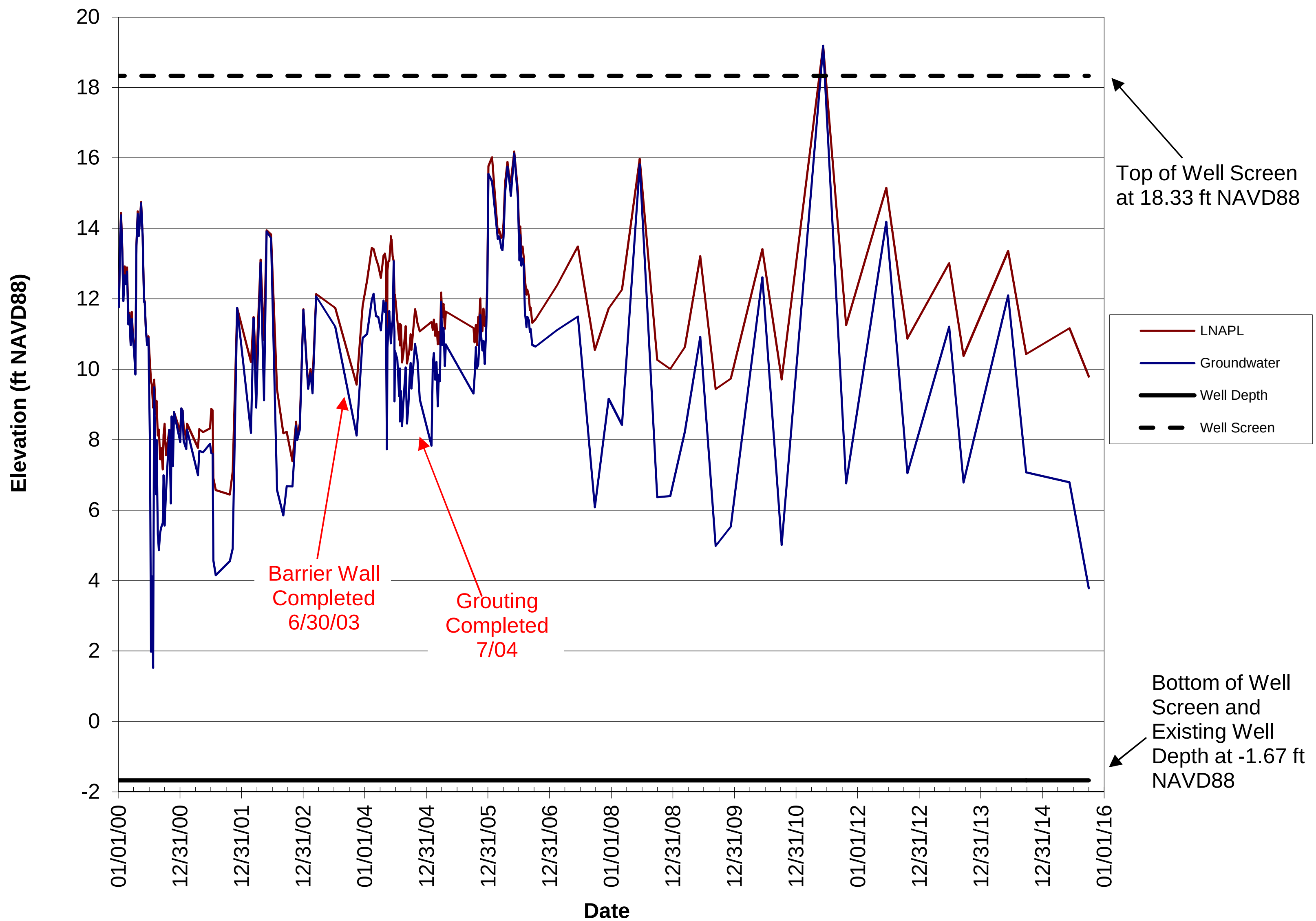
Figure

4-18



McCormick and Baxter Superfund Site
Portland, Oregon

1999 to 2015 NAPL Thickness Plot for Well EW-23s

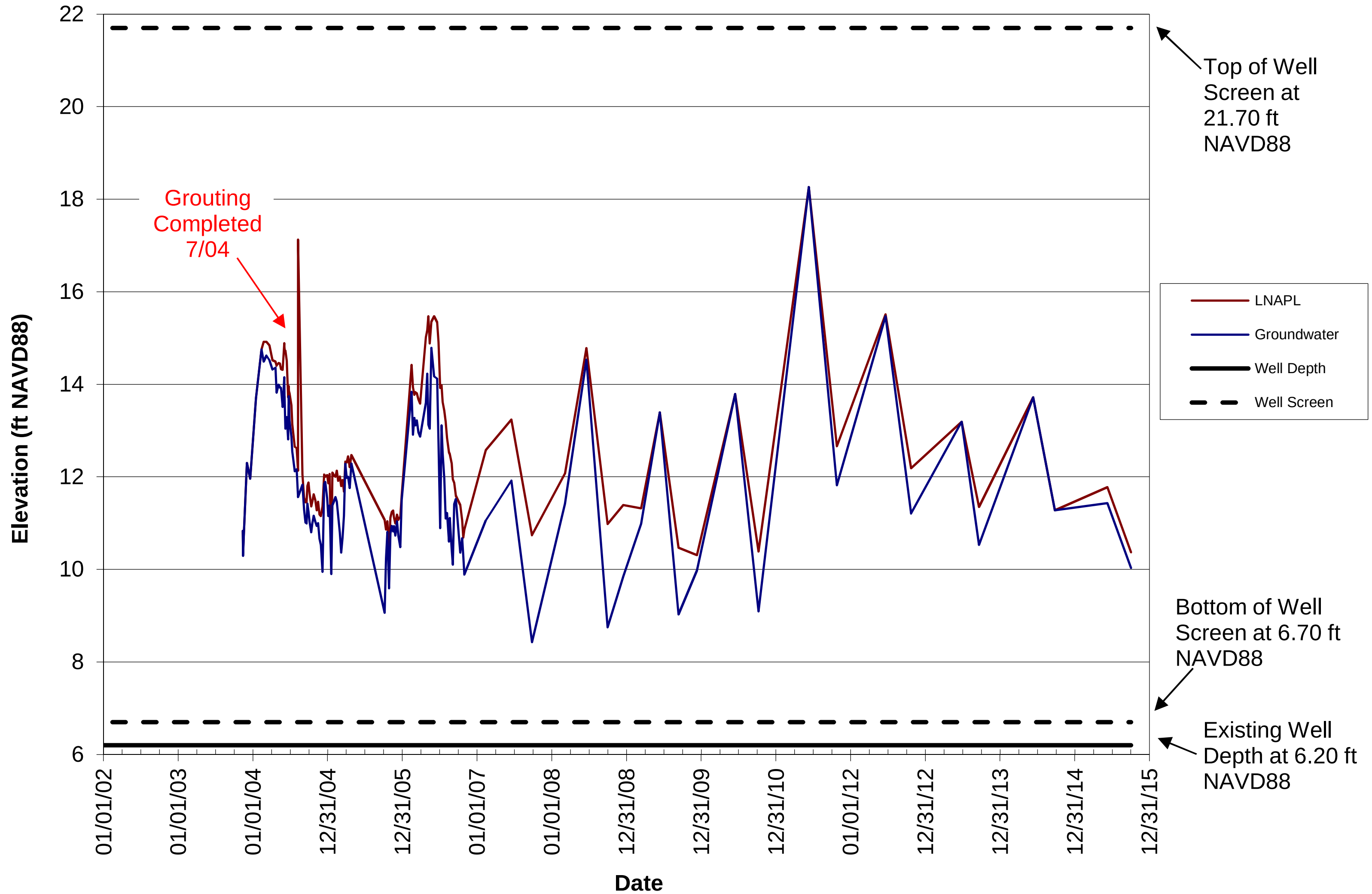
6/16

HARTCROWSER

GSI Water Solutions, Inc.

Figure

4-19



McCormick and Baxter Superfund Site
Portland, Oregon

2003 to 2015 NAPL Thickness Plot for Well MW-56s

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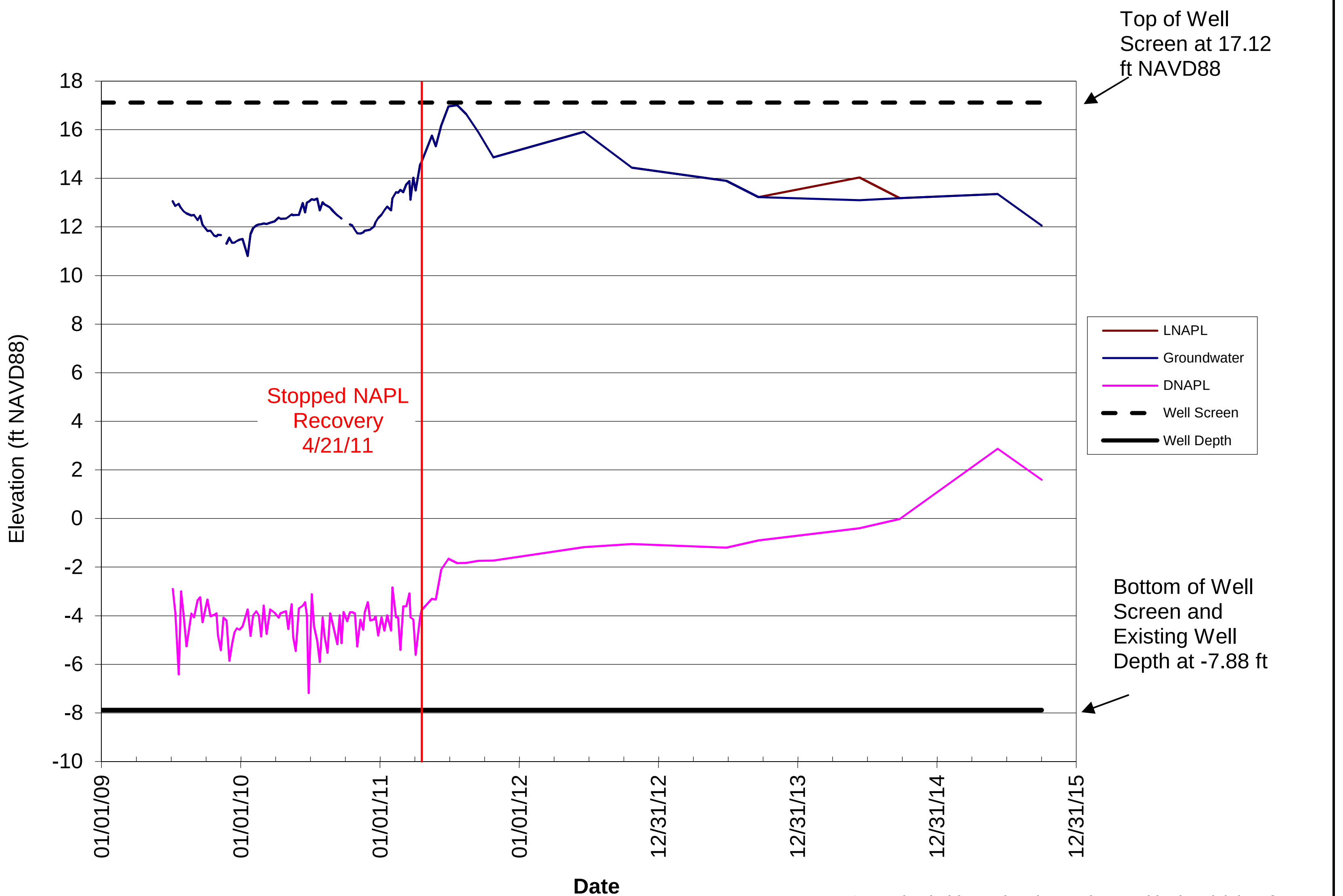
Figure

4-20



Note: Ground subsidence has been observed in the vicinity of EW-1s and the well casing has sunk over time. The screened interval and total well depth have been referenced to the most recent ground survey from September 2009. Given that the elevations are changing with time, the elevations shown are approximate.

McCormick and Baxter Superfund Site
Portland, Oregon

2009 to 2015 NAPL Thickness Plot for Well EW-1s

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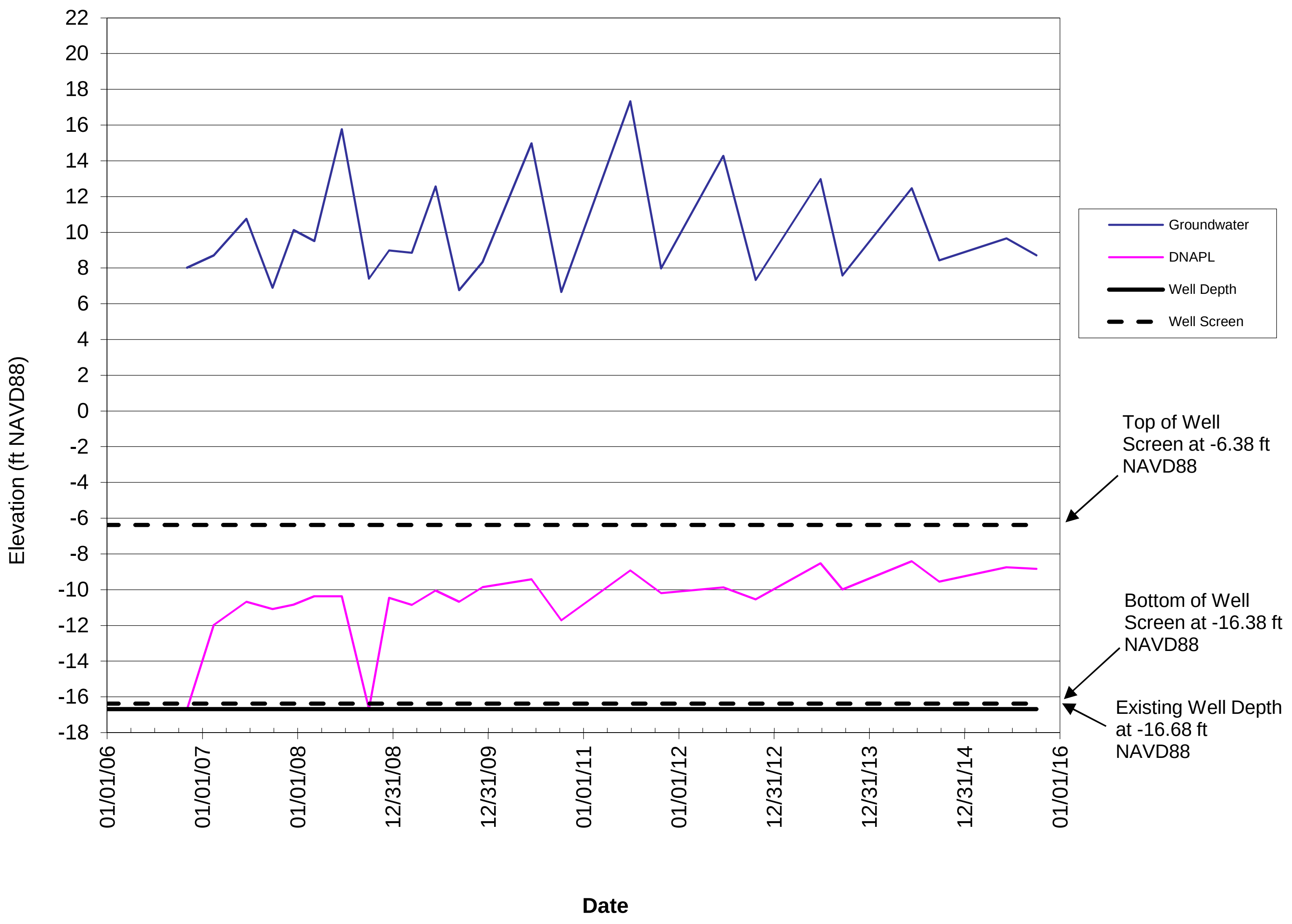
Figure

4-21



McCormick and Baxter Superfund Site
Portland, Oregon

2006 to 2015 NAPL Thickness Plot for Well MW-22i

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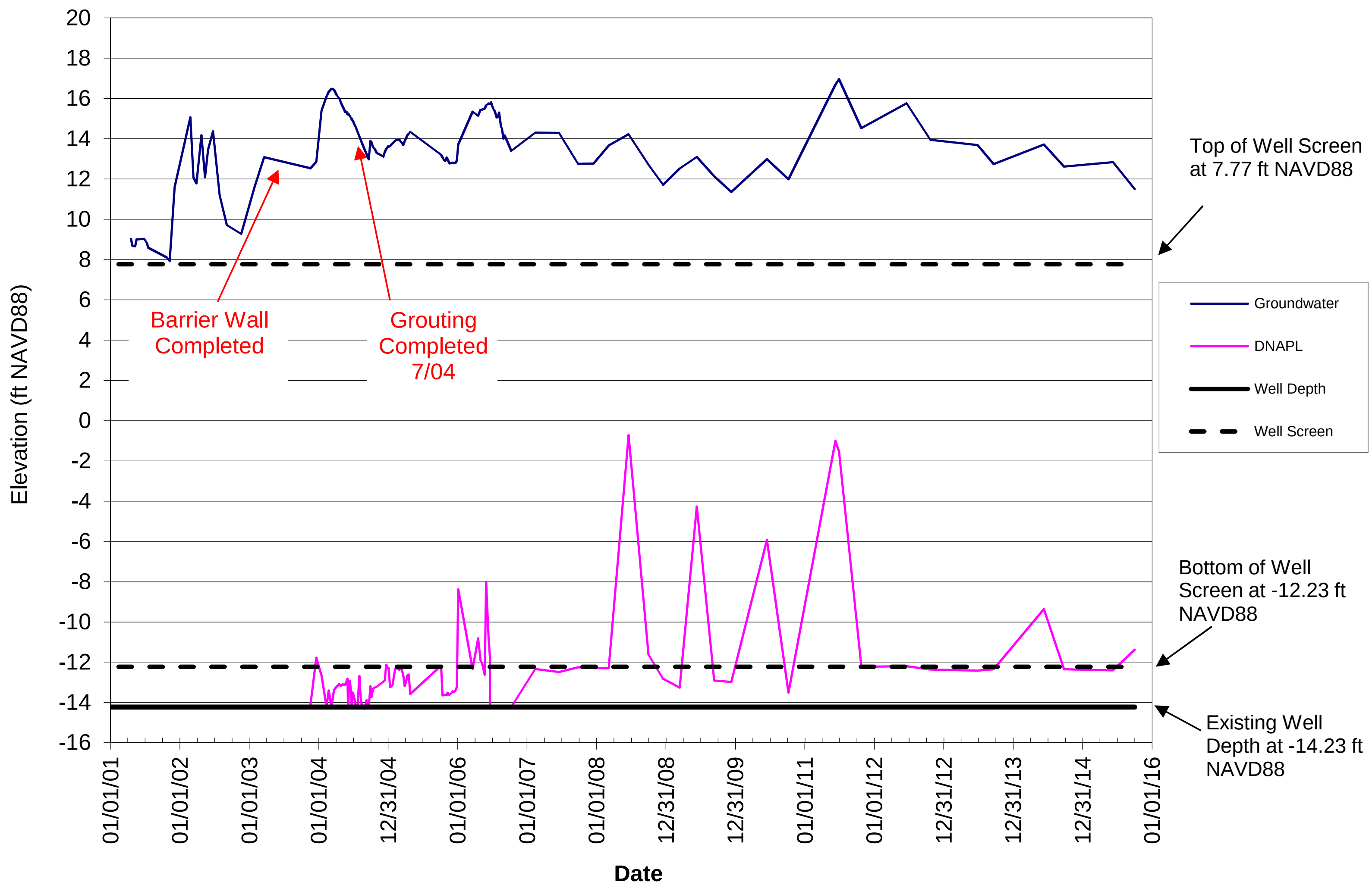
Figure

4-22



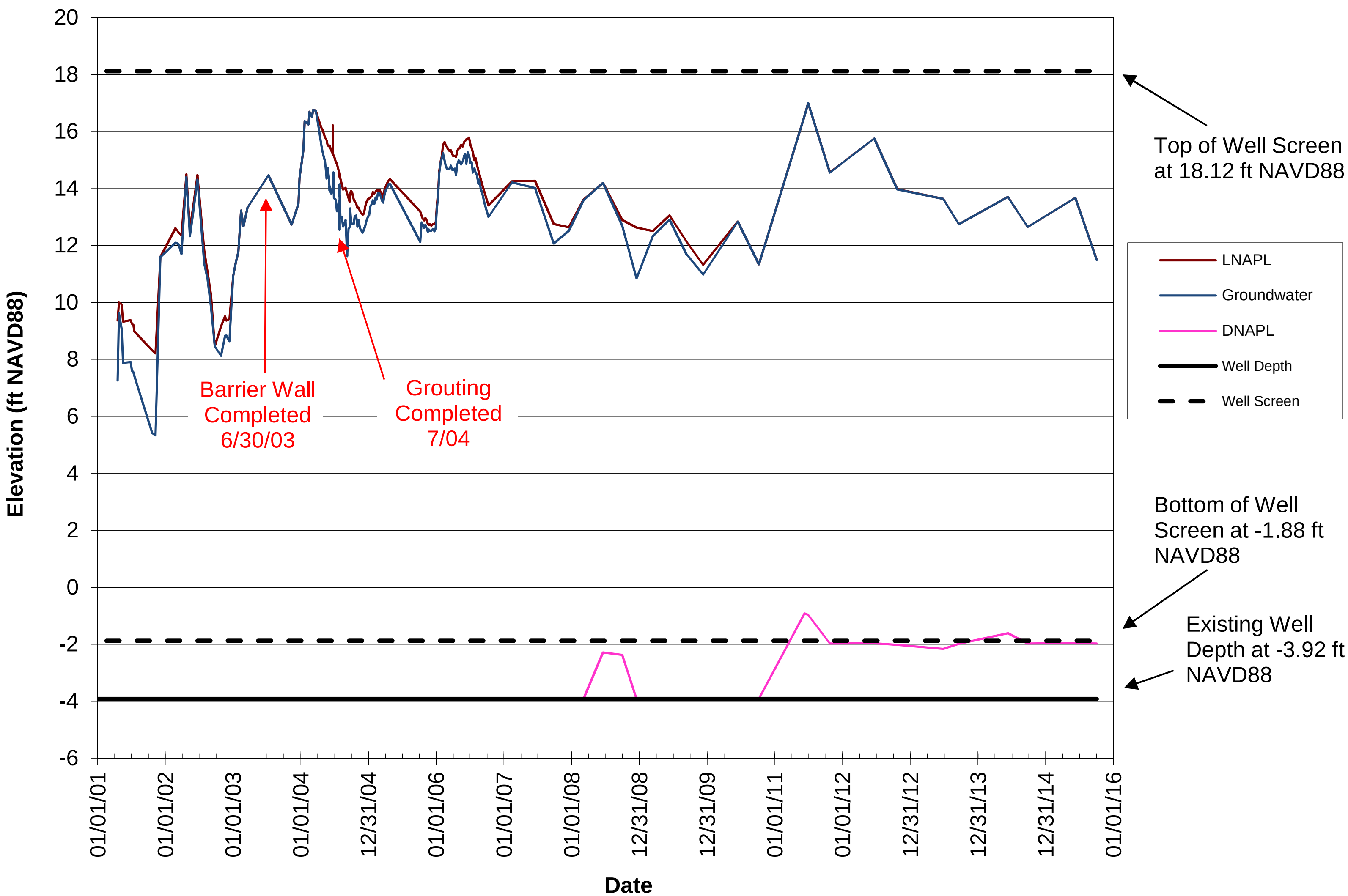
McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2015 NAPL Thickness Plot for Well EW-8s

6/16

Figure

4-23

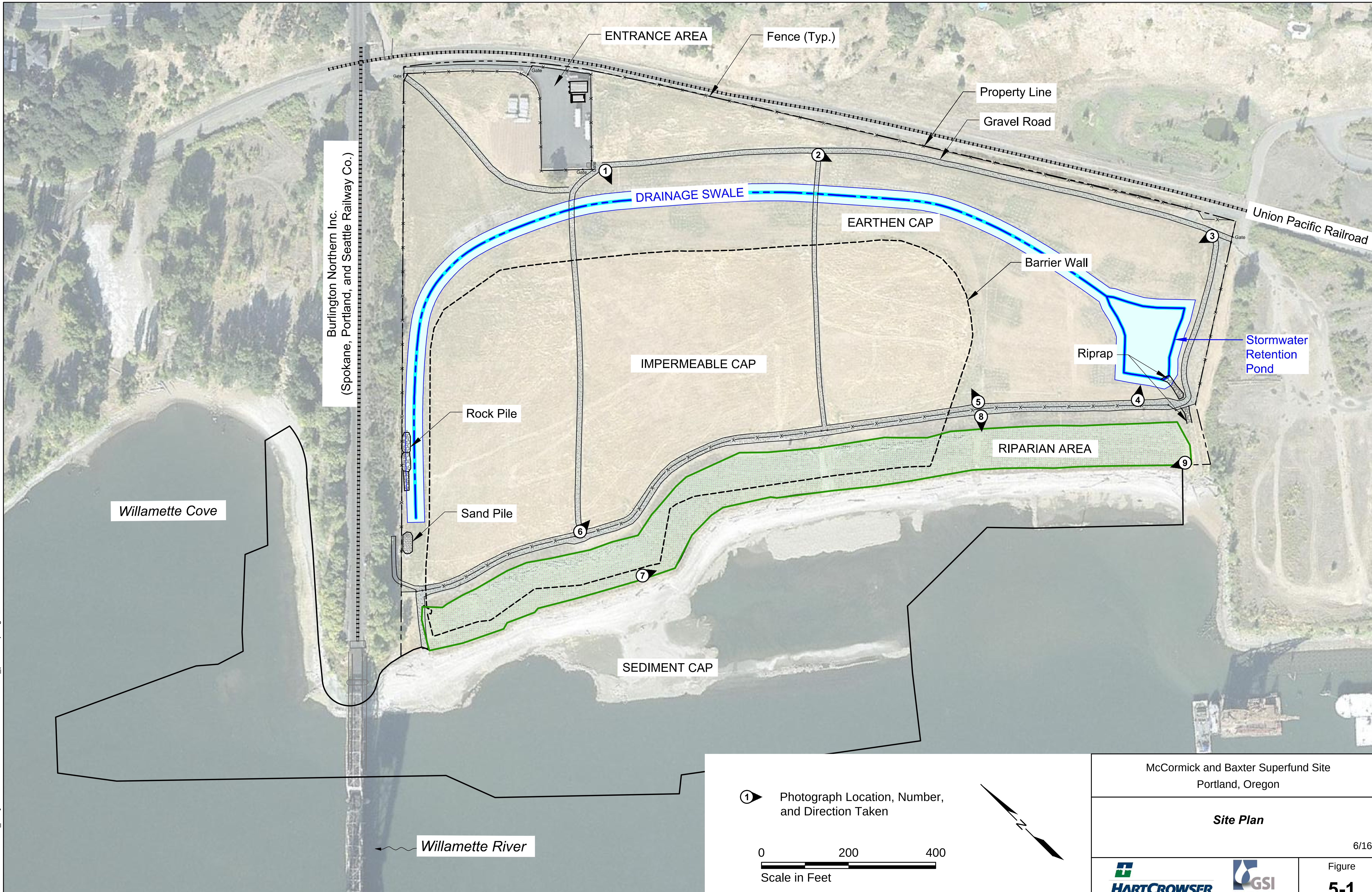


McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2015 NAPL Thickness Plot for Well EW-18s

6/16

Figure
4-24



McCormick and Baxter Superfund Site
Portland, Oregon

Site Plan

6/16

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Figure
5-1

F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\1567010_(Site Plan).dwg

APPENDIX A
Photograph Log – Site Activities and Observations

Photograph 1 – Repaired sign at southeast corner of site, looking north.

Photograph 2 – Animal burrow located along north perimeter fence.

Photograph 3 – Exposed ACB loops.

Photograph 4 –ACB cable loops cut to eliminate trip hazard.

Photograph 5 – Inner casing measuring point on well MW-23d.

Photograph 6 – Stormwater drainage at outfall.

Photograph 7 – Sediment cap and Canada geese in the Willamette River.

Photograph 8 – Feathers near well MW-23d indicate predator activity at the site.

Photograph 9 – View of lower sediment cap (looking south).

Photograph 10 – Typical habitat gravel within ACB armoring along the Willamette River.

Photograph 11 – Typical habitat gravel within ACB armoring in Willamette Cover.

Photograph 12 – Buoy number 4 replacement.

Photograph 13 – Derelict vessels in Willamette Cove.

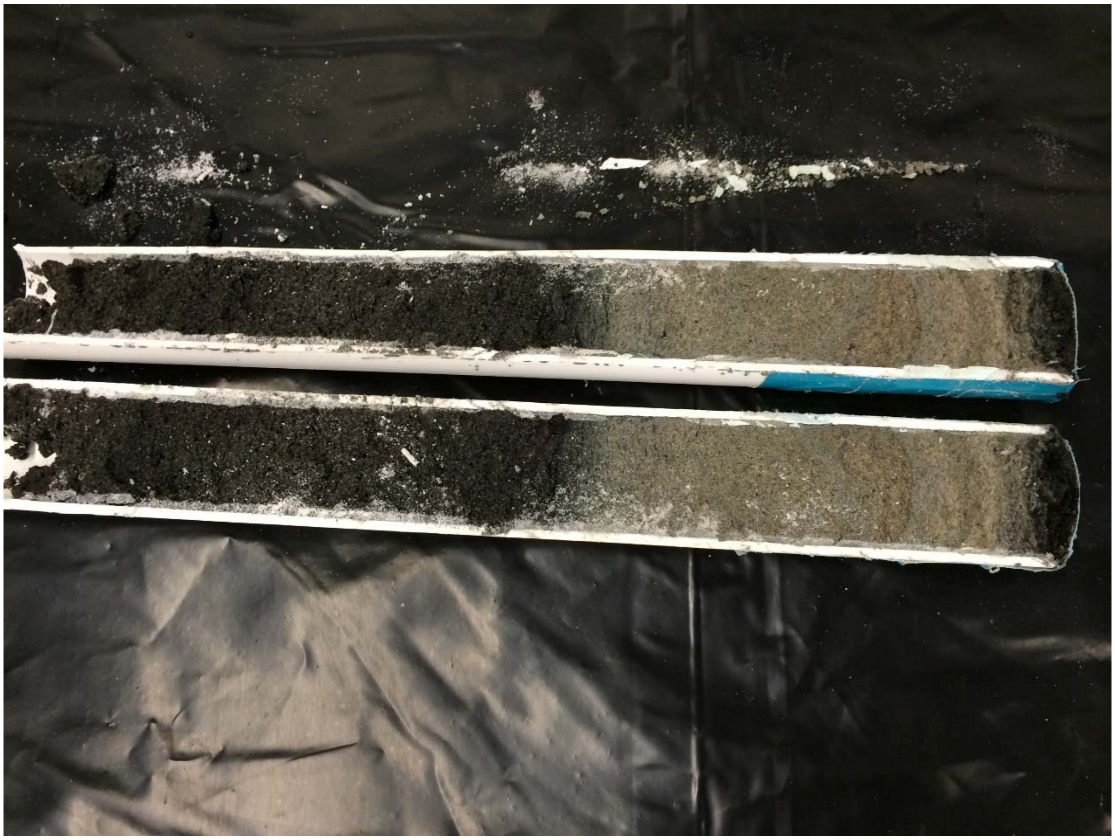
Photograph 14 – Mulch placed beneath TRM during shoreline repairs.

Photograph 15 – Completed shoreline repairs showing stapled TRM and new planting.

Photograph 16 – Newly planted pacific wax myrtle within TRM.

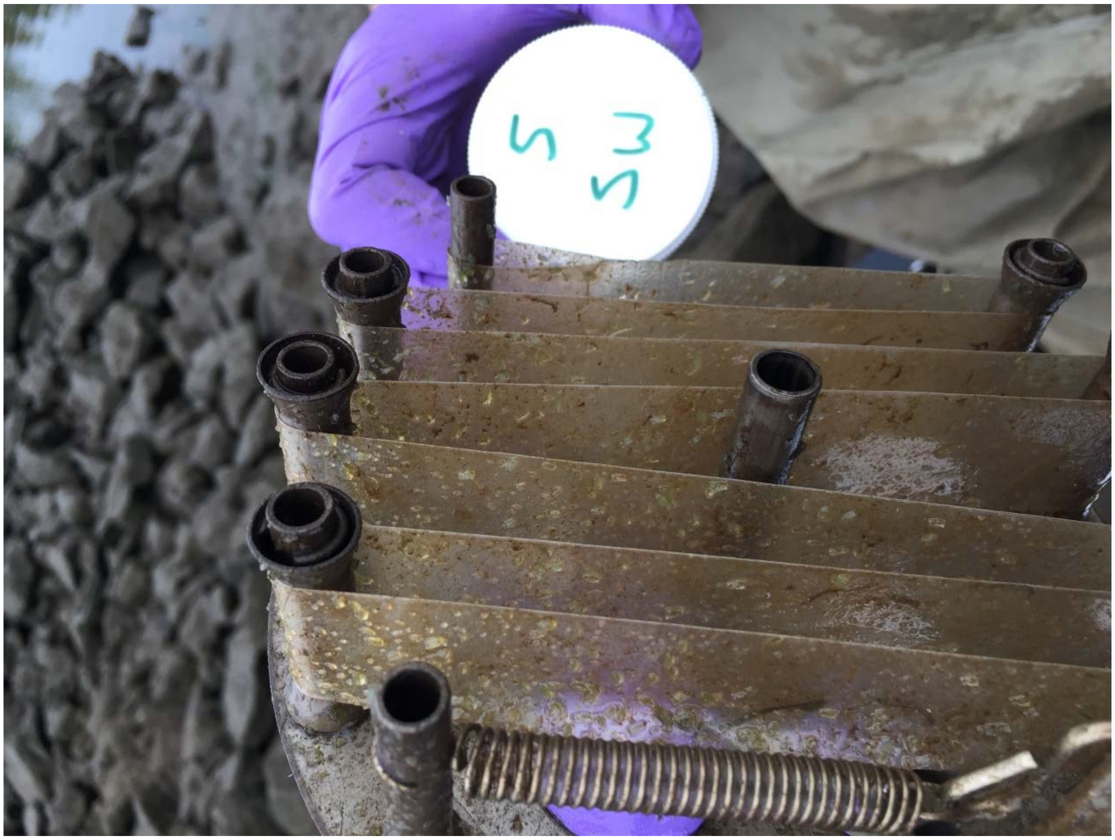
Photograph 17 – Irrigation piping that has been removed.

Photograph 18 – Willamette Cove sediment cap ACB blocks (bright orange) that were replaced following September 2015 organoclay sampling.



Photograph 19 – Organoclay sediment cores from Willamette Cove.

Photograph 20 – Typical surface water sampling equipment setup.



Photograph 21 – Recovered surface water sampler from early warning sample location number 5.

Photograph 22 – Recovered sub-armoring, inter-armoring, and surface water sampler from early warning sample location number 12.

Photograph 23 – In-place surface water sampler from early warning sample location number 12.

APPENDIX B
Sediment Cap Sampling Documentation

APPENDIX B1
Oregon State University (OSU) Analytical Report for Surface, Inter-armoring, and Sub-armoring Water

F15-14 McCormick & Baxter Site Assessment 2015 Analytical Report

Prepared for

Oregon Department of Environmental Quality
700 NE Multnomah St.
Suite 600
Portland, Oregon 97232

Prepared by

FOOD SAFETY & ENVIRONMENTAL STEWARDSHIP LABORATORY
ENVIRONMENTAL AND MOLECULAR TOXICOLOGY DEPT
1007 AGRICULTURE AND LIFE SCIENCES BUILDING
OREGON STATE UNIVERSITY
CORVALLIS, OR 97331-7301

Contact: Dr. Kim A. Anderson, Director
phone: 541-737-8501, fax: 541-737-0497
email: kim.anderson@oregonstate.edu

OSU
Oregon State University

SUBMISSION INFORMATION

Client: Sarah Miller
Address: 700 NE Multnomah St.
Suite 600
Portland, OR 97232

FSES Case #: F15-14
Client Case #: N/A
Date Received: 10/6/2015
Sample Type(s): PE PSDs and DGT
Report Status: Final
Samples Delivered By: FSES Collection
Condition Samples Received: on ice
Submitter: FSES staff

Report Date: 2/19/2016

Executive Summary

The Food Safety & Environmental Stewardship Program (FSES) provided sampling and analytical services under intergovernmental agreement (DEQ # OPSR-NWR-15-01, OSU # DEQ-060115) executed June 26th, 2015 between Oregon State University (OSU) and Oregon Department of Environmental Quality (DEQ).

Under this agreement FSES provided the following services:

- Standard operating procedures (SOPs) for laboratory operations, analytical methods and field methods for finalization of the McCormick & Baxter 2015 Sampling and Analysis Plan (SAP)
- Manufactured polyethylene (PE) passive sampling devices (PSDs) with performance reference compound (PRC) infusion
- Procurement of Diffusive Gradient Thinfilm (DGT) PSDs from DGT Research Ltd for analysis of dissolved metals
- Field sampling equipment rental for:
    - 10 locations with inter-armoring and surface water samplers
        - 2 locations with duplicate co-located samplers
    - 4 locations with sub-armoring (within sand cap), inter-armoring, and surface water samplers as an early assessment for sediment cap contaminant breakthrough
    - 2 locations to determine surface water quality upstream and downstream of sediment cap
- Field assistance to GSI Water Solutions, Inc. (GSI) and the US EPA Region 10 dive team.
- Subsequent extraction of PSDs and measurement of 61 polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol (PCP), and four metals (Cu, Cr, Zn, As)
- Analytical report (this document)

Sampling and Analytical Plan

Thirteen SOPs were provided to cover all laboratory, field, and analytical processes to be carried out by FSES during this campaign. The final draft of the SAP was accepted by DEQ on July 9, 2015. Updates to four SOPs were made since this acceptance of the SAP. Instrument detection limits for PCP were determined and this is reflected in updates to SOPs 420.00 & SOP 407.01 provided in appendices I & II. SOPs 802.01 & 811.00 regarding the extraction of Diffusive Gradients in Thinfilm (DGT) Passive Sampling Devices (PSDs) were updated to reflect the commercial availability of resin gel, an added filtration step to remove the FeOxide resin gel prior to analysis, and updates to equation parameters such as volumes and diffusion coefficients for total As, found in appendices III & IV.

Field Operations

Deployment of PSDs occurred on September 15th and 16th, 2015 and were retrieved on October 6th 2015 by FSES laboratory personnel. Following retrieval, samplers were transported back to OSU in a cooler on blue ice for processing. Temperature loggers (onset TidbiT v2) were programmed to record hourly observations and deployed in a large subset of the samplers. Analysis of temperature logs indicated very good agreement throughout all samplers with an observed average water temperature of 18.98 C with a range of (18.69 – 19.25 C) between samples throughout the deployment period.

PE PSD Processing and Analysis

Upon arrival in the laboratory, PE PSDs were stored at -20 °C and logged into laboratory information management system (LIMS) within 24 hours. PSDs were post deployment cleaned between October 8th and 15th, 2015 and extracted between October 9th and 21st, 2015. PSDs were analyzed for PAHs and PCP between October 22nd and November 3rd, 2015.

DGT Processing and Analysis

DGTs were stored at 4 °C upon arrival in the laboratory and logged into LIMS within 24 hours. DGTs were dismantled October 19th and 20th, 2015. At this time, 5 of 26 FeOxide (As) and 9 of 26 chelex 100 (Cu, Cr, Zn) samples were identified to have the sampling window compromised during deployment, allowing sediment to adhere to the resin gel. These are reported as “NR” in Table 2. This failure of the DGT sampling window occurred at a higher rate on this project than past projects and is discussed further in future recommendations below. The uncompromised resin gels were extracted beginning October 28th, 2015. On October 29th, 2015 chain of custody of sample extracts was given to Ch2M Hill Applied Sciences Laboratory (ASL) for analysis of metals between November

24th and 25th, 2015. This analysis change was approved verbally by Scott Manzano on October 6, 2015.

PAH results

Field and laboratory quality control samples showed detectable levels of up to ten of the 61PAHs, with seven of the ten being substituted naphthalenes. However, these levels present on the field and laboratory blanks accounted for less than 0.5% of total PAH concentrations in sample extracts on average. A blank subtraction was applied by adding the average extract concentration of the four post deployment cleaning blanks to the average extract concentration of the two field blanks and subtracting this number from each sample prior to back calculating to environmental concentrations. Post deployment cleaning blanks are laboratory control samples used to assess contamination during the cleaning process by running a blank PE PSD through the post-deployment cleaning process between samples. Field blanks are blank PE PSDs that are exposed to the air during deployment and retrieval of PSDs in the field. Compounds with blank subtraction applied are flagged with a "B" in the Table 2. All other instrument and laboratory quality control samples met data quality objectives as stated in the method SOPs in the SAP.

All concentrations reported for PE PSD samples are freely dissolved water concentrations (C_{free}). No assumptions were necessary with regard to the sampling kinetics for any compound because the full kinetic model with performance reference compounds (PRCs) was used when calculating water concentrations, described in SOP 407.01 Section III.C to calculate sampling rates and C_{free} water concentrations. PRC dissipation rates were between 20% and 80% for at least one PRC in all samples providing a high level of confidence in the estimated water concentrations. In the case of PRC losses less than 10% or greater than 90%, the PRC with the nearest log K_{ow} to the target analyte was used to calculate a sampling rate. This was applied for surface water samples where pyrene-d10 was substituted for fluorene-d10 due to greater than 90% fluorene-d10 dissipation. Additionally, a transcription error in the T_0 PRC concentrations for fluorene-d10 was identified in the SAP and accounted for in this report which changed the concentrations of some lower molecular weight PAHs compared to the first report. Table 3, contains updated T_0 PRC fortification levels to clarify this error. All samples contained measurable levels of PAHs. The highest monitoring sample was site B inter-armoring water with a Σ61 PAH concentration of 9.2 ug/L and Σ16 PP PAH concentration of 8.2 ug/L. The highest early warning sample, Site 12 inter-armoring water, contained 7.6 ug/L Σ61 PAHs and 6.7 ug/L Σ16 PP PAHs.

Substitution for censored data (analytes found to below limits of detection or quantitation, reported as BLOD and BLOQ in table 2) has not been performed due to the more complex nature of passive sampling device quantitation limits. Table 4 includes a reproduction of method quantitation limits (MQL) reported in

SOP 407 from the SAP for the study design in this campaign. Method quantitation limits are based on back calculations from instrument quantitation limits (IQL) to environmental concentrations using average sampling rates from a previous sampling campaign in Portland Harbor. As each sampler has its own defined sampling rates (based on PRC loss), and thus its own MQL, it is possible that some of the values reported may be lower than the MQLs in table 4.

PCP results

All instrument, laboratory and field quality control samples met data quality objectives set by FSES laboratory QAPP SOPs which were included in the SAP. All samples in this campaign were below limits of detection.

Metals results

All laboratory quality control samples were within established control limits employed by ASL. Trip blanks contained detectable levels of zinc and the average concentration was subtracted from samples prior to back calculation to water concentrations and are flagged with a "B" in Table 2. All reported concentrations for DGT samples are freely dissolved water concentrations (C_{DGT}) and were calculated using the equations in SOP 802.01 section V. Only four samples showed reportable levels of As. The highest C_{DGT} As was measured at Site A in the Surface water .at 0.0010 mg/L. Only three samples showed reportable levels of Cr, the highest measured at site K inter-armoring water at 0.00059 mg/L. Seventeen samples showed reportable levels of Cu, the highest measured at site C inter-armoring water at 0.0051 mg/L. After blank subtraction, 15 samples had reportable levels of Zn, with the highest measured at site C inter-armoring water at 0.011 mg/L.

To clarify how C_{DGT} concentrations were calculated, the certificates of analysis from ASL and OSU login report are included in appendix V and appendix VI. There were separate experimental dilution factors for chelex 100 (for Cr, Cu, Zn) and FeOxide (for As) resin gels that needed to be accounted for prior to using these data with the formulas to calculating a water concentration outlined in the SOPs. Prior to calculation of C_{DGT} apply a dilution factor of 2.5 for As and 5 for Cr, Cu, and Zn. Zn also requires a blank subtraction prior to calculation.

Future Recommendations

In future sampling events it may be advantageous to composite five PE PSDs in surface water samples to establish lower detection limits. This is especially important for the higher molecular weight PAHs. Given the homogeneity of temperature observed in this study between locations, , it may be possible to reduce the number of temperature loggers in future campaigns or to use information freely available from a USGS monitoring station in Portland. A change in approach and DGT type should be considered to mitigate the loss of

DGT samplers in future sampling campaigns. The DGT sampling windows were likely compromised during the process of sampler deployment in which the sediment and water cages were dropped overboard followed by diver placement into the sediment. To avoid direct damage to the DGT sampling windows a suspension system should be added to limit direct contact from the sides of the cages and probes. Furthermore, DGT are available in a stick format that are much more durable and may be placed outside the probe. These also have a greater volume which would decrease the detection limits of dissolved metals.

Questions: If you have any additional questions, please call the Food Safety & Environmental Stewardship Laboratory Director at 541-737-8501.

DIRECTOR: ____ DATE: ________________
Kim A. Anderson, PhD

OSU Oregon State University

ABBREVIATIONS

Σ61 PAHs = Summation of all 61 PAHs measured in SOP
Σ16 PP PAHs = Summation of 16 EPA Priority Pollutant PAHs
ASL = Ch2MHill Applied Sciences Laboratory
BLOD = Below limit of detection
BLOQ = Below limit of quantitation
CDNRT = Client did not request test
C_{free} = Concentration of freely dissolved organic compounds
C_{DGT} = Concentration of freely dissolved metals
DEQ = Oregon Department of Environmental Quality
FSES = Food Safety & Environmental Stewardship Program
GSI = GSI Water Solutions, Inc.
IQL = Instrument quantitation limit
LIMS = Laboratory information management system
MQL = Method quantitation limit
NR = Not reported
OSU = Oregon State University
PAH = Polycyclic Aromatic Hydrocarbons
PSD = Passive sampling device
PRC = Performance reference compound
QAPP = Quality assurance program plan
SAP = Sampling and analysis plan
SOP = Standard operating procedure

UNITS

ppt = part per trillion
ppb = part per billion
ppm = part per million
ng/L = ppt
µg/kg = ppb
µg/L = ppb
mg/L = ppm

LIST OF TABLES

Table 1. Sample Identification and Analytical Program

Table 2. Surface, Inter-Armoring, and Sub-Armoring Water Data: Fall 2015 McCormick & Baxter Superfund Site, Portland, Oregon

Table 3. Polyethylene Passive Sampling Device Performance Reference Compound T_0 Fortification Levels

Table 4. Estimated Method Quantitation Limits for PAHs and PCP

LIST OF APPENDICES

Appendix I: SOP 420.00 *Determination of Pentachlorophenol using GC-MS/MS*

Appendix II: SOP 407.01 *Calculation of Freely Dissolved Water Concentrations of Organic Compounds Derived from Polyethylene Passive Sampling Devices*

Appendix III: SOP 802.01 Assembly and Extraction of Diffusive Gradients in Thinfilm Passive Sampling Device

Appendix IV: SOP 811.00 Extraction of Diffusive Gradients in Thinfilm Passive Sampling Device for Total Arsenic

Appendix V: ASL Certificate of Analysis P3514 and P3515

Appendix VI: FSES Login Report

RESULTS

Sample Collection

PSD sampling equipment was dropped on the GPS locations by FSES and GSI staff aboard the US EPA boat. Once cleared, US EPA Region 10 dive team members removed rock armoring and placed sampling equipment at the correct depth across and within the cap. **Table 1** highlights the sampling duration of each sample and the average temperature if sampler was accompanied by a tidbit data logger. Given the known homogeneity of temperature in this system, tidbit loggers were included with 67% of the samplers with most water depths represented.

Quality Control

Quality control samples including field, trip, instrument, and cleaning blanks as well as laboratory duplicates accounted for over 30% of total samples run. A blank subtraction for PAHs and Zn was perform as described above to account for laboratory and field levels. All QC samples met data quality objectives set by FSES laboratory quality assurance program plan outlined in SOP's included in the SAP.

Analysis Results

Analytical results are presented in **Table 2.** Summed PAHs were calculated for all 61 PAHs measured, the EPA 16 priority pollutant PAHs, and The EPA IRIS 2010 (draft document) approach was used to calculate the sum BAP equivalent concentrations (USEPA 2010).

REFERENCES

USEPA (2010). Development of a Relative Potency Factor (RFP) Approach for Polycyclic Aromatic Hydrocarbons (PAH) Mixtures, Integrated Risk Information System (IRIS).

TABLES (Continued on next page)

Table 1
Sample Identification and Analytical Program

Sampling Station ID	Sampling Interval	Sample Media	Unique Sample ID	Tidbit ID	Start date/time	End date/time	Total Minutes	Total Days	Average Temp C
A	Surface Water	PE	MBSWPE1015-A		9/15/15 16:12	10/6/15 8:38	29786	20.68	
		DGT	MBSWDGT1015-A		9/15/15 16:12	10/6/15 8:38	29786	20.68	
B	Surface Water	PE	MBSWPE1015-B		9/15/15 15:33	10/6/15 8:20	29807	20.70	
		DGT	MBSWDGT1015-B		9/15/15 15:33	10/6/15 8:20	29807	20.70	
	Inter-Armoring	PE	MBIAPE1015-B	9767264	9/15/15 15:33	10/6/15 8:20	29807	20.70	19.09
		DGT	MBIADGT1015-B	9767264	9/15/15 15:33	10/6/15 8:20	29807	20.70	19.09
C	Surface Water	PE	MBSWPE1015-C		9/16/15 9:15	10/6/15 15:20	29165	20.25	
		DGT	MBSWDGT1015-C		9/16/15 9:15	10/6/15 15:20	29165	20.25	
	Inter-Armoring	PE	MBIAPE1015-C	10786649	9/16/15 9:15	10/6/15 15:20	29165	20.25	18.76
			MBIAPE1015-C-Dup	10582693	9/16/15 9:15	10/6/15 15:20	29165	20.25	18.81
		DGT	MBIADGT1015-C	10786649	9/16/15 9:15	10/6/15 15:20	29165	20.25	18.76
			MBIADGT1015-C-Dup	10582693	9/16/15 9:15	10/6/15 15:20	29165	20.25	18.81
D	Surface Water	PE	MBSWPE1015-D	10582692	9/15/15 10:52	10/6/15 13:54	30422	21.13	18.92
		DGT	MBSWDGT1015-D	10582692	9/15/15 10:52	10/6/15 13:54	30422	21.13	18.92
	Inter-Armoring	PE	MBIAPE1015-D	10786652	9/15/15 10:52	10/6/15 13:54	30422	21.13	19.23
		DGT	MBIADGT1015-D	10786652	9/15/15 10:52	10/6/15 13:54	30422	21.13	19.23
E	Surface Water	PE	MBSWPE1015-E	10582687	9/15/15 10:24	10/6/15 13:42	30438	21.14	18.94
		PE	*MBSWPE1015-E-Dup*	10582687	9/15/15 10:24	10/6/15 13:42	30438	21.14	18.94
		DGT	MBSWDGT1015-E		9/15/15 10:24	10/6/15 13:42	30438	21.14	18.94
		DGT	*MBSWDGT1015-E-Dup*		9/15/15 10:24	10/6/15 13:42	30438	21.14	18.94
	Inter-Armoring	PE	MBIAPE1015-E	10786659	9/15/15 10:24	10/6/15 13:42	30438	21.14	19.06
		DGT	MBIADGT1015-E	10786659	9/15/15 10:24	10/6/15 13:42	30438	21.14	19.06
F	Surface Water	PE	MBSWPE1015-F	9779961	9/15/15 14:45	10/6/15 14:45	30240	21.00	18.89
		DGT	MBSWDGT1015-F	9779961	9/15/15 14:45	10/6/15 14:45	30240	21.00	18.89
G	Surface Water	PE	MBSWPE1015-G		9/15/15 12:23	10/6/15 13:02	30279	21.03	
		DGT	MBSWDGT1015-G		9/15/15 12:23	10/6/15 13:02	30279	21.03	
	Inter-Armoring	PE	MBIAPE1015-G	10582685	9/15/15 12:23	10/6/15 13:02	30279	21.03	19.05
		DGT	MBIADGT1015-G	10582685	9/15/15 12:23	10/6/15 13:02	30279	21.03	19.05
H	Surface Water	PE	MBSWPE1015-H	9779938	9/15/15 11:25	10/6/15 13:25	30360	21.08	18.97
		DGT	MBSWDGT1015-H	9779938	9/15/15 11:25	10/6/15 13:25	30360	21.08	18.97
	Inter-Armoring	PE	MBIAPE1015-H	10786654	9/15/15 11:25	10/6/15 13:25	30360	21.08	19.09
		DGT	MBIADGT1015-H	10786654	9/15/15 11:25	10/6/15 13:25	30360	21.08	19.09
I	Surface Water	PE	MBSWPE1015-I	10786657	9/15/15 13:22	10/6/15 12:15	30173	20.95	18.89
		DGT	MBSWDGT1015-I	10786657	9/15/15 13:22	10/6/15 12:15	30173	20.95	18.89
	Inter-Armoring	PE	MBIAPE1015-I	9779954	9/15/15 13:22	10/6/15 12:15	30173	20.95	19.08
		DGT	MBIADGT1015-I	9779954	9/15/15 13:22	10/6/15 12:15	30173	20.95	19.08
J	Surface Water	PE	MBSWPE1015-J		9/15/15 13:51	10/6/15 11:10	30079	20.89	
		DGT	MBSWDGT1015-J		9/15/15 13:51	10/6/15 11:10	30079	20.89	
	Inter-Armoring	PE	MBIAPE1015-J	9767261	9/15/15 13:51	10/6/15 11:10	30079	20.89	18.95
		DGT	MBIADGT1015-J	9767261	9/15/15 13:51	10/6/15 11:10	30079	20.89	18.95
K	Surface Water	PE	MBSWPE1015-K	10582691	9/15/15 14:22	10/6/15 11:40	30078	20.89	18.92
		DGT	MBSWDGT1015-K	10582691	9/15/15 14:22	10/6/15 11:40	30078	20.89	18.92
	Inter-Armoring	PE	MBIAPE1015-K	10786655	9/15/15 14:22	10/6/15 11:40	30078	20.89	18.75
		DGT	MBIADGT1015-K	10786655	9/15/15 14:22	10/6/15 11:40	30078	20.89	18.75
L	Surface Water	PE	MBSWPE1015-L		9/16/15 9:45	10/6/15 15:20	29135	20.23	
		DGT	MBSWDGT1015-L		9/16/15 9:45	10/6/15 15:20	29135	20.23	
	Inter-Armoring	PE	MBIAPE1015-L	10786650	9/16/15 9:45	10/6/15 15:20	29135	20.23	19.21
		DGT	MBIADGT1015-L	10786650	9/16/15 9:45	10/6/15 15:20	29135	20.23	19.21
Early Warning									
5	Surface Water	PE	MBSWPE1015-5		9/15/15 16:12	10/6/15 9:00	29808	20.70	
	Inter-Armoring	PE	MBIAPE1015-5	9779948	9/15/15 16:12	10/6/15 9:00	29808	20.70	19.06
	Sub-Armoring	PE	MBSAPE1015-5	10786658	9/15/15 16:12	10/6/15 9:00	29808	20.70	19.25
12	Surface Water	PE	MBSWPE1015-12	10786653	9/15/15 14:15	10/6/15 9:38	29963	20.81	19.09
	Inter-Armoring	PE	MBIAPE1015-12		9/15/15 14:15	10/6/15 9:38	29963	20.81	
	Sub-Armoring	PE	MBSAPE1015-12	10786648	9/15/15 14:15	10/6/15 9:38	29963	20.81	18.69
13	Inter-Armoring	PE	MBIAPE1015-13	10786651	9/15/15 13:30	10/6/15 10:06	30036	20.86	19.06
	Sub-Armoring	PE	MBSAPE1015-13		9/15/15 13:30	10/6/15 10:06	30036	20.86	
16	Surface Water	PE	MBSWPE1015-16		9/16/15 10:14	10/6/15 10:52	28838	20.03	
	Inter-Armoring	PE	MBIAPE1015-16		9/16/15 10:14	10/6/15 10:52	28838	20.03	
	Sub-Armoring	PE	MBSAPE1015-16	10786656	9/16/15 10:14	10/6/15 10:52	28838	20.03	18.96
Background									
1 (Upstream)	Surface Water	PE	MBSWPE1015-1		9/15/15 15:23	10/6/15 9:45	29902	20.77	
		DGT	MBSWDGT1015-1		9/15/15 15:23	10/6/15 9:45	29902	20.77	
27 (Downstream)	Surface Water	PE	MBSWPE1015-27		9/16/15 10:40	10/6/15 10:00	28760	19.97	
		DGT	MBSWDGT1015-27		9/16/15 10:40	10/6/15 10:00	28760	19.97	

Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		Location A	Location B		Location C			Location D	
SAMPLE TYPE		Surface Water	Surface Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water
Sample ID		MBSW1015-A	MBSW1015-B	MBIA1015-B	MBSW1015-C	MBIA1015-C	MBIA1015-C-Dup	MBSW1015-D	MBIA1015-D
Deployment Date Time		9/15/15 16:12	9/15/15 15:33	9/15/15 15:33	9/16/15 9:15	9/16/15 9:15	9/16/15 9:15	9/15/15 10:52	9/15/15 10:52
Sample Date Time		10/6/15 8:38	10/6/15 8:20	10/6/15 8:20	10/6/15 15:20	10/6/15 15:20	10/6/15 15:20	10/6/15 13:54	10/6/15 13:54
CONTAMINANT OF INTEREST									
Dissolved Metals (mg/L)									
Arsenic		0.0010	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	NR
Chromium		NR	BLOQ	NR	BLOQ	0.00053	0.000079	BLOQ	NR
Copper		NR	0.00011	NR	0.00011	0.0051	0.0010	0.00019	NR
Zinc		NR	0.0026 B	NR	BLOQ B	0.0075 B	0.011 B	0.00016 B	NR
Pentachlorophenol (ug/L)		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Polyaromatic Hydrocarbons (ug/L)									
Naphthalene	PP	BLOQ B	0.00052 B	0.0030 B	0.074 B	0.0083 B	0.0077 B	0.00019 B	BLOQ B
2-Methylnaphthalene		0.000090 B	0.00069 B	0.0024 B	0.014 B	0.0013 B	0.0014 B	0.00032 B	BLOQ B
1-Methylnaphthalene		0.00029 B	0.0021 B	0.013 B	0.013 B	0.0013 B	0.0014 B	0.00029 B	0.000028 B
2-Ethylnaphthalene		0.000018 B	0.000089 B	0.00062 B	0.00056 B	0.000078 B	0.000099 B	0.000026 B	0.000029 B
2,6-Dimethylnaphthalene		0.00043 B	0.0032 B	0.25 B	0.0029 B	0.00043 B	0.00040 B	0.00027 B	0.00014 B
1,6-dimethylNaphthalene		0.0014 B	0.0057 B	0.34 B	0.0036 B	0.00054 B	0.00051 B	0.00036 B	0.00013 B
1,4-dimethylnaphthalene		0.00053	0.0017	0.070	0.00072	0.00012	0.00011	0.000085	BLOQ
1,5-dimethylnaphthalene		0.00066	0.0018	0.074	0.00074	0.00012	0.00011	0.00011	BLOQ
1,2-dimethylnaphthalene		0.00059 B	0.0021 B	0.11 B	0.00081 B	0.00014 B	0.00012 B	0.000092 B	0.000061 B
1,8-Dimethylnaphthalene		BLOQ	0.00012	0.0043	0.000047	BLOD	BLOQ	BLOD	BLOD
2,6-Diethylnaphthalene		0.000075	0.00022	0.0027	0.000082	BLOQ	BLOD	0.000066	BLOD
Acenaphthylene	PP	0.00024	0.0010	0.012	0.00046	BLOQ	BLOQ	BLOQ	BLOD
Acenaphthene	PP	0.025 B	0.10 B	5.6 B	0.041 B	0.0079 B	0.0076 B	0.0036 B	0.0031 B
Fluorene	PP	0.0079 B	0.040 B	1.9 B	0.015 B	0.0026 B	0.0025 B	0.0012 B	0.00044 B
Dibenzothiophene		0.00014	0.0011	0.092	0.00037	0.000079	0.000066	0.000084	0.000066
Phenanthrene	RPF 0, PP	0.0010 B	0.0037 B	0.6 B	0.0031 B	0.00074 B	0.00061 B	0.00086 B	0.00063 B
Anthracene	RPF 0, PP	0.00031	0.0012	0.057	0.00061	0.000064	0.000060	0.00023	0.000087
2-Methylphenanthrene		0.00015	0.00025	0.0096	0.00018	0.00016	0.00012	0.00016	0.00017
2-Methylanthracene		0.000052	0.000092	0.0014	0.000052	BLOD	BLOD	0.000059	BLOD
1-Methylphenanthrene		0.00015	0.00026	0.0055	0.00014	0.00012	0.000085	0.00015	0.00012
9-Methylanthracene		0.000038	0.000031	0.00015	0.000029	BLOD	BLOD	0.000033	BLOD
3,6-Dimethylphenanthrene		0.000078	0.00011	0.00033	0.000066	BLOQ	BLOD	0.000081	BLOQ
Fluoranthene	RPF 0.08, PP	0.0021	0.0034	0.034	0.0023	0.00020	0.00018	0.0024	0.00036
2,3-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
9,10-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Pyrene	RPF 0, PP	0.0014	0.0024	0.012	0.0017	0.00014	0.00013	0.0020	0.00028
Retene	PP	0.00056	0.00058	0.000088	0.00045	0.000030	0.000023	0.0010	0.00011
Benzo(a)fluorene		0.00015	0.00019	0.00018	0.00014	BLOD	BLOD	0.00017	BLOQ
Benzo(b)fluorene		0.000082	0.00010	0.00022	0.000075	BLOD	BLOD	0.000091	BLOQ
Benzo(c)fluorene	RPF 20	0.000071	0.000083	0.000072	0.000060	BLOQ	BLOQ	0.000086	BLOQ

See table 4 for MQL based on IQL
BLOD = Below limit of detection
BLOQ = Below limit of quatitation
NR = Not reported
CDNRT = Client did not request test
B = Blank subtracted
PP = EPA 16 Priority Pollutant
RPF = Relative Potentecy Factor

Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		**Location A**	**Location B**		**Location C**			**Location D**	
SAMPLE TYPE		**Surface Water**	**Surface Water**	**Inter-Armoring Water**	**Surface Water**	**Inter-Armoring Water**	**Inter-Armoring Water**	**Surface Water**	**Inter-Armoring Water**
Sample ID		MBSW1015-A	MBSW1015-B	MBIA1015-B	MBSW1015-C	MBIA1015-C	MBIA1015-C-Dup	MBSW1015-D	MBIA1015-D
Deployment Date Time		9/15/15 16:12	9/15/15 15:33	9/15/15 15:33	9/16/15 9:15	9/16/15 9:15	9/16/15 9:15	9/15/15 10:52	9/15/15 10:52
Sample Date Time		10/6/15 8:38	10/6/15 8:20	10/6/15 8:20	10/6/15 15:20	10/6/15 15:20	10/6/15 15:20	10/6/15 13:54	10/6/15 13:54
CONTAMINANT OF INTEREST									
Polyaromatic Hydrocarbons (ug/L)									
1-Methylpyrene		0.000056	0.000070	0.000049	0.000047	BLOD	BLOD	0.000067	BLOD
Benzo(a)anthracene	RPF 0.2, PP	0.00017	0.00019	0.00010	0.00014	BLOQ	BLOQ	0.00019	BLOQ
Cyclopenta(cd)pyrene	RPF 0.4	0.000018	0.000018	BLOD	0.000012	BLOD	BLOD	0.000028	BLOD
Triphenylene		0.00012	0.00015	0.000094	0.00010	BLOQ	BLOQ	0.00012	BLOQ
Chrysene	RPF 0.1, PP	0.00021	0.00023	0.00013	0.00017	BLOQ	BLOQ	0.00022	0.000017
6-Methyl chrysene		0.000029	0.000029	BLOQ	0.000020	BLOD	BLOD	0.000026	BLOD
5-Methylchrysene		BLOQ	0.000024	BLOQ	BLOQ	BLOD	BLOD	0.000025	BLOD
Benzo (b) fluoranthene	RPF 0.8, PP	0.000093	0.00011	0.000066	0.000066	BLOQ	BLOQ	0.000077	0.000013
7,12-Dimethylbenz(a)anthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (k) fluoranthene	RPF 0.03	0.000042	0.000046	0.000028	0.000030	BLOD	BLOD	0.000036	BLOQ
Benzo (j) fluoranthene	RPF 0.3	0.000043	0.000048	0.000030	0.000031	BLOD	BLOD	0.000034	BLOQ
Benzo (e) pyrene		0.000074	0.000082	0.000055	0.000052	BLOD	BLOQ	0.000067	BLOQ
Benzo (a) pyrene	PP	BLOQ	0.000032	BLOQ	BLOQ	BLOD	BLOD	0.000038	BLOD
Indeno (1,2,3-c,d) pyrene	RPF 0.07, PP	0.000025	0.000020	BLOD	0.000015	BLOD	BLOD	0.000021	BLOD
Dibenzo (a,h) anthracene	PP	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (a) chrysene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (g,h,i) perylene	RPF 0.009, PP	0.000034	0.000028	0.000015	0.000022	BLOD	BLOD	0.000030	BLOD
Anthanthrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(1,2-b)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-j)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) fluoranthene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,l) pyrene	RPF 30	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-k)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-e)pyrene	RPF 0.3	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) pyrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Coronene		BLOD	BLOQ	BLOD	BLOD	BLOD	BLOD	BLOQ	BLOD
Dibenzo(e,l)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-a)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (b) perylene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,i) pyrene	RPF 0.6	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,h) pyrene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Σ61 PAHs (ug/L)		0.044	0.17	9.2	0.18	0.024	0.023	0.015	0.0058
Σ16 PP PAHs (ug/L)		0.039	0.15	8.2	0.14	0.020	0.019	0.012	0.0050
Σcarcinogenic PAHs (BAPeq ug/L)		0.0017	0.0021	0.0043	0.0015	0.000016	0.000014	0.0021	0.000041

See table 4 for MQL based on IQL
BLOD = Below limit of detection
BLOQ = Below limit of quatitation
NR = Not reported
CDNRT = Client did not request test
B = Blank subtracted
PP = EPA 16 Priority Pollutant
RPF = Relative Potentecy Factor

Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		Location E			Location 13-SW	Location G		Location H	
SAMPLE TYPE		**Surface Water**	**Surface Water**	**Inter-Armoring Water**	**Surface Water**	**Surface Water**	**Inter-Armoring Water**	**Surface Water**	**Inter-Armoring Water**
Sample ID		MBSW1015-E	MBSW1015-E-Dup	MBIA1015-E	MBSW1015-F	MBSW1015-G	MBIA1015-G	MBSW1015-H	MBIA1015-H
Deployment Date Time		9/15/15 10:24	9/15/15 10:24	9/15/15 10:24	9/15/15 14:45	9/15/15 12:23	9/15/15 12:23	9/15/15 11:25	9/15/15 11:25
Sample Date Time		10/6/15 13:42	10/6/15 13:42	10/6/15 13:42	10/6/15 10:03	10/6/15 13:02	10/6/15 13:02	10/6/15 13:25	10/6/15 13:25
CONTAMINANT OF INTEREST									
Dissolved Metals (mg/L)									
Arsenic		BLOD	BLOD	NR	BLOD	BLOD	NR	BLOD	BLOD
Chromium		BLOQ	BLOQ	NR	BLOQ	BLOQ	NR	BLOQ	NR
Copper		0.00016	0.00016	NR	0.00016	0.00015	NR	0.00015	NR
Zinc		0.00043 B	0.00038 B	NR	0.0020 B	0.00045 B	NR	BLOQ B	NR
Pentachlorophenol (ug/L)		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Polyaromatic Hydrocarbons (ug/L)									
Naphthalene	PP	BLOQ B	0.00041 B	BLOD B	0.00088 B	0.00051 B	BLOQ B	0.00061 B	BLOQ B
2-Methylnaphthalene		0.00018 B	0.00014 B	0.000030 B	0.000066 B	0.00027 B	BLOQ B	0.00020 B	BLOQ B
1-Methylnaphthalene		0.00021 B	0.00017 B	0.00040 B	0.00038 B	0.00019 B	BLOQ B	0.00019 B	BLOQ B
2-Ethylnaphthalene		BLOQ B	BLOQ B	BLOD B	0.000052 B	BLOQ B	BLOQ B	BLOQ B	BLOQ B
2,6-Dimethylnaphthalene		0.00020 B	0.00016 B	0.0045 B	0.00035 B	0.00016 B	0.000092 B	0.00018 B	0.000080 B
1,6-dimethylNaphthalene		0.00030 B	0.00022 B	0.0091 B	0.00077 B	0.00019 B	0.000069 B	0.00023 B	0.000055 B
1,4-dimethylnaphthalene		BLOQ	BLOQ	BLOQ	0.00021	BLOQ	BLOD	BLOQ	BLOD
1,5-dimethylnaphthalene		BLOQ	BLOQ	BLOQ	0.00025	BLOQ	BLOD	BLOQ	BLOD
1,2-dimethylnaphthalene		BLOQ B	BLOQ B	0.0077 B	0.00024 B	BLOQ B	BLOQ B	BLOQ B	BLOQ B
1,8-Dimethylnaphthalene		BLOD	BLOD	BLOD	BLOQ	BLOD	BLOD	BLOD	BLOD
2,6-Diethylnaphthalene		BLOD	BLOD	BLOD	BLOD	BLOQ	BLOD	BLOQ	BLOD
Acenaphthylene	PP	BLOQ	BLOQ	BLOQ	0.00024	BLOQ	BLOD	BLOQ	BLOD
Acenaphthene	PP	0.0026 B	0.0027 B	0.37 B	0.0094 B	0.00096 B	0.00029 B	0.0022 B	0.00029 B
Fluorene	PP	0.00082 B	0.00077 B	0.0051 B	0.0033 B	0.00048 B	0.00025 B	0.00079 B	0.00026 B
Dibenzothiophene		0.000050	0.000039	0.000039	0.000096	0.000039	0.000044	0.000038	0.000040
Phenanthrene	RPF 0, PP	0.00060 B	0.00042 B	0.00065 B	0.00082 B	0.00048 B	0.00032 B	0.00047 B	0.00034 B
Anthracene	RPF 0, PP	0.00018	0.00013	0.00013	0.00024	0.00018	BLOQ	0.00017	BLOQ
2-Methylphenanthrene		0.00013	0.00013	0.00012	0.00010	0.00012	0.00012	0.00013	0.00018
2-Methylanthracene		0.000051	0.000053	0.000050	0.000036	0.000054	BLOD	0.000054	BLOQ
1-Methylphenanthrene		0.00011	0.00011	0.00032	0.000094	0.00011	BLOQ	0.00011	BLOQ
9-Methylanthracene		BLOQ	BLOQ	BLOQ	0.000015	BLOQ	BLOD	BLOQ	BLOD
3,6-Dimethylphenanthrene		0.000057	0.000066	0.000045	0.000032	0.000086	BLOQ	0.000078	BLOQ
Fluoranthene	RPF 0.08, PP	0.0018	0.0017	0.0034	0.0014	0.0017	0.00032	0.0016	0.00056
2,3-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
9,10-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Pyrene	RPF 0, PP	0.0014	0.0013	0.0014	0.0011	0.0013	0.00024	0.0013	0.00042
Retene	PP	0.00048	0.00053	0.000064	0.00017	0.00071	0.000062	0.00062	BLOQ
Benzo(a)fluorene		0.00012	0.00013	BLOQ	0.000058	0.00017	BLOQ	0.00015	BLOQ
Benzo(b)fluorene		0.000062	0.000072	BLOQ	0.000027	0.000098	BLOQ	0.000079	BLOQ
Benzo(c)fluorene	RPF 20	0.000070	0.000064	BLOQ	0.000045	0.000068	BLOQ	0.000067	BLOQ

See table 4 for MQL based on IQL
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PP = EPA 16 Priority Pollutant
RPF = Relative Potentecy Factor

Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		Location E			Location 13-SW	Location G		Location H	
SAMPLE TYPE		**Surface Water**	**Surface Water**	**Inter-Armoring Water**	**Surface Water**	**Surface Water**	**Inter-Armoring Water**	**Surface Water**	**Inter-Armoring Water**
Sample ID		MBSW1015-E	MBSW1015-E-Dup	MBIA1015-E	MBSW1015-F	MBSW1015-G	MBIA1015-G	MBSW1015-H	MBIA1015-H
Deployment Date Time		9/15/15 10:24	9/15/15 10:24	9/15/15 10:24	9/15/15 14:45	9/15/15 12:23	9/15/15 12:23	9/15/15 11:25	9/15/15 11:25
Sample Date Time		10/6/15 13:42	10/6/15 13:42	10/6/15 13:42	10/6/15 10:03	10/6/15 13:02	10/6/15 13:02	10/6/15 13:25	10/6/15 13:25
CONTAMINANT OF INTEREST									
Polyaromatic Hydrocarbons (ug/L)									
1-Methylpyrene		0.000043	0.000047	BLOQ	0.000022	0.000068	BLOQ	0.000056	BLOQ
Benzo(a)anthracene	RPF 0.2, PP	0.00012	0.00013	BLOQ	0.000060	0.00020	BLOQ	0.00016	BLOQ
Cyclopenta(cd)pyrene	RPF 0.4	0.000021	0.000023	BLOD	0.0000082	0.000033	BLOD	0.000029	BLOD
Triphenylene		0.000075	0.000082	BLOQ	0.000045	0.00011	BLOQ	0.00010	BLOQ
Chrysene	RPF 0.1, PP	0.00014	0.00015	BLOQ	0.000076	0.00022	BLOQ	0.00018	BLOQ
6-Methyl chrysene		BLOQ	BLOQ	BLOD	0.0000082	BLOQ	BLOD	BLOQ	BLOD
5-Methylchrysene		BLOQ	BLOQ	BLOD	0.0000079	BLOQ	BLOD	BLOQ	BLOD
Benzo (b) fluoranthene	RPF 0.8, PP	0.000051	0.000052	BLOQ	0.000030	0.000076	BLOQ	0.000061	BLOQ
7,12-Dimethylbenz(a)anthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (k) fluoranthene	RPF 0.03	0.000026	0.000027	BLOQ	0.000013	0.000040	BLOQ	0.000031	BLOQ
Benzo (j) fluoranthene	RPF 0.3	0.000021	BLOQ	BLOD	0.000013	BLOQ	BLOD	0.000026	BLOD
Benzo (e) pyrene		0.000043	0.000045	BLOD	0.000022	0.000069	BLOQ	0.000055	BLOQ
Benzo (a) pyrene	PP	BLOQ	BLOQ	BLOD	0.000012	BLOQ	BLOD	BLOQ	BLOD
Indeno (1,2,3-c,d) pyrene	RPF 0.07, PP	0.000017	0.000020	BLOD	0.0000063	0.000028	BLOD	0.000019	BLOD
Dibenzo (a,h) anthracene	PP	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (a) chrysene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (g,h,i) perylene	RPF 0.009, PP	0.000022	0.000026	BLOD	0.0000083	0.000037	BLOD	0.000027	BLOD
Anthanthrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(1,2-b)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-j)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) fluoranthene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,l) pyrene	RPF 30	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-k)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-e)pyrene	RPF 0.3	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) pyrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Coronene		BLOD	BLOD	BLOD	BLOQ	BLOD	BLOD	BLOD	BLOD
Dibenzo(e,l)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-a)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (b) perylene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,i) pyrene	RPF 0.6	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,h) pyrene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Σ61 PAHs (ug/L)		0.010	0.0099	0.011	0.020	0.0088	0.0018	0.010	0.0022
Σ16 PP PAHs (ug/L)		0.0082	0.0083	0.0093	0.017	0.0069	0.0015	0.0082	0.0019
Σcarcinogenic PAHs (BAPeq ug/L)		0.0016	0.0015	0.00027	0.0011	0.0016	0.000026	0.0016	0.000045

See table 4 for MQL based on IQL
BLOD = Below limit of detection
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RPF = Relative Potentecy Factor

Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		Location I		Location J		Location K		Location L	
SAMPLE TYPE		Surface Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water	Surface Water	Inter-Armoring Water
Sample ID		MBSW1015-I	MBIA1015-I	MBSW1015-J	MBIA1015-J	MBSW1015-K	MBIA1015-K	MBSW1015-L	MBIA1015-L
Deployment Date Time		9/15/15 13:22	9/15/15 13:22	9/15/15 13:51	9/15/15 13:51	9/15/15 14:22	9/15/15 14:22	9/16/15 9:45	9/16/15 9:45
Sample Date Time		10/6/15 12:15	10/6/15 12:15	10/6/15 11:10	10/6/15 11:10	10/6/15 11:40	10/6/15 11:40	10/6/15 15:20	10/6/15 15:20
CONTAMINANT OF INTEREST									
Dissolved Metals (mg/L)									
Arsenic		BLOQ	0.00096	BLOQ	BLOD	BLOD	NR	BLOD	NR
Chromium		BLOQ	NR	BLOQ	BLOQ	BLOQ	0.00059	BLOQ	NR
Copper		0.00014	NR	0.00013	0.00031	0.00014	0.00021	0.00012	NR
Zinc		0.0038 B	NR	0.00010 B	0.00036 B	0.0025 B	0.0024 B	0.000049 B	NR
Pentachlorophenol (ug/L)		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Polyaromatic Hydrocarbons (ug/L)									
Naphthalene	PP	BLOQ B	BLOQ B	0.00013 B	BLOQ B	BLOQ B	BLOQ B	0.0043 B	BLOQ B
2-Methylnaphthalene		BLOQ B	0.00019 B	0.000012 B	BLOQ B	BLOQ B	BLOQ B	0.0018 B	BLOQ B
1-Methylnaphthalene		BLOQ B	0.00016 B	0.00010 B	BLOQ B	0.000096 B	BLOQ B	0.0017 B	BLOQ B
2-Ethylnaphthalene		BLOQ B	BLOQ B	0.000029 B	BLOQ B	0.000018 B	0.000029 B	0.000075 B	BLOQ B
2,6-Dimethylnaphthalene		0.00011 B	0.00021 B	0.00018 B	0.000031 B	0.00018 B	0.00019 B	0.00049 B	0.00011 B
1,6-dimethylNaphthalene		0.00012 B	0.00023 B	0.00023 B	0.000016 B	0.00020 B	0.00013 B	0.00065 B	0.00013 B
1,4-dimethylnaphthalene		BLOQ	BLOQ	BLOQ	BLOQ	BLOQ	BLOQ	0.00015	BLOQ
1,5-dimethylnaphthalene		BLOQ	BLOQ	0.000057	BLOQ	BLOQ	BLOQ	0.00016	BLOQ
1,2-dimethylnaphthalene		BLOQ B	BLOQ B	0.000039 B	BLOQ B	0.000046 B	BLOQ B	0.00016 B	BLOQ B
1,8-Dimethylnaphthalene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
2,6-Diethylnaphthalene		BLOQ	BLOD	0.000073	BLOD	0.000070	BLOD	0.000059	BLOD
Acenaphthylene	PP	BLOQ	BLOD	BLOQ	BLOD	BLOQ	BLOQ	BLOQ	BLOQ
Acenaphthene	PP	0.00088 B	0.0033 B	0.0011 B	BLOQ B	0.0012 B	0.0018 B	0.0072 B	0.00012 B
Fluorene	PP	0.00041 B	0.0011 B	0.00065 B	0.000098 B	0.00056 B	0.00031 B	0.0027 B	0.00036 B
Dibenzothiophene		0.000036	0.000094	0.000050	0.000019	0.000048	0.000046	0.00012	0.000069
Phenanthrene	RPF 0, PP	0.00043 B	0.00094 B	0.00066 B	0.000082 B	0.00066 B	0.00024 B	0.0014 B	0.00043 B
Anthracene	RPF 0, PP	0.00018	0.00022	0.00022	BLOQ	0.00020	0.000085	0.00030	0.00028
2-Methylphenanthrene		0.00011	0.00016	0.00018	0.000058	0.00017	0.000067	0.00019	0.00019
2-Methylanthracene		0.000043	BLOQ	0.000080	BLOD	0.000072	BLOQ	0.000058	BLOQ
1-Methylphenanthrene		0.00010	0.00012	0.00016	BLOQ	0.00015	BLOQ	0.00016	0.00016
9-Methylanthracene		BLOQ	BLOQ	0.000039	BLOD	0.000034	BLOD	0.000036	BLOQ
3,6-Dimethylphenanthrene		0.00006	BLOQ	0.00017	BLOQ	0.00014	BLOQ	0.00012	0.000016
Fluoranthene	RPF 0.08, PP	0.0014	0.0010	0.0024	0.00029	0.0022	0.00031	0.0024	0.00075
2,3-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
9,10-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Pyrene	RPF 0, PP	0.0011	0.00074	0.0018	0.00019	0.0016	0.00024	0.0016	0.0021
Retene	PP	0.00052	0.00033	0.0013	0.000058	0.0011	0.000056	0.00094	0.000070
Benzo(a)fluorene		0.00012	0.000061	0.00029	BLOQ	0.00024	BLOQ	0.00023	0.000048
Benzo(b)fluorene		0.000066	BLOQ	0.00015	BLOQ	0.00013	BLOQ	0.00012	0.000045
Benzo(c)fluorene	RPF 20	0.000059	0.000044	0.000085	BLOQ	0.000080	BLOQ	0.000080	0.000081

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RPF = Relative Potentecy Factor

Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		Location I		Location J		Location K		Location L	
SAMPLE TYPE		**Surface Water**	**Inter-Armoring Water**	**Surface Water**	**Inter-Armoring Water**	**Surface Water**	**Inter-Armoring Water**	**Surface Water**	**Inter-Armoring Water**
Sample ID		MBSW1015-I	MBIA1015-I	MBSW1015-J	MBIA1015-J	MBSW1015-K	MBIA1015-K	MBSW1015-L	MBIA1015-L
Deployment Date Time		9/15/15 13:22	9/15/15 13:22	9/15/15 13:51	9/15/15 13:51	9/15/15 14:22	9/15/15 14:22	9/16/15 9:45	9/16/15 9:45
Sample Date Time		10/6/15 12:15	10/6/15 12:15	10/6/15 11:10	10/6/15 11:10	10/6/15 11:40	10/6/15 11:40	10/6/15 15:20	10/6/15 15:20
CONTAMINANT OF INTEREST									
Polyaromatic Hydrocarbons (ug/L)									
1-Methylpyrene		0.000048	0.000023	0.00010	BLOQ	0.000087	BLOQ	0.000080	0.000034
Benzo(a)anthracene	RPF 0.2, PP	0.00013	0.000055	0.00032	BLOD	0.00025	BLOQ	0.00026	0.000054
Cyclopenta(cd)pyrene	RPF 0.4	0.000022	BLOD	0.000046	BLOD	0.000038	BLOD	0.000028	BLOD
Triphenylene		0.000084	0.000031	0.00019	BLOQ	0.00016	BLOQ	0.00016	0.000068
Chrysene	RPF 0.1, PP	0.00015	0.000066	0.00034	BLOQ	0.00028	BLOQ	0.00031	0.000041
6-Methyl chrysene		BLOQ	BLOQ	0.000042	BLOD	BLOQ	BLOD	0.000036	BLOQ
5-Methylchrysene		BLOQ	BLOQ	0.000060	BLOQ	0.000053	BLOQ	0.000052	BLOQ
Benzo (b) fluoranthene	RPF 0.8, PP	0.000059	0.000033	0.00011	BLOQ	0.000091	BLOQ	0.00012	0.000039
7,12-Dimethylbenz(a)anthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (k) fluoranthene	RPF 0.03	0.000029	BLOQ	0.000054	BLOD	0.000043	BLOQ	0.000051	BLOQ
Benzo (j) fluoranthene	RPF 0.3	0.000026	BLOQ	0.000056	BLOD	0.000040	BLOD	0.000053	BLOQ
Benzo (e) pyrene		0.000051	BLOQ	0.00010	BLOQ	0.000081	BLOD	0.000097	BLOQ
Benzo (a) pyrene	PP	BLOQ	BLOQ	0.000049	BLOD	BLOQ	BLOD	0.000046	BLOQ
Indeno (1,2,3-c,d) pyrene	RPF 0.07, PP	0.000020	0.000019	0.000029	BLOD	0.000024	BLOD	0.000027	BLOD
Dibenzo (a,h) anthracene	PP	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (a) chrysene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (g,h,i) perylene	RPF 0.009, PP	0.000028	0.000024	0.000044	BLOD	0.000036	BLOD	0.000039	BLOQ
Anthanthrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(1,2-b)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-j)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) fluoranthene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,l) pyrene	RPF 30	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-k)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-e)pyrene	RPF 0.3	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) pyrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Coronene		BLOD	BLOD	BLOQ	BLOD	BLOQ	BLOD	BLOQ	BLOD
Dibenzo(e,l)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-a)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (b) perylene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,i) pyrene	RPF 0.6	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,h) pyrene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Σ61 PAHs (ug/L)		0.0064	0.0091	0.012	0.00084	0.010	0.0035	0.029	0.0052
Σ16 PP PAHs (ug/L)		0.0053	0.0078	0.0092	0.00072	0.0082	0.0030	0.022	0.0042
Σcarcinogenic PAHs (BAPeq ug/L)		0.0014	0.0010	0.0021	0.000023	0.0020	0.000025	0.0020	0.0017

See table 4 for MQL based on IQL
BLOD = Below limit of detection
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Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		Location 5			Location 12-SW	Location 12		Location 13	
SAMPLE TYPE		**Surface Water**	**Inter-Armoring Water**	**Sub-Armoring Water**	**Surface Water**	**Inter-Armoring Water**	**Sub-Armoring Water**	**Inter-Armoring Water**	**Sub-Armoring Water**
Sample ID		MBSW1015-5	MBIA1015-5	MBSA1015-5	MBSW1015-12	MBIA1015-12	MBSA1015-12	MBIA1015-13	MBSA1015-13
Deployment Date Time		9/15/15 16:12	9/15/15 16:12	9/15/15 16:12	9/15/15 14:15	9/15/15 14:15	9/15/15 14:15	9/15/15 13:30	9/15/15 13:30
Sample Date Time		10/6/15 9:00	10/6/15 9:00	10/6/15 9:00	10/6/15 9:38	10/6/15 9:38	10/6/15 9:38	10/6/15 10:06	10/6/15 10:06
CONTAMINANT OF INTEREST									
Dissolved Metals (mg/L)									
Arsenic		CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT
Chromium		CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT
Copper		CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT
Zinc		CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT	CDNRT
Pentachlorophenol (ug/L)		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Polyaromatic Hydrocarbons (ug/L)									
Naphthalene	PP	0.026 B	0.00064 B	0.00082 B	0.00057 B	0.020 B	0.026 B	BLOQ B	BLOQ B
2-Methylnaphthalene		0.012 B	0.00032 B	0.00044 B	BLOQ B	0.0032 B	0.0021 B	0.000017 B	BLOQ B
1-Methylnaphthalene		0.012 B	0.00062 B	0.0019 B	0.0012 B	0.37 B	0.28 B	0.00037 B	0.00022 B
2-Ethylnaphthalene		0.00057 B	0.000050 B	0.00015 B	0.00037 B	0.018 B	0.012 B	0.00011 B	0.000028 B
2,6-Dimethylnaphthalene		0.0032 B	0.00024 B	0.0056 B	0.0035 B	0.10 B	0.036 B	0.00064 B	0.00024 B
1,6-dimethylNaphthalene		0.0041 B	0.00025 B	0.0072 B	0.0065 B	0.21 B	0.10 B	0.00092 B	0.00030 B
1,4-dimethylnaphthalene		0.00095	BLOQ	0.0041	0.0027	0.063	0.022	0.00019	BLOQ
1,5-dimethylnaphthalene		0.00094	BLOQ	0.0034	0.0025	0.070	0.026	0.00026	BLOQ
1,2-dimethylnaphthalene		0.0010 B	0.000088 B	0.0056 B	0.0028 B	0.096 B	0.038 B	0.00025 B	0.000091 B
1,8-Dimethylnaphthalene		0.000071	BLOD	0.00024	0.00017	0.0044	0.0018	BLOD	BLOD
2,6-Diethylnaphthalene		0.000083	BLOD	BLOQ	0.00012	0.00075	0.00031	BLOD	BLOD
Acenaphthylene	PP	0.00035	BLOQ	0.00062	0.0021	0.016	0.0060	BLOD	BLOD
Acenaphthene	PP	0.044 B	0.0031 B	0.45 B	0.16 B	6.0 B	2.7 B	0.0082 B	0.0031 B
Fluorene	PP	0.017 B	0.0013 B	0.027 B	0.040 B	0.63 B	0.12 B	0.0040 B	0.0011 B
Dibenzothiophene		0.00046	0.000071	0.00013	0.00024	0.0044	0.0014	0.00097	0.00032
Phenanthrene	RPF 0, PP	0.0041 B	0.00035 B	0.00084 B	0.00048 B	0.013 B	0.0077 B	0.012 B	0.0048 B
Anthracene	RPF 0, PP	0.00071	0.00013	0.00024	0.00046	0.0059	0.0017	0.00120	0.00068
2-Methylphenanthrene		0.00024	0.000083	0.00027	0.00013	0.00074	0.00073	0.00027	0.00036
2-Methylanthracene		0.00007	BLOQ	BLOQ	0.000090	0.00049	0.00019	0.000036	0.000052
1-Methylphenanthrene		0.00019	0.000071	0.00021	0.00019	0.0016	0.0011	0.00018	0.00020
9-Methylanthracene		0.00004	BLOQ	BLOQ	0.000027	0.000038	BLOD	BLOD	BLOD
3,6-Dimethylphenanthrene		0.00011	BLOQ	0.000032	0.000091	0.00013	0.000091	0.000018	0.000025
Fluoranthene	RPF 0.08, PP	0.0030	0.00055	0.00067	0.0022	0.0042	0.0015	0.00051	0.00063
2,3-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
9,10-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Pyrene	RPF 0, PP	0.0020	0.00037	0.00056	0.0026	0.0048	0.0024	0.00045	0.00052
Retene	PP	0.00080	0.00015	0.00032	0.00072	0.00071	0.0012	0.000028	0.000034
Benzo(a)fluorene		0.00024	0.000036	0.000071	0.00017	0.00017	0.00012	BLOQ	BLOQ
Benzo(b)fluorene		0.00013	BLOQ	BLOQ	0.00010	0.00013	0.000068	BLOQ	BLOQ
Benzo(c)fluorene	RPF 20	0.000077	0.000026	0.000040	0.000094	0.00010	0.000087	0.000017	0.000018

See table 4 for MQL based on IQL
BLOD = Below limit of detection
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NR = Not reported
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Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		Location 5			Location 12-SW	Location 12		Location 13	
SAMPLE TYPE		Surface Water	Inter-Armoring Water	Sub-Armoring Water	Surface Water	Inter-Armoring Water	Sub-Armoring Water	Inter-Armoring Water	Sub-Armoring Water
Sample ID		MBSW1015-5	MBIA1015-5	MBSA1015-5	MBSW1015-12	MBIA1015-12	MBSA1015-12	MBIA1015-13	MBSA1015-13
Deployment Date Time		9/15/15 16:12	9/15/15 16:12	9/15/15 16:12	9/15/15 14:15	9/15/15 14:15	9/15/15 14:15	9/15/15 13:30	9/15/15 13:30
Sample Date Time		10/6/15 9:00	10/6/15 9:00	10/6/15 9:00	10/6/15 9:38	10/6/15 9:38	10/6/15 9:38	10/6/15 10:06	10/6/15 10:06
CONTAMINANT OF INTEREST									
Polyaromatic Hydrocarbons (ug/L)									
1-Methylpyrene		0.000079	BLOQ	0.000030	0.000071	0.000053	0.000040	0.000010	0.000011
Benzo(a)anthracene	RPF 0.2, PP	0.00023	BLOQ	0.000062	0.00018	0.00012	0.00013	BLOQ	BLOQ
Cyclopenta(cd)pyrene	RPF 0.4	0.000026	BLOD	BLOD	0.000024	BLOD	BLOD	BLOD	BLOD
Triphenylene		0.00017	0.000018	0.000045	0.00013	0.000059	0.000048	BLOQ	BLOQ
Chrysene	RPF 0.1, PP	0.00028	0.000030	0.000071	0.00024	0.00016	0.00016	0.000016	0.000012
6-Methyl chrysene		BLOQ	BLOD	BLOD	0.000028	BLOQ	BLOQ	BLOD	BLOD
5-Methylchrysene		0.000056	BLOD	BLOQ	0.000026	BLOQ	BLOQ	BLOD	BLOD
Benzo (b) fluoranthene	RPF 0.8, PP	0.00012	0.000020	0.000053	0.000090	0.000041	0.000065	BLOQ	BLOQ
7,12-Dimethylbenz(a)anthracene		BLOD	BLOD	BLOD	BLOQ	BLOD	BLOD	BLOD	BLOD
Benzo (k) fluoranthene	RPF 0.03	0.000055	BLOQ	BLOQ	0.000040	0.000018	0.000027	BLOD	BLOD
Benzo (j) fluoranthene	RPF 0.3	0.000055	BLOQ	BLOQ	0.000040	0.000019	0.000030	BLOD	BLOD
Benzo (e) pyrene		0.00010	BLOQ	BLOQ	0.000074	0.000028	0.000044	BLOD	BLOQ
Benzo (a) pyrene	PP	BLOQ	BLOD	BLOQ	0.000039	BLOQ	0.000031	BLOD	BLOD
Indeno (1,2,3-c,d) pyrene	RPF 0.07, PP	0.000030	BLOD	BLOD	0.000021	BLOD	0.000012	BLOD	BLOD
Dibenzo (a,h) anthracene	PP	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (a) chrysene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (g,h,i) perylene	RPF 0.009, PP	0.000046	BLOQ	BLOQ	0.000032	0.0000092	0.000014	BLOD	BLOD
Anthanthrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(1,2-b)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-j)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) fluoranthene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,l) pyrene	RPF 30	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-k)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-e)pyrene	RPF 0.3	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) pyrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Coronene		BLOD	BLOD	BLOD	BLOQ	BLOD	BLOD	BLOD	BLOD
Dibenzo(e,l)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-a)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (b) perylene		BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,i) pyrene	RPF 0.6	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,h) pyrene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD	BLOD
Σ61 PAHs (ug/L)		0.14	0.0085	0.51	0.23	7.6	3.4	0.031	0.013
Σ16 PP PAHs (ug/L)		0.099	0.0066	0.48	0.21	6.7	2.9	0.026	0.011
Σcarcinogenic PAHs (BAPeq ug/L)		0.0020	0.00058	0.00092	0.0022	0.0023	0.0020	0.00038	0.00041

See table 4 for MQL based on IQL
BLOD = Below limit of detection
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Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		Location 16			Location 1	Location 27
SAMPLE TYPE		Surface Water	Inter-Armoring Water	Sub-Armoring Water	Surface Water	Surface Water
Sample ID		MBSW1015-16	MBIA1015-16	MBSA1015-16	MBSW1015-1	MBSW1015-27
Deployment Date Time		9/16/15 10:14	9/16/15 10:14	9/16/15 10:14	9/15/15 15:23	9/16/15 10:40
Sample Date Time		10/6/15 10:52	10/6/15 10:52	10/6/15 10:52	10/6/15 9:45	10/6/15 10:00
CONTAMINANT OF INTEREST						
Dissolved Metals (mg/L)						
Arsenic		CDNRT	CDNRT	CDNRT	0.00074	0.00077
Chromium		CDNRT	CDNRT	CDNRT	NR	BLOQ
Copper		CDNRT	CDNRT	CDNRT	NR	0.00016
Zinc		CDNRT	CDNRT	CDNRT	NR	0.010 B
Pentachlorophenol (ug/L)		BLOD	BLOD	BLOD	BLOD	BLOD
Polyaromatic Hydrocarbons (ug/L)						
Naphthalene	PP	BLOQ B	BLOQ B	BLOQ B	BLOQ B	BLOQ B
2-Methylnaphthalene		0.0000089 B	BLOQ B	0.00015 B	BLOQ B	BLOQ B
1-Methylnaphthalene		0.00013 B	0.00012 B	0.0010 B	0.000054 B	0.000019 B
2-Ethylnaphthalene		0.000016 B	0.000011 B	0.000046 B	BLOQ B	BLOQ B
2,6-Dimethylnaphthalene		0.00014 B	0.00024 B	0.0044 B	0.000097 B	0.000090 B
1,6-dimethylNaphthalene		0.00020 B	0.00022 B	0.0028 B	0.00013 B	0.00012 B
1,4-dimethylnaphthalene		BLOQ	0.00027	0.0054	BLOQ	BLOQ
1,5-dimethylnaphthalene		0.000051	0.00026	0.0054	BLOQ	BLOQ
1,2-dimethylnaphthalene		0.000043 B	0.00020 B	0.0046 B	BLOQ B	BLOQ B
1,8-Dimethylnaphthalene		BLOD	BLOQ	0.00043	BLOD	BLOD
2,6-Diethylnaphthalene		BLOD	BLOD	BLOD	BLOD	BLOD
Acenaphthylene	PP	BLOQ	BLOQ	0.00097	BLOQ	BLOQ
Acenaphthene	PP	0.0016 B	0.019 B	0.40 B	0.00080 B	0.00094 B
Fluorene	PP	0.00052 B	0.0032 B	0.067 B	0.00036 B	0.00038 B
Dibenzothiophene		0.000034	0.000024	0.00020	0.00003	0.000036
Phenanthrene	RPF 0, PP	0.00050 B	0.00014 B	0.00048 B	0.00042 B	0.00044 B
Anthracene	RPF 0, PP	0.00019	BLOQ	0.00052	0.00017	0.00022
2-Methylphenanthrene		0.00012	0.000041	0.000055	0.00011	0.00011
2-Methylanthracene		0.000056	BLOQ	BLOQ	0.000041	0.000049
1-Methylphenanthrene		0.00011	BLOQ	0.000045	0.00010	0.00010
9-Methylanthracene		0.000027	BLOD	BLOQ	BLOQ	BLOQ
3,6-Dimethylphenanthrene		0.000069	BLOD	BLOD	0.000046	0.000063
Fluoranthene	RPF 0.08, PP	0.0016	0.00021	0.00017	0.0014	0.0017
2,3-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD
9,10-Dimethylanthracene		BLOD	BLOD	BLOD	BLOD	BLOD
Pyrene	RPF 0, PP	0.0013	0.00014	0.00017	0.0011	0.0014
Retene	PP	0.00057	0.000044	0.000050	0.00047	0.00050
Benzo(a)fluorene		0.00011	BLOD	BLOD	0.000091	0.00013
Benzo(b)fluorene		0.000059	BLOQ	BLOQ	0.000050	0.000069
Benzo(c)fluorene	RPF 20	0.000065	BLOQ	0.000012	0.000057	0.000071

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Table 2
Surface, Inter-Armoring, and Sub Armoring Water Data: Fall 2015
McCormick Baxter Superfund Site

SAMPLE LOCATION		Location 16			Location 1	Location 27
SAMPLE TYPE		**Surface Water**	**Inter-Armoring Water**	**Sub-Armoring Water**	**Surface Water**	**Surface Water**
Sample ID		MBSW1015-16	MBIA1015-16	MBSA1015-16	MBSW1015-1	MBSW1015-27
Deployment Date Time		9/16/15 10:14	9/16/15 10:14	9/16/15 10:14	9/15/15 15:23	9/16/15 10:40
Sample Date Time		10/6/15 10:52	10/6/15 10:52	10/6/15 10:52	10/6/15 9:45	10/6/15 10:00
CONTAMINANT OF INTEREST						
Polyaromatic Hydrocarbons (ug/L)						
1-Methylpyrene		0.000045	BLOD	0.0000066	0.000035	0.000052
Benzo(a)anthracene	RPF 0.2, PP	0.00012	BLOQ	BLOQ	0.000087	0.00015
Cyclopenta(cd)pyrene	RPF 0.4	0.000018	BLOD	BLOD	BLOQ	BLOQ
Triphenylene		0.000075	BLOQ	0.000011	0.000057	0.000088
Chrysene	RPF 0.1, PP	0.00014	BLOQ	0.000013	0.00010	0.00018
6-Methyl chrysene		0.000017	BLOD	BLOQ	BLOQ	BLOQ
5-Methylchrysene		0.000018	BLOD	BLOQ	BLOQ	BLOQ
Benzo (b) fluoranthene	RPF 0.8, PP	0.000047	BLOQ	0.000011	0.000038	0.000066
7,12-Dimethylbenz(a)anthracene		BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (k) fluoranthene	RPF 0.03	0.000021	BLOD	BLOQ	0.000020	0.000034
Benzo (j) fluoranthene	RPF 0.3	0.000021	BLOD	BLOQ	BLOQ	0.000028
Benzo (e) pyrene		0.000040	BLOQ	BLOQ	0.000032	0.000055
Benzo (a) pyrene	PP	0.000021	BLOD	BLOQ	BLOQ	BLOQ
Indeno (1,2,3-c,d) pyrene	RPF 0.07, PP	0.000010	BLOD	BLOD	0.000016	0.000021
Dibenzo (a,h) anthracene	PP	BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (a) chrysene		BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (g,h,i) perylene	RPF 0.009, PP	0.000017	BLOD	0.0000083	0.000018	0.000026
Anthanthrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(1,2-b)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-j)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) fluoranthene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,l) pyrene	RPF 30	BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-k)fluoranthene		BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-e)pyrene	RPF 0.3	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,e) pyrene	RPF 0.4	BLOD	BLOD	BLOD	BLOD	BLOD
Coronene		BLOQ	BLOD	BLOD	BLOD	BLOD
Dibenzo(e,l)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD
Naphtho(2,3-a)pyrene		BLOD	BLOD	BLOD	BLOD	BLOD
Benzo (b) perylene		BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,i) pyrene	RPF 0.6	BLOD	BLOD	BLOD	BLOD	BLOD
Dibenzo (a,h) pyrene	RPF 0.9	BLOD	BLOD	BLOD	BLOD	BLOD
Σ61 PAHs (ug/L)		0.0081	0.024	0.49	0.0059	0.0071
Σ16 PP PAHs (ug/L)		0.0066	0.023	0.47	0.0050	0.0060
Σcarcinogenic PAHs (BAPeq ug/L)		0.0015	0.000017	0.00026	0.0013	0.0017

See table 4 for MQL based on IQL
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OSU Oregon State University

Table 3. Polyethylene Passive Sampling Device Performance Reference Compound T_0 Fortification Levels

Compound	Amount (ng)
Fluorene-d10	37300
Pyrene-d10	1570
Benzo(b)fluoranthene-d12	1570

Table 4. Estimated Method Quantitation Limits for PAHs and PCP

Compound	CAS #	log Kow	PRC	Method Quantiation Limit (ng/L)
Naphthalene	91-20-3	3.30	Fluorene-d10	0.44
2-Methylnaphthalene	91-57-6	3.86	Fluorene-d10	0.081
1-Methylnaphthalene	90-12-2	3.87	Fluorene-d10	0.031
2-Ethylnaphthalene	939-27-5	4.38	Fluorene-d10	0.034
2,6-Dimethylnaphthalene	581-42-0	4.31	Fluorene-d10	0.036
1,6-Dimethylnaphthalene	575-43-9	4.26	Fluorene-d10	0.037
1,4-dimethylnaphthalene	571-53-4	4.37	Fluorene-d10	0.045
1,5 dimethylnaphthalene	571-61-9	4.38	Fluorene-d10	0.042
1,2-Dimethylnaphthalene	573-98-8	4.31	Fluorene-d10	0.039
1,8-Dimethylnaphthalene	569-41-5	4.26	Fluorene-d10	0.038
2,6-Diethylnaphthalene	59919-41-4	4.30	Fluorene-d10	0.034
Acenaphthylene	208-96-8	3.94	Fluorene-d10	0.1
Acenaphthene	83-32-9	3.92	Fluorene-d10	0.23
Fluorene	86-73-7	4.18	Fluorene-d10	0.043
Dibenzothiophene	132-65-0	4.38	Fluorene-d10	0.0085
Phenanthrene	85-01-8	4.46	Fluorene-d10	0.014
Anthracene	120-12-7	4.45	Fluorene-d10	0.032
2-Methylphenanthrene	2531-84-2	4.86	Pyrene-d10	0.0074
2-Methylanthracene	613-12-7	5.00	Pyrene-d10	0.0079
1-Methylphenanthrene	832-69-9	5.08	Pyrene-d10	0.017
9-Methylanthracene	779-02-2	5.07	Pyrene-d10	0.014
3,6-Dimethylphenanthrene	1576-67-6	5.44	Benzo[b]fluoranthene-d12	0.0074
Fluoranthene	613-06-9	5.22	Pyrene-d10	0.008
2,3-Dimethylanthracene	206-44-0	5.60	Benzo[b]fluoranthene-d12	0.006
9,10-Dimethylanthracene	781-43-1	5.69	Benzo[b]fluoranthene-d12	0.015
Pyrene	129-00-0	4.88	Pyrene-d10	0.0078
Retene	483-65-8	6.35	Benzo[b]fluoranthene-d12	0.017

Benzo(a)fluorene	238-84-6	5.40	Benzo[b]fluoranthene-d12	0.018
Benzo(b)flourene	243-17-4	5.77	Benzo[b]fluoranthene-d12	0.018
Benzo(c)fluorene	205-12-9	5.19	Pyrene-d10	0.004
1-Methylpyrene	238-71-7	5.48	Benzo[b]fluoranthene-d12	0.007
Benz(a)anthracene	56-55-3	5.76	Benzo[b]fluoranthene-d12	0.013
Cyclopenta(c,d)pyrene	27208-37-3	5.50	Benzo[b]fluoranthene-d12	0.0094
Triphenylene	217-59-4	5.49	Benzo[b]fluoranthene-d12	0.0072
Chrysene	218-01-9	5.81	Benzo[b]fluoranthene-d12	0.0088
6-Methylchrysene	1705-85-7	6.07	Benzo[b]fluoranthene-d12	0.017
5-Methylchrysene	3697-24-3	6.07	Benzo[b]fluoranthene-d12	0.019
Benzo(b)fluoranthene	205-99-2	5.78	Benzo[b]fluoranthene-d12	0.0065
7,12-Dimethylbenz(a)anthracene	57-97-6	5.80	Benzo[b]fluoranthene-d12	0.017
Benzo(k)fluoranthene	207-08-9	6.11	Benzo[b]fluoranthene-d12	0.01
Benzo(j)fluoranthene	205-82-3	6.11	Benzo[b]fluoranthene-d12	0.011
Benzo(e)pyrene	192-97-2	6.44	Benzo[b]fluoranthene-d12	0.015
Benzo(a)pyrene	50-32-8	6.13	Benzo[b]fluoranthene-d12	0.023
Indeno(1,2,3-c,d) pyrene	193-39-5	6.70	Benzo[b]fluoranthene-d12	0.0065
Dibenz(a,h)anthracene	53-70-3	6.75	Benzo[b]fluoranthene-d12	0.026
Picene	213-46-7	7.11	Benzo[b]fluoranthene-d12	0.024
Benzo(ghi)perylene	191-24-2	6.63	Benzo[b]fluoranthene-d12	0.0081
Anthanthrene	191-26-4	7.04	Benzo[b]fluoranthene-d12	0.01
Naptho[1,2-b]fluoranthene	5385-22-8	7.29	Benzo[b]fluoranthene-d12	0.036
Naptho[2,3-j]fluoranthene	205-83-4	7.29	Benzo[b]fluoranthene-d12	0.036
Dibenzo(a,e)fluoroanthene	5385-75-1	7.28	Benzo[b]fluoranthene-d12	0.017
Dibenzo(a,l)pyrene	191-30-0	7.71	Benzo[b]fluoranthene-d12	0.023
Naptho[2,3-k]fluoranthene	207-18-1	7.29	Benzo[b]fluoranthene-d12	0.036
Naptho[2,3-e]pyrene	193-09-9	7.29	Benzo[b]fluoranthene-d12	0.036
Dibenzo(a,e)pyrene	192-65-4	7.28	Benzo[b]fluoranthene-d12	0.23
Coronene	191-07-1	7.64	Benzo[b]fluoranthene-d12	0.032
Dibenzo(e,l)pyrene	192-51-8	6.20	Benzo[b]fluoranthene-d12	0.02
Naptho[2,3-a]pyrene	196-42-9	7.29	Benzo[b]fluoranthene-d12	0.036
Benzo(b)perylene	197-70-6	7.00	Benzo[b]fluoranthene-d12	0.029
Dibenzo(a,i)pyrene	189-55-9	7.28	Benzo[b]fluoranthene-d12	0.05
Dibenzo(a,h)pyrene	189-64-0	7.28	Benzo[b]fluoranthene-d12	0.018
Pentachlorophenol	87-86-5	5.12	Fluorene-d10	0.865

Determination of Pentachlorophenol using GC-MS/MS

Food Safety and Environmental Stewardship Program
Oregon State University Standard Operating Procedure

Scope
This procedure applies to the analysis of pentachlorophenol by GC-MS/MS and has been validated for use with polyethylene passive sampling devices. Instrument detection limits are 1400 pg/uL.

Contributors: G. R. Wilson, D.J. Minick, R.P. Scott

Responsibilities
Staff members involved in performing this work are responsible for reading, understanding and complying with the requirements for this SOP. The Director is responsible for ensuring that the content of this SOP is complied with and that qualified staff performs these analyses. The senior chemists are responsible for informing staff members of the requirements and interpretation of this SOP and are responsible for enforcing this SOP.

Status
This document is considered current standard operating procedure of the Food Safety and Environmental Stewardship Laboratory when management approval is documented by signature below. This Standard Operating Procedure is effective on the date of approval signature and supersedes all previous versions.

Approved	____________________ Kim A. Anderson, Ph.D.	**Director** Title	______ Date
Historical File	____________________ Signature/Initials		______ Date

I. Equipment and Apparatus

- **A.** Agilent 7890/7000C GC/MS/MS
- **B.** Splitless single taper line, Agilent, 4 mm ID, Part# 5190-2292(or equivalent)
- **C.** Deactivated glass wool
- **D.** Septa, Restek, Thermolite 11mm Part# 27142 (or equivalent)
- **E.** Column, J&W Scientific, Select PAH, Part# CP7462, 30m, ID 0.25mm, Film 0.15 um
- **F.** Chromatography vials, 2 mL, amber, screw cap, Agilent (or equivalent)
- **G.** Chromatography vial inserts, Agilent (or equivalent)

II. Reagents

- **A.** Hexanes, Fisher GC Resolv™ (or equivalent)
- **B.** Ethyl Acetate, EMD Omnisolve (or equivalent)
- **C.** Acetone, EMD Omnisolve (or equivalent)

D. Isooctane, Fisher, Optima (or equivalent)

III. Standards

A. See **Table 1** for a list of analytes, surrogates and internal standards.

B. Primary Standards are neat standards or solutions ordered from several sources.

C. Standard Solutions

1. Analytical standards shall be prepared in isooctane or hexane at levels that are comparable to estimated sample levels. The suggested range is 1 to 1000 µg/mL.
2. Expiration of solutions occurs five years after preparation of that solution. Shorter expiration periods may be used and should be used as appropriate, consult with the senior chemist or director if you have any questions. Expired standards must be recertified and documented before use.
3. Fortification solutions are prepared such that the concentration of spiked compounds in the final extract will be 500 pg/uL. This concentration will be verified prior to use in extractions. Expiration of spike solutions (and subsequent re-verification) occurs one (5years from the date of preparation, or as noted per chemist discretion.
4. All stock, standard, and spike solutions are stored at ≤4 ºC and allowed to warm to room temperature prior to use. Storage of neat standards and solutions will be based on the suppliers' recommendations.

IV. Instrument Operating Parameters

A. Refer to **Table 2** for operating conditions

1. Carrier Gas: Helium (99.99% purity)
2. Pack a small amount of deactivated glass wool into injection port liner
3. Use acetone and hexane wash vials for syringe cleaning between injections

V. Sample Preparation

A. See appropriate SOP for sample preparation procedures.

VI. Sample Analysis

A. Sample extracts are analyzed on the GC/MS/MS by method **I-PCP-XXX-###_MRM.m** ("**I**" = instrument, "**X**" = matrix type, "#" = current method version increasing with each calibration or tune) using the appropriate standards and quality control samples. Qualitative identification of analytes in the extract is performed using retention time and mass spectral information. Quantitative analysis is performed by quantifying the relative abundance of characteristic masses (MRM) see **Table 1**.

B. Calibration

1. Standard calibration mixes, containing all target analytes in the method, or target analytes of specific interest, will be run at the beginning of a method or when the verification standard fails DQOs. The calibration standard series will be run, the data edited, and the calibration curve updated prior to running samples.
2. The calibration standard samples should be calibrated according to the procedures outlined in the MS MassHunter User's Guide. Analytical standards are used to quantify concentrations using a calibration curve specific to each analyte. Curves can be constructed using an average

response factor (ARF), linear or quadratic curves with or without weighing depending on their individual instrumental response.

3. Before running a batch of samples a continuing calibration verification (CCV) sample will be analyzed. See **Table 3** for DQOs and corrective actions.

C. Analysis

1. Use GC/MS/MS method name: **I-PCP-XXX-###_MRM.** Analytes, surrogate compounds and the internal standard are identified and quantified as pg/µL by the MassHunter software. At least one other MRM is used as a qualifier in the mass spectral display for identification (see **Table 1**). Analytes are corrected for surrogate compound recovery by the MassHunter software. Surrogate compound responses are a ratio of relative response factors to the internal standard. Surrogate compounds and internal standards can change with different matrices and extraction methods. Please refer to the matrix specific SOP to determine applicable surrogate compounds and internal standards. Analyte instrumental responses are expressed as a ratio of relative response factors to their specified surrogate compound. If the response for a peak exceeds the calibration range by more than nominally 20%, dilute the extract, and adjust the internal standard concentration to 500 pg/ µL and reanalyze.

VII. Calculations

A. Fortification levels:

1. *[std vol (µL) X std conc (pg/µL)] / final volume of sample (µL) = fortification level (pg/µL*)

VIII. Quality Control

A. The calibration curve should have an $r^2 \geq 0.99$ and consist of no fewer than five (5) standards. A continuing calibration verification should be run at the beginning of each day. If the percentage recovery is +/- 30% of the true values sample analysis may begin. If the recoveries are outside the DQOs then the instrument should be re-calibrated and/or troubleshoot as applicable. At least one calibration check should be run each day, for large batches, a calibration check should be run every 10-15 samples. <u>Specific projects may have unique data quality objectives and that criteria may be used, and will take precedent to assess method performance as applicable</u>. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the specific extraction method used.

B. In recognition of advances that are occurring in chromatography, the analyst is permitted certain options to improve the separations or lower the cost of measurements. Each time such a modification is made to the method, the analyst is required to document any alterations to the procedure on bench sheets during the analysis. For permanent changes, the standard operating procedures should be formally updated with new validations.

C. A solvent blank should be run with each sequence, the concentration of analytes detected in the laboratory reagent blank should be zero.

D. The recovery of analytes in laboratory spikes should be between 70% and 130% of the true value.

IX. Documentation Requirements

A. Check http://fses.oregonstate.edu/sop-toc for current version of all required documents.

B. A completed chromatography bench sheet, QC summary and a copy of the calibration verification results are required for all analyses.

X. Safety and Health

A. Please consult Material Safety Data Sheet (MSDS) for information on pentachlorophenol and reagents. The toxicity and carcinogenicity of some chemicals used in this method have not been precisely defined; each chemical should be treated as a potential health hazard, and exposure to these chemicals should be minimized. Consult instrument manual for information on safe operation of the GC/MS/MS. Personnel performing this method will observe all appropriate state, federal, and Oregon State University laboratory safety procedures. Further consult SOP4110 for instrumental operation. Precautions should be taken when handling solid chemicals per Oregon State Environmental Health and Safety office for handling carcinogens. Note: handling solids may require specialized trained personnel.

XI. References

A. None

XII. Validation

A. This method has been reviewed and validated for use in polyethylene passive sampling device extracts.

Table 1: Pentachlorophenol, surrogates and internal standards detected by GC/MS listed in Order of Retention on a 30m Select PAH Column:

Compound Name	CAS #	Type	Exp_RT	LOD (pg/uL)	LOQ (pg/uL)
Pentachlorophenol	87-86-5	Target	8.33	1400	4460
Phenanthrene D10-SS	1517-22-2	Target	9.28	1.67	5.00
Perylene-D12	1520-96-3	ISTD	33.14	-	-

Table 2 : Instrument Control Parameters (Copied from MassHunter acqmeth.txt)

```
INSTRUMENT CONTROL PARAMETERS:    7000C-QQQ
                   ------------------------------------------

   D:\MassHunter\GCMS\1\methods\C-PCP-PSD-001MRM.M
      Thu Sep 24 14:49:47 2015

Control Information
------- -----------

Sample Inlet             : GC
Injection Source         : GC ALS
Injection Location:  Rear
Mass Spectrometer        : Enabled


 No Sample Prep method has been assigned to this method.


GC
Oven
Temperature
Setpoint                                     On
(Initial)                                    60 °C
Hold Time                                    1 min
Post Run                                     310 °C
Program
#1 Rate                                      40 °C/min
#1 Value                                     180 °C
#1 Hold Time                                 0 min
#2 Rate                                      3 °C/min
#2 Value                                     200 °C
#2 Hold Time                                 0 min


Equilibration Time                           0.5 min
Max Temperature                              350 °C
Maximum Temperature Override                 Disabled
Slow Fan                                     Disabled
Cryo                                         Off

Collision Cell/Backflush
Pressure
Setpoint                                     Off
(Initial)                                    1 psi
Post Run                                     0 psi

He Quench Gas                                On    2.25 mL/min
```

N2 Collision Gas	On 1.5 mL/min
ALS	
Back Injector	
Syringe Size	10 µL
Injection Volume	1 µL
Solvent A Washes (PreInj)	2
Solvent A Washes (PostInj)	3
Solvent A Volume	8 µL
Solvent B Washes (PreInj)	2
Solvent B Washes (PostInj)	3
Solvent B Volume	8 µL
Sample Washes	0
Sample Wash Volume	8 µL
Sample Pumps	4
Dwell Time (PreInj)	0 min
Dwell Time (PostInj)	0 min
Solvent Wash Draw Speed	300 µL/min
Solvent Wash Dispense Speed	6000 µL/min
Sample Wash Draw Speed	300 µL/min
Sample Wash Dispense Speed	6000 µL/min
Injection Dispense Speed	6000 µL/min
Viscosity Delay	0 sec
Sample Depth	Disabled
Injection Type	Standard
L1 Airgap	0.2 µL
Solvent Wash Mode	A, B
Sample Overlap	
Mode	Sample overlap is not enabled
ALS Errors	Pause for user interaction
Front MM Inlet He	
Temperature	
Setpoint	Off
(Initial)	320 °C
Post Run	0 °C
Mode	Pulsed Splitless
Heater	Off
Pressure	Off
Total Flow	Off
Septum Purge Flow	Off
Septum Purge Flow Mode	Switched
Injection Pulse Pressure	35 psi Until 0.3 min
Purge Flow to Split Vent	50 mL/min at 0.7 min
Cryo	Off
Back SS Inlet He	
Mode	Pulsed Splitless
Heater	On 320 °C
Pressure	On 17.677 psi
Total Flow	On 30 mL/min
Septum Purge Flow	On 3 mL/min
Gas Saver	On 15 After 2 min mL/min
Injection Pulse Pressure	35 psi Until 0.3 min
Purge Flow to Split Vent	25 mL/min at 0.7 min
Thermal Aux 2 (MSD Transfer Line)	

Temperature	
Setpoint	On
(Initial)	320 °C
Post Run	0 °C
Column	
Column #1	
Flow	
Setpoint	Off
(Initial)	2 mL/min
Post Run	1 mL/min
J&W CP7462	
Select PAH	
0 °C—350 °C (350 °C): 30 m x 250 µm x 0.15 µm	
Column lock	Unlocked
In	Back SS Inlet He
Out	MSD
(Initial)	60 °C
Pressure	17.677 psi
Flow	2 mL/min
Average Velocity	51.792 cm/sec
Holdup Time	0.96539 min
Column Outlet Pressure	0 psi
Aux EPC 4,5,6	
Aux EPC 4 H2	
Pressure	
Setpoint	On
(Initial)	50 psi
Post Run	0 psi
Aux EPC 5 He	
Pressure	
Setpoint	Off
(Initial)	5 psi
Post Run	0 psi
Aux EPC 6 N2	
Pressure	
Setpoint	On
(Initial)	2 psi
Post Run	0 psi

Table 3 : Data Quality Objectives, Acceptance Criteria and Corrective Actions

QC Sample	Purpose	Frequency	Acceptance Criteria	Corrective Action
Initial Calibration	Accuracy	Prior to project analyses and if post-maintenance calibration check fails	R^2 of ≥0.99 if linear, ≥0.995 if quadratic	Perform instrument maintenance, and reanalyze
Instrument Detection Limits	Detection Limit	Prior to project analyses	Signal to noise (peak to peak) ratio is above 3	Perform instrument maintenance, Reanalyze
Continuing Calibration Verification	Accuracy despite matrix or instrument variability	One per 10-15 samples, or as necessary	±30% of true value for at least 80% of target analytes	Perform instrument maintenance and re-analyze samples
Instrument Blank	Detection Limit, contamination	Beginning of each batch	Below analyte Instrument Detection Limit	Re-analyze, perform instrument maintenance, and/or flag data
Sample Spike	Preparation and handling bias	One per 25 Field Samples	Analyte percent recovery 50% to 150%	Flag Data as appropriate
Internal Standard Peak Area	Analytical Bias	Each sample and standard	Percent detected 50% to 100%	Re-analyze if a standard, perform instrument maintenance, and/or flag sample data
Surrogate Recovery	Analytical Bias	Each sample	Percent Recovery 50% to 150%	Re-analyze if it is a blank or standard, flag sample data

Table 4 : Quantifier and Qualifier Ions and Collision Cell Voltages for each compound

Name	CAS #	RT	Quantifier Precursor Ion	Quantifier Product Ion	Collision Energy (V)	Qualifier Precursor Ion	Qualifier Product Ion	Collision Energy (V)
Pentachlorophenol	87-86-5	8.33	266	167	25	266	165	25
Phenanthrene-D10 SS	1517-22-2	9.28	188	160	20	188	186	15
Perylene-D12	1520-96-3	33.14	264	260	35	264	236	30

Title: Calculation of Freely Dissolved Water Concentrations of Organic Compounds Derived from Polyethylene Passive Sampling Devices (PSD)

Scope
This method describes the calculations required for determining surface water and sediment porewater concentrations of polycyclic aromatic hydrocarbons (PAH), oxygenated polycyclic aromatic hydrocarbons (OPAHs), and pesticides that have been collected using polyethylene (PE) passive sampling devices (PSD). Prior analysis by applicable standard analytical method is required to determine analyte concentrations in the sampler.

Contributors: G. Sower, L. Quarles, K.A. Anderson

Responsibilities
Staff members involved in performing this work are responsible for reading, understanding and complying with the requirements for this SOP. The Director is responsible for ensuring that the content of this SOP is complied with and that qualified staff performs these analyses. The senior chemists are responsible for informing staff members of the requirements and interpretation of this SOP and are responsible for enforcing this SOP.

Status
This document is considered current standard operating procedure of the Food Safety and Environmental Stewardship Laboratory when management approval is documented by signature below. This Standard Operating Procedure is effective on the date of approval signature and supersedes all previous versions.

Approved	________________ Kim A. Anderson, Ph.D.	**Director** Title	______ Date
Historical File	________________ Signature/Initials		______ Date

I. Laboratory quantitation of analytes in PSDs

A. Fortification levels for one PSD:

1. PRC fortification solution must be prepared by a chemist in accordance with the needs of the project.

2. *[std. vol. (µL) X std. conc. (µg/µL)] / wt. of sample (g*) = fortification level (µg/g*).

B. Quantitative analysis to determine unknown sample levels:

1. See the specific analyte SOP analytical procedure for quantitative measurement.

II. Calculations using performance reference compounds (PRCs) [4].

A. The following calculations are performed using XLIMS data to excel feature. This process will place detection/reporting limit flagged concentrations from the instrument into the attached excel spreadsheet and produce one file per sample.

B. The chemist should verify:

1. Quantity of PE PSDs

2. PRC fortification levels

3. Duration of deployment in days

4. PRC selection:

a) If a loss of greater than 90% or less than 10% of any PRC is observed then the next PRC compound with the nearest log Kow to the target compound should be used to calulate a sampling rate.

C. Final values are stored in XLIMS using the resulting excel file.

*Note the calculation described does not account for temperature differences and assumes that your sampling system temperature range is between 2 and 30 C. "The experimental evidence suggests that K_{sw} values are not temperature dependent in the 2 to 30 C temperature range" Huckins *et al* 2006 page 53. See Huckins *et al* 2006 (and references therein), page 53-56 for explaination and how to account for temperature if required.

Calculation of Sampling Rate (*R_s*) of PRC's:

$$R_{s,PRC} = (V_s \times 10^{logK_{sw,PRC}} \times k_e)/1000$$

where the sampler water partition coefficient (*K_{sw}*) is given by:

$$Log\ K_{sw} = a_0 + 2.321(logK_{ow}) - 0.1618(logK_{ow})^2$$

$$a_0 = -2.61\ for\ PAHs, PCBs, 4,4' - DDE$$
$$a_0 = -3.2\ for\ polar\ pesticides$$
$$(From\ Huckins\ page\ 54\ equation\ 3.28)$$

the volume (*V_s*) of sampler is:

$$V_s = (\#\ of\ PE\ Strips) \times (5.0\ cm^3)$$

the PRC release rate constant (*k_e*) is estimated using:

$$k_e = -\ln(\frac{t_E}{t_0})/E$$

where:

$$t_0 = PRC\ amount\ in\ PE\ at\ time = 0$$
$$t_E = PRC\ amount\ in\ PE\ at\ time = E$$
$$E = Exposure\ duration\ in\ days$$

Calculation of Water Concentration (*$C_{w,analyte}$*) for Target Compounds:

$$C_{w,analyte} = \frac{analyte\ accumulation}{V_s \times K_{sw,analyte}(1 - \exp\left(-\frac{R_{s,analyte} \times 1000 \times E}{V_s \times K_{sw,analyte}}\right))}$$

where the sampling rate of the target compound ($R_{s,analyte}$) is:

$$R_{s,analyte} = R_{s,PRC} \times \left(\frac{a_{analyte}}{a_{PRC}}\right)$$

and:

$$loga = 0.0130logK_{ow}^3 - 0.3173logK_{ow}^2 + 2.244logK_{ow}$$
$$(From\ Huckins\ page\ 60\ equation\ 3.35)$$

*Remember to use appropriate K_{ow} for $K_{sw,PRC}$ and $K_{sw,analayte}$ calculations

III. References

1. Petty, J. D.; Huckins, J. N.; Martin, D. B.; Adornato, T. G., Use of semipermeable membrane devices (SPMDS) to determine bioavailable organochlorine pesticide residues in streams receiving irrigation drainwater. *Chemosphere* **1995,** 30, (10), 1891-1903.
2. Huckins, J. N.; Petty, J. D.; Orazio, C. E.; Lebo, J. A.; Clark, R. C.; Gibson, V. L.; Gala, W. R.; Echols, K. R., Determination of uptake kinetics (Sampling rates) by lipid-containing semipermeable membrane devices (SPMDs) for polycyclic aromatic hydrocarbons (PAHs) in water. *Environmental Science & Technology* **1999,** 33, (21), 3918-3923.
3. Luellen, D. R.; Shea, D., Calibration and Field Verification of Semipermeable Membrane Devices for Measuring Polycyclic Aromatic Hydrocarbons in Water. *Environmental Science & Technology* **2002,** 36, (8), 1791-1797.
4. Huckins, J. N.; Petty, J. D.; Booij, K., *Monitors of organic chemicals in the environment : semipermeable membrane devices*. Springer: New York, 2006; p xv, 223.
5. Mackay, D.; Shiu, W. Y.; Ma, K. C., *Physical-Chemical Properties and Environmental Fate Handbook*. CRC Press: Boca Raton, FL, 1999.
6. Neff, J. M.; Burns, W. A., Estimation of polycyclic aromatic hydrocarbon concentrations in the water column based on tissue residues in mussels and salmon: An equilibrium partitioning approach. *Environmental Toxicology and Chemistry* **1996,** 15, (12), 2240-2253.
7. *Food Safety Environmental Stewardship Program SOP 2120: Preparation of Polyethylene Passive Sampling Devices for Environmental Sampling Equipment.*

Table 1. Target PAH compounds with suggested PRC compound and estimated method detection limit (MDL) based on three week deployment with 5 PSDs composited in surface water and 1 PSD in sediment pore water at a Portland Harbor Superfund Site with analysis by SOP 418. K_{ow} values are from: US EPA. [2014]. Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.10. United States Environmental Protection Agency, Washington, DC, USA.

Compound	CAS #	log Kow	PRC	MDL(ng/L)	
				Surface water	Pore water
Naphthalene	91-20-3	3.30	Fluorene-d10	0.088	0.44
2-Methylnaphthalene	91-57-6	3.86	Fluorene-d10	0.016	0.081
1-Methylnaphthalene	90-12-2	3.87	Fluorene-d10	0.0063	0.031
2-Ethylnaphthalene	939-27-5	4.38	Fluorene-d10	0.0069	0.034
2,6-Dimethylnaphthalene	581-42-0	4.31	Fluorene-d10	0.0073	0.036
1,6-Dimethylnaphthalene	575-43-9	4.26	Fluorene-d10	0.0074	0.037
1,4-dimethylnaphthalene	571-53-4	4.37	Fluorene-d10	0.009	0.045
1,5 dimethylnaphthalene	571-61-9	4.38	Fluorene-d10	0.0084	0.042
1,2-Dimethylnaphthalene	573-98-8	4.31	Fluorene-d10	0.0077	0.039
1,8-Dimethylnaphthalene	569-41-5	4.26	Fluorene-d10	0.0076	0.038
2,6-Diethylnaphthalene	59919-41-4	4.30	Fluorene-d10	0.0068	0.034
Acenaphthylene	208-96-8	3.94	Fluorene-d10	0.02	0.1
Acenaphthene	83-32-9	3.92	Fluorene-d10	0.046	0.23
Fluorene	86-73-7	4.18	Fluorene-d10	0.0086	0.043
Dibenzothiophene	132-65-0	4.38	Fluorene-d10	0.0017	0.0085
Phenanthrene	85-01-8	4.46	Fluorene-d10	0.0028	0.014
Anthracene	120-12-7	4.45	Fluorene-d10	0.0065	0.032
2-Methylphenanthrene	2531-84-2	4.86	Pyrene-d10	0.0015	0.0074
2-Methylanthracene	613-12-7	5.00	Pyrene-d10	0.0016	0.0079
1-Methylphenanthrene	832-69-9	5.08	Pyrene-d10	0.0034	0.017
9-Methylanthracene	779-02-2	5.07	Pyrene-d10	0.0028	0.014
3,6-Dimethylphenanthrene	1576-67-6	5.44	Benzo[b]fluoranthene-d12	0.0015	0.0074
Fluoranthene	613-06-9	5.22	Pyrene-d10	0.0016	0.008
2,3-Dimethylanthracene	206-44-0	5.60	Benzo[b]fluoranthene-d12	0.0012	0.006
9,10-Dimethylanthracene	781-43-1	5.69	Benzo[b]fluoranthene-d12	0.003	0.015
Pyrene	129-00-0	4.88	Pyrene-d10	0.0016	0.0078
Retene	483-65-8	6.35	Benzo[b]fluoranthene-d12	0.0035	0.017
Benzo(a)fluorene	238-84-6	5.40	Benzo[b]fluoranthene-d12	0.0036	0.018
Benzo(b)flourene	243-17-4	5.77	Benzo[b]fluoranthene-d12	0.0035	0.018
Benzo(c)fluorene	205-12-9	5.19	Pyrene-d10	0.00089	0.004
1-Methylpyrene	238-71-7	5.48	Benzo[b]fluoranthene-d12	0.0013	0.007
Benz(a)anthracene	56-55-3	5.76	Benzo[b]fluoranthene-d12	0.0027	0.013
Cyclopenta(c,d)pyrene	27208-37-3	5.50	Benzo[b]fluoranthene-d12	0.0019	0.0094
Triphenylene	217-59-4	5.49	Benzo[b]fluoranthene-d12	0.0014	0.0072

Chrysene	218-01-9	5.81	Benzo[b]fluoranthene-d12	0.0018	0.0088
6-Methylchrysene	1705-85-7	6.07	Benzo[b]fluoranthene-d12	0.0033	0.017
5-Methylchrysene	3697-24-3	6.07	Benzo[b]fluoranthene-d12	0.0038	0.019
Benzo(b)fluoranthene	205-99-2	5.78	Benzo[b]fluoranthene-d12	0.0013	0.0065
7,12-Dimethylbenz(a)anthracene	57-97-6	5.80	Benzo[b]fluoranthene-d12	0.0033	0.017
Benzo(k)fluoranthene	207-08-9	6.11	Benzo[b]fluoranthene-d12	0.002	0.01
Benzo(j)fluoranthene	205-82-3	6.11	Benzo[b]fluoranthene-d12	0.0021	0.011
Benzo(e)pyrene	192-97-2	6.44	Benzo[b]fluoranthene-d12	0.003	0.015
Benzo(a)pyrene	50-32-8	6.13	Benzo[b]fluoranthene-d12	0.0045	0.023
Indeno(1,2,3-c,d) pyrene	193-39-5	6.70	Benzo[b]fluoranthene-d12	0.0013	0.0065
Dibenz(a,h)anthracene	53-70-3	6.75	Benzo[b]fluoranthene-d12	0.0052	0.026
Picene	213-46-7	7.11	Benzo[b]fluoranthene-d12	0.0047	0.024
Benzo(ghi)perylene	191-24-2	6.63	Benzo[b]fluoranthene-d12	0.0016	0.0081
Anthanthrene	191-26-4	7.04	Benzo[b]fluoranthene-d12	0.002	0.01
Naptho[1,2-b]fluoranthene	5385-22-8	7.29	Benzo[b]fluoranthene-d12	0.0071	0.036
Naptho[2,3-j]fluoranthene	205-83-4	7.29	Benzo[b]fluoranthene-d12	0.0071	0.036
Dibenzo(a,e)fluoroanthene	5385-75-1	7.28	Benzo[b]fluoranthene-d12	0.0033	0.017
Dibenzo(a,l)pyrene	191-30-0	7.71	Benzo[b]fluoranthene-d12	0.0047	0.023
Naptho[2,3-k]fluoranthene	207-18-1	7.29	Benzo[b]fluoranthene-d12	0.0071	0.036
Naptho[2,3-e]pyrene	193-09-9	7.29	Benzo[b]fluoranthene-d12	0.0071	0.036
Dibenzo(a,e)pyrene	192-65-4	7.28	Benzo[b]fluoranthene-d12	0.046	0.23
Coronene	191-07-1	7.64	Benzo[b]fluoranthene-d12	0.0064	0.032
Dibenzo(e,l)pyrene	192-51-8	6.20	Benzo[b]fluoranthene-d12	0.0039	0.02
Naptho[2,3-a]pyrene	196-42-9	7.29	Benzo[b]fluoranthene-d12	0.0071	0.036
Benzo(b)perylene	197-70-6	7.00	Benzo[b]fluoranthene-d12	0.0059	0.029
Dibenzo(a,i)pyrene	189-55-9	7.28	Benzo[b]fluoranthene-d12	0.01	0.05
Dibenzo(a,h)pyrene	189-64-0	7.28	Benzo[b]fluoranthene-d12	0.0037	0.018
Pentachlorophenol	87-86-5	5.12	Fluorene-d10	4.326	0.865

Title: Assembly and Extraction of Diffusive Gradients in Thinfilm (DGT) Passive Sampling Device (PSD)

Scope
This method describes the assembly of and metal extraction from the diffusive gradients in thinfilm (DGT) sampling device. The DGT is an *in situ* passive sampling device (PSD) for the collection of labile, bioavailable, cationic metals in solution. Typical analysis after extraction may include Anodic Stripping Voltammetry (ASV), inductively coupled plasma optical emission spectroscopy (ICP/OES), and ICP mass spectrometry (ICP/MS). The analytes covered by this extraction procedure are outlined in Table 1.

Contributors: W.E Hillwalker, A. Perez, K.A. Hobbie

Responsibilities
Staff members involved in performing this work are responsible for reading, understanding and complying with the requirements for this SOP. The Director is responsible for ensuring that the content of this SOP is complied with and that qualified staff performs these analyses. The senior chemists are responsible for informing staff members of the requirements and interpretation of this SOP and are responsible for enforcing this SOP.

Status
This document is considered current standard operating procedure of the Food Safety and Environmental Stewardship Laboratory when management approval is documented by signature below. This Standard Operating Procedure is effective on the date of approval signature and supersedes all previous versions.

Approved	________________ Kim A. Anderson, Ph.D.	**Director** Title	______ Date
Historical File	________________ Signature/Initials		______ Date

I. Equipment and Apparatus

Note: Acid strip (4 N HNO_3 soak) all glassware, containers and glass pipettes before use (see SOP 2110- Laboratory Container Cleaning procedure). The type of chelex gel resin should be properly selected for your analytes of interest.

- **A.** Glass plate
- **B.** Gel disc cutter, DGT Research, Ltd. or the 2.5 cm diameter mouth of the original gel strip or sheet container
- **C.** Plastic forceps and or glass pasteur pipettes
- **D.** 1.5 mL centrifuge tubes with locking flip top
- **E.** Small flathead screwdriver
- **F.** Quart size Ziploc™ bags – or equivalent
- **G.** 1000 uL Pipetman™ – or equivalent

H. DGT solution deployment units (contains a cap with a 3.14 cm^2 window and a base), DGT Research, Ltd – or equivalent
I. Chelex gel strips in 18 MΩ.cm water, stored at 4 °C, DGT Research, Ltd – or equivalent
J. Diffusive gel sheets (open pore, 0.76 cm) in 0.1M $NaNO_3$ solution, stored at 4 °C, DGT Research, Ltd – or equivalent
K. Polysulfone membrane 0.45 µm filter, 2.5 cm diameter, 13 to 25 mm thickness, Pall Corporation – or equivalent

II. DGT Assembly (if required, DGT can be purchased preassembled from DGT Research)

A. Making gel discs from strips or sheets

1. Using the glass pipettes, pull the gel strip or sheet from the container onto the glass surface. *Note: Retain the original solution in the original container.*
2. Using the glass pipettes, unroll the gel strip or sheet onto the glass surface. *Note: The gels are fairly durable but can be split if handled roughly. Avoid lifting; rather tease out on the glass surface.*
3. Using the disc gel cutter (or the 2.5 cm diameter mouth of the gel strip container), cut a 2.5 cm diameter disc from the strip or sheet.
a) Press and twist the cutter at the same time to ensure a clean cut.
b) Approximately 22 and 25 discs can be created from the chelex resin gel strip and the diffusive gelsheet, respectively.
4. Place the gel discs into the original container and solution using the glass pipettes.
5. The container of gel discs in the original 18 MΩ.cm water or 0.1M $NaNO_3$ solution can be stored at 4 °C until assembly.

B. DGT assembly (See **Figure 1**)

1. Using the glass pipettes, remove a chelex gel disc from the original container and place it on the solution deployment molding base. Ensure that the resin side is face up. *Note: the resin side is rougher than the other side.*
2. Using the glass pipettes, place the diffusive gel disc on top of the chelex gel.
3. Using the glass pipettes or clean gloves, place the filter membrane on top of the diffusive gel.
4. Carefully place the cap onto the molding base, making sure it is horizontal. Use even force and press down until the cap reaches the base.
a) If the cap and base do not meet correctly, the DGT is not ready for deployment. Either remove the cap and try again, or replace with a new DGT assembly.
b) Dispose of caps that have a significant crack. Dispose of either base or cap if plastic is yellowing and less flexible.

5. Place assembled DGTs in sealable plastic bags and label with prep date. Store at 4 ^{o}C until use. DGTs can be made weeks ahead of deployment if stored properly. Do not use DGTs with visibly dry membrane filters.

III. DGT Field deployment and retrieval (see SAM 100: Deploying and Retrieving Passive Sampling Devices (PSD) from Aquatic Systems.

IV. Metal extraction from the DGT

1. After retrieval, DGT should be stored in sealable plastic bags at 4^{o}C until processing. Ensure that filter and gels do not dry out during storage.
2. To retrieve the chelex resin gel after deployment, insert a screwdriver into the groove in the cap and twist to remove the cap from the base.
   - **a)** The cap and base can be reused. Place in bucket of detergent and clean according to SOP 2110.
   - **b)** Dispose of caps that have a significant crack. Dispose of either base or cap if plastic is yellowing and less flexible.
3. Using glass pipettes, Remove the filter and diffusive gel layers, leaving the chelex resin-gel. Dispose of filter and diffusive gel in trash.
4. Using clean glass pipettes, place the chelex resin-gel in a 1.5 mL centrifuge tube.
   - **a)** This sample can be stored at 4 ^{o}C for later extraction. To ensure chelex gel does not dry out, ~50 μL of 18 MΩ-cm water can be added.
5. Extraction (this step can be scaled up if needed, the extraction solution should cover the chelex resin gel in the extraction vessel)
   - **a)** Add 1 mL of 1M HNO_3 solution to centrifuge tube.
   - **b)** Vortex to ensure the resin-gel is fully immersed in the HNO_3 solution.
   - **c)** Leave the resin-gel in the 1M HNO_3 solution at room temperature for 24 hours.
6. After the 24 hour acid extraction, transfer extracting solution to receiving container.
7. Dilute if necessary prior to analysis.
8. Dispose of the centrifuge tube and the chelex resin-gel.

V. Calculations

A. The following formulas provide the time-integrated concentration of metal in the solution during the DGT deployment period:

B. Calculate the mass of each metal accumulated in the chelex resin-gel layer (M) using equation (1).

(1) $M = Ce\ (V_{acid} + V\ gel)\ /\ fe$

Where Ce is the concentration (ng/mL) of metals in acid used to extract, note: you will need to account for experimental and instrument dilution; V_{acid} is the volume (mL) of the acid used to extract, Vgel is the volume of chelex resin-gel, typically 0.031 mL, and fe is a relative elution factor, typically 0.8 (unitless).

C. The concentration of metal in the solution collected by the DGT (C_{DGT}) can be calculated using equation (2).

(2) $C_{DGT} = M\Delta g/(DtA)$

Where Δg is the thickness of the diffusive gel and filter membrane (typically 0.08 cm for the diffusive gel + 0.025 cm for the filter membrane), D is the diffusive coefficient of metal in the gel (D = E^{-6} cm^2/sec, see table 2), t is the deployment time (sec), and A is the exposure area of the solution deployment unit window (A= 3.14 cm^2).

VI. Documentation Requirements

A. Check http://fses.oregonstate.edu/sop-toc for current version of all required documents.

1. DGT Extraction Bench Sheet

VII. Validation

A. This method has been validated and all applicable documentation is available in the FSES document archive vault in Weniger.

VIII. Safety and Health

A. Consult the SOP safety section before working with acid. Personnel performing this method will adhere to Oregon State University Chemical Hygiene Plan and applicable FSES laboratory safety SOPs.

IX. References

A. Davison, B, and Zhang H., "DGT Research" 2/4/2002, http://www.dgtresearch.com.

B. International Network for Acid Prevention, "Diffusive Gradients in Thin-films (DGT), A Technique for Determining Bioavailable Metal Concentrations" March 2002, http://www.inap.com.au/public_downloads/Research_Projects/Diffusive_Gradients_in_Thin-films.pdf

Figure 1: Assemble DGT units for solution deployment

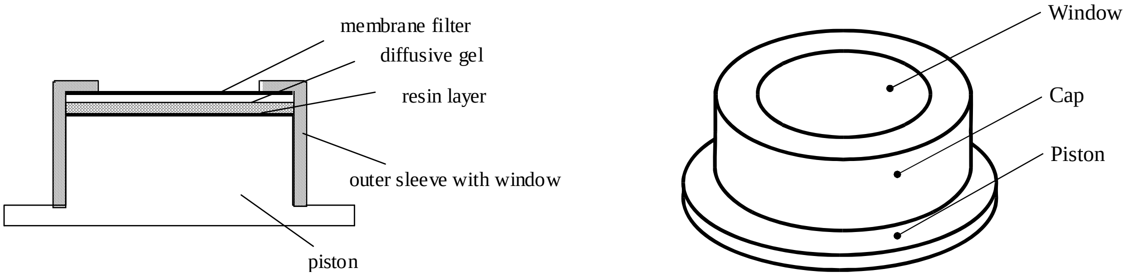

Table 1: Diffusion coefficients (D) of metal ions in DGT gel at different temperatures ranging from 1 to 35°C (D = E^{-6} cm^2/sec)

Temp (ºC)	Ag	Al	Cd	Co	Cr	Cu	Fe	Mn	Ni	Pb	Zn
1	6.58	2.22	2.84	2.77	2.36	2.91	2.85	2.73	2.69	3.75	2.84
2	6.83	2.30	2.95	2.88	2.45	3.02	2.96	2.83	2.80	3.89	2.94
3	7.09	2.39	3.06	2.99	2.54	3.13	3.07	2.94	2.90	4.04	3.05
4	7.35	2.48	3.18	3.10	2.63	3.25	3.18	3.05	3.01	4.19	3.17
5	7.62	2.57	3.29	3.21	2.73	3.36	3.30	3.16	3.12	4.34	3.28
6	7.89	2.66	3.41	3.32	2.82	3.48	3.42	3.27	3.23	4.49	3.40
7	8.17	2.75	3.53	3.44	2.92	3.61	3.54	3.39	3.34	4.65	3.52
8	8.45	2.85	3.65	3.56	3.02	3.73	3.66	3.50	3.46	4.81	3.64
9	8.74	2.94	3.78	3.68	3.13	3.86	3.79	3.62	3.58	4.98	3.77
10	9.04	3.04	3.90	3.80	3.23	3.99	3.91	3.74	3.70	5.14	3.89
11	9.34	3.14	4.03	3.93	3.34	4.12	4.04	3.87	3.82	5.31	4.02
12	9.64	3.25	4.16	4.06	3.45	4.26	4.18	4.00	3.94	5.49	4.15
13	9.95	3.35	4.30	4.19	3.56	4.39	4.31	4.12	4.07	5.67	4.29
14	10.27	3.46	4.43	4.32	3.67	4.53	4.45	4.26	4.20	5.85	4.42
15	10.59	3.57	4.57	4.46	3.79	4.68	4.59	4.39	4.33	6.03	4.56
16	10.92	3.68	4.72	4.60	3.91	4.82	4.73	4.52	4.47	6.21	4.70
17	11.25	3.79	4.86	4.74	4.03	4.97	4.87	4.66	4.60	6.40	4.85
18	11.59	3.90	5.01	4.88	4.15	5.12	5.02	4.80	4.74	6.60	4.99
19	11.93	4.02	5.15	5.02	4.27	5.27	5.17	4.95	4.88	6.79	5.14
20	12.28	4.14	5.30	5.17	4.39	5.42	5.32	5.09	5.02	6.99	5.29
21	12.64	4.26	5.46	5.32	4.52	5.58	5.47	5.24	5.17	7.19	5.44
22	13.00	4.38	5.61	5.47	4.65	5.74	5.63	5.39	5.32	7.40	5.60
23	13.36	4.50	5.77	5.63	4.78	5.90	5.79	5.54	5.47	7.61	5.76
24	13.73	4.62	5.93	5.78	4.91	6.06	5.95	5.69	5.62	7.82	5.92
25	14.11	4.75	6.09	5.94	5.05	6.23	6.11	5.85	5.77	8.03	6.08
26	14.49	4.88	6.26	6.10	5.19	6.40	6.28	6.01	5.93	8.25	6.24
27	14.88	5.01	6.43	6.27	5.32	6.57	6.45	6.17	6.09	8.47	6.41
28	15.27	5.14	6.60	6.43	5.47	6.74	6.62	6.33	6.25	8.69	6.58
29	15.67	5.28	6.77	6.60	5.61	6.92	6.79	6.50	6.41	8.92	6.75
30	16.08	5.41	6.94	6.77	5.75	7.10	6.96	6.66	6.58	9.15	6.92
31	16.49	5.55	7.12	6.94	5.90	7.28	7.14	6.83	6.74	9.39	7.10
32	16.90	5.69	7.30	7.12	6.05	7.46	7.32	7.00	6.91	9.62	7.28
33	17.32	5.83	7.48	7.29	6.20	7.65	7.50	7.18	7.09	9.86	7.46
34	17.75	5.98	7.67	7.47	6.35	7.84	7.69	7.36	7.26	10.10	7.64
35	18.18	6.12	7.85	7.66	6.51	8.03	7.87	7.53	7.44	10.35	7.83

Source: Davison, B, and Zhang H., “DGT Research” 2/4/2002, http://www.dgtresearch.com.

Project #: **Project Description:** **Chemists:**

No	FSES ID	Sample name	chelex transfer to 1.5 mL centrifuge tube	1 mL of 1M HNO_3 added	Vortex	24 hr extraction start date: start time: _______________ end date: end time:	Removal of extractant into receiving container	Comments
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
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22								
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29								
30								
31								
32								
33								
34								
35								

Project #: **Project Description:** **Chemists:**

No	FSES ID	Sample name	chelex transfer to 1.5 mL centrifuge tube	1 mL of 1M HNO_3 added	Vortex	24 hr extraction start date: start time: ______________ end date: end time:	Removal of extractant into receiving container	Comments
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								
51								
52								
53								
54								
55								
56								

Reagent	Company & Lot No.	Expt. Date
Nitric Acid, conc		
18.3Ω.cm H_2O		

Pipette Serial #	Validation date

Extraction

Deployment start date:	
Deployment time (s)	
AVG Temp (^oC)	
Extraction start date:	
Receiving container:	

Analysis

Instrument	
Method name	
Analysis date	
Sequence	

Samples

Storage location	

Chemist Review: ______________________

FSES Director Review: ______________________

Title: Extraction of Diffusive Gradients in Thinfilm (DGT) Passive Sampling Device (PSD) for Total Arsenic

Scope

This method describes the extraction from the diffusive gradients in thinfilm (DGT) sampling device to determine total arsenic. The DGT is an *in situ* passive sampling device (PSD) for the collection of labile, bioavailable, cationic metals in solution. Typical analysis after extraction may include inductively coupled plasma optical emission spectroscopy (ICP/OES), or ICP mass spectrometry (ICP/MS).

Contributors: W.E Hillwalker, A. Perez, K.A. Hobbie

Responsibilities

Staff members involved in performing this work are responsible for reading, understanding and complying with the requirements for this SOP. The Director is responsible for ensuring that the content of this SOP is complied with and that qualified staff performs these analyses. The senior chemists are responsible for informing staff members of the requirements and interpretation of this SOP and are responsible for enforcing this SOP.

Status

This document is considered current standard operating procedure of the Food Safety and Environmental Stewardship Laboratory when management approval is documented by signature below. This Standard Operating Procedure is effective on the date of approval signature and supersedes all previous versions.

Approved	________________ Kim A. Anderson, Ph.D.	**Director** Title	______ Date
Historical File	________________ Signature/Initials		______ Date

I. Equipment and Apparatus

Note: Acid strip (4 N HNO_3 soak) all glassware, containers and glass pipettes before use (see SOP 2110- Laboratory Container Cleaning procedure). The type of chelex gel resin should be properly selected for your analytes of interest.

- **A.** Glass plate
- **B.** Plastic forceps and or glass pasteur pipettes
- **C.** Culture tubes with appropriate volumetric markings
- **D.** Small flathead screwdriver
- **E.** Quart size Ziploc™ bags – or equivalent
- **F.** 1000 uL Pipetman™ – or equivalent
- **G.** DGT solution deployment units equipped with either Fe-oxide or Zr-oxide resin gels (contains a cap with a 3.14 cm^2 window and a base), DGT Research, Ltd – or equivalent

II. DGT Assembly (if required, DGT can be purchased preassembled from DGT Research)

1. See SOP 802 for assembly of DGT. Resin gel will consist of Fe-oxide.

III. DGT Field deployment and retrieval (see SOP 100: Deploying and Retrieving Passive Sampling Devices (PSD) from Aquatic Systems.

IV. Removal of resin gel from the DGT

1. After retrieval, DGT should be stored in sealable plastic bags at 4^{o}C until processing. Ensure that filter and gels do not dry out during storage.
2. To retrieve the resin gel after deployment, insert a screwdriver into the groove in the cap and twist to remove the cap from the base.
    - **a)** The cap and base can be reused. Place in bucket of detergent and clean according to SOP 2110.
    - **b)** Dispose of caps that have a significant crack. Dispose of either base or cap if plastic is yellowing and less flexible.
3. Using glass pipettes or plastic forceps, Remove the filter and diffusive gel layers, leaving the chelex resin-gel. Dispose of filter and diffusive gel in trash.
4. Using clean glass pipettes or plastic forceps, place the chelex resin-gel in culture tube.
    - **a)** This sample can be stored at 4 ^{o}C for later extraction. To ensure chelex gel does not dry out, ~50 μL of 18 MΩ-cm water can be added.

B. Arsenic extraction from resin gel (this step can be scaled up if needed, the extraction solution should cover the resin gel in the extraction vessel)

1. Extraction of Fe-oxide resin gel
    - **a)** Add 2 mL of Concentrated HCl solution to culture tube.
    - **b)** Vortex to ensure the resin-gel is fully immersed in the HCl solution.
    - **c)** Place on orbital shaker at room temperature for 24 hours.
2. After the 24 hour acid extraction, dilute to a final volume with 18 MΩ-cm water and filter through a 0.45 um PVDF filter to remove remaining resin gel.
3. Dilute if necessary prior to analysis.
4. Dispose of the culture tube and the chelex resin-gel.

V. Calculations

A. The following formulas provide the time-integrated concentration of metal in the solution during the DGT deployment period:

B. Calculate the mass of each metal accumulated in the chelex resin-gel layer (M) using equation (1).

(1) $M = Ce (V_{acid} + V\ gel) / fe$

Where Ce is the concentration (ng/mL) of metals in acid used to extract, note: you will need to account for experimental and instrument dilution; V_{acid} is the volume (mL) of the acid used to extract, Vgel is the volume of chelex resin-gel, typically 0.047 mL, and fe is a relative elution factor, typically 0.8 (unitless).

C. The concentration of metal in the solution collected by the DGT (C_{DGT}) can be calculated using equation (2).

(2) $C_{DGT} = M\Delta g/(DtA)$

Where Δg is the thickness of the diffusive gel and filter membrane (typically 0.08 cm for the diffusive gel + 0.025 cm for the filter membrane), D is the diffusive coefficient of metal in the gel (D = E^{-6} cm^2/sec, see table 2), t is the deployment time (sec), and A is the exposure area of the solution deployment unit window (A= 3.14 cm^2).

VI. Documentation Requirements

A. Check http://fses.oregonstate.edu/sop-toc for current version of all required documents.

1. FeOxide DGT Extraction Bench Sheet

VII. Validation

A. This method has been validated and all applicable documentation is available in the FSES document archive vault in Weniger.

VIII. Safety and Health

A. Consult the SOP safety section before working with acid. Personnel performing this method will adhere to Oregon State University Chemical Hygiene Plan and applicable FSES laboratory safety SOPs.

IX. References

A. Davison, B, and Zhang H., “DGT Research” 2/4/2002, http://www.dgtresearch.com.

B. International Network for Acid Prevention, “Diffusive Gradients in Thin-films (DGT), A Technique for Determining Bioavailable Metal Concentrations” March 2002, http://www.inap.com.au/public_downloads/Research_Projects/Diffusive_Gradients_in_Thin-films.pdf

Table 1: Diffusion coefficients (D) of total Arsenic in DGT gel at different temperatures ranging from 1 to 35°C (D = E^{-6} cm^2/sec)

Temp (ºC)	**As**
1	2.77
2	2.88
3	2.99
4	3.10
5	3.22
6	3.33
7	3.45
8	3.57
9	3.69
10	3.82
11	3.95
12	4.08
13	4.22
14	4.35
15	4.49
16	4.64
17	4.78
18	4.92
19	5.07
20	5.22
21	5.37
22	5.53
23	5.69
24	5.84
25	6.00
26	6.16
27	6.33
28	6.49
29	6.66
30	6.83
31	7.00
32	7.17
33	7.34
34	7.52

Source: As D calculated from data determined in reference 1 and based on step-wise differences between Ds for Co, Cd and Mn. Reference 1: Fitz, W. J.; W.W.Wenzel; H. Zhang, J. Nurmi, K. Stipek; Z. Fischerova; P. Schweiger, G. Kollensperger;, L. Q. Ma; G. Stingeder 2003. Rhisosphere characteristics of the arsenic hyperaccumulator Pteris vitta L. and monitoring of phytoremoval efficiency, Environ. Sci. Technol. 37: 5008-5014.

SAM 811
FeOxide DGT Extraction Bench Sheet

Project #: **Project Description:** **Chemists:**

No	FSES ID	Sample name	chelex transfer to culture tube	2 mL of Conc. HCL added	Vortex	24 hr extraction on orbital shaker start date: start time: end date: end time:	Dilute to final vol (mL) and vortex	Filter through 0.45um PVDF filter into recieving container	Comments
1	0	0							
2	0	0							
3	0	0							
4	0	0							
5	0	0							
6	0	0							
7	0	0							
8	0	0							
9	0	0							
10	0	0							
11	0	0							
12	0	0							
13	0	0							
14	0	0							
15	0	0							
16	0	0							
17	0	0							
18	0	0							
19	0	0							
20	0	0							
21	0	0							
22	0	0							
23	0	0							
24	0	0							
25	0	0							
26	0	0							
27	0	0							
28	0	0							
29	0	0							
30	0	0							
31	0	0							
32	0	0							
33	0	0							
34	0	0							

SAM 811
FeOxide DGT Extraction Bench Sheet

Project #: **Project Description:** **Chemists:**

No	FSES ID	Sample name	chelex transfer to culture tube	2 mL of Conc. HCL added	Vortex	24 hr extraction on orbital shaker start date: start time: ________________ end date: end time:	Dilute to final vol (mL) and vortex	Filter through 0.45um PVDF filter into recieving container	Comments
35	0	0							
36	0	0							
37	0	0							
38	0	0							
39	0	0							
40	0	0							
41	0	0							
42	0	0							
43	0	0							
44	0	0							
45	0	0							
46	0	0							
47	0	0							
48	0	0							
49	0	0							
50	0	0							
51	0	0							
52	0	0							
53	0	0							
54	0	0							
55	0	0							
56	0	0							

Reagent	Company & Lot No.	Expt. Date
HCl Acid, conc		
18.3Ω.cm H_2O		

Pipette Serial #	Validation date

Extraction

Deployment start date:	
Deployment time (s)	
AVG Temp (^oC)	
Extraction start date:	
Receiving container:	

Analysis

Instrument	
Method name	
Analysis date	
Sequence	

Samples

Storage location	

Chemist Review: ______________________________

FSES Director Review: ______________________________

Analytical Report for

OSU Food Science - F15-14 MCB 2015

Ag & Life Science Bldg
Room 1007
Corvallis, OR 97331

ASL Report #: P3514
Project ID: 921425.OTC

Attn: Kevin Hobbie

Authorized and Released By:

Laboratory Project Manager
Kathy McKinley
(541) 758-0235 ext.23144
November 30, 2015

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

CH2M - Applied Sciences Laboratory
1100 NE Circle Boulevard, Suite 300
Corvallis, Oregon 97330
www.ch2m.com

ASL Report #: P3514

Sample Receipt Comments

We certify that the test results meet all standard ASL requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
P351401	A150526	10/29/15 08:00	10/30/15
P351402	A150528	10/29/15 08:00	10/30/15
P351403	A150530	10/29/15 08:00	10/30/15
P351404	A150532	10/29/15 08:00	10/30/15
P351405	A150535	10/29/15 08:00	10/30/15
P351406	A150536	10/29/15 08:00	10/30/15
P351407	A150538	10/29/15 08:00	10/30/15
P351408	A150543	10/29/15 08:00	10/30/15
P351409	A150544	10/29/15 08:00	10/30/15
P351410	A150548	10/29/15 08:00	10/30/15
P351411	A150550	10/29/15 08:00	10/30/15
P351412	A150554	10/29/15 08:00	10/30/15
P351413	A150556	10/29/15 08:00	10/30/15
P351414	A150558	10/29/15 08:00	10/30/15
P351415	A150560	10/29/15 08:00	10/30/15
P351416	A150562	10/29/15 08:00	10/30/15
P351417	A150564	10/29/15 08:00	10/30/15
P351418	A150566	10/29/15 08:00	10/30/15
P351419	A150570	10/29/15 08:00	10/30/15
P351420	A150585	10/29/15 08:00	10/30/15
P351421	A150587	10/29/15 08:00	10/30/15
P351422	A150592	10/29/15 08:00	10/30/15
P351423	A150716	10/29/15 08:00	10/30/15
P351424	A150718	10/29/15 08:00	10/30/15
P351425	A150593	10/29/15 08:00	10/30/15

1100 NE Circle Blvd., Suite 300
Corvallis, OR 97330
Tel 541-768-3120 Fax 541-752-0276

CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3514

Project: OSU Food Science **Project #:** 921425.OTC

With the exceptions noted as flags, footnotes, or detailed in the section below; standard operating procedures were followed in the analysis of the samples and no problems were encountered or anomalies observed.

All laboratory quality control samples were within established control limits, with any exceptions noted below, or in the associated QC summary forms.

Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. For diluted samples, the reporting limits are adjusted for the dilution required.

Calculations are performed before rounding to minimize errors in calculated values.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the section below, or in the sample receipt documentation.

Method(s):
E200.8: E200.2, FLDFLT

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
Project Name:	**OSU Food Science**	**Lab Batch ID:**	**P3514**
Date Received:	10/30/15	Report Revision No.:	0
Type:	See C.O.C.		
Matrix:	Water		

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Result	Qual	Units	Date Analyzed
Arsenic: E200.8								
Dissolved Metals								
A150526	P351401F	50	1.50	25.0	49.7		ug/L	11/24/15
A150528	P351402F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150530	P351403F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150532	P351404F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150535	P351405F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150536	P351406F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150538	P351407F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150543	P351408F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150544	P351409F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150548	P351410F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150550	P351411F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150554	P351412F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150556	P351413F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150558	P351414F	50	1.50	25.0	1.65	J	ug/L	11/24/15
A150560	P351415F	50	1.50	25.0	47.7		ug/L	11/24/15
A150562	P351416F	50	1.50	25.0	1.73	J	ug/L	11/24/15
A150564	P351417F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150566	P351418F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150570	P351419F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150585	P351420F	50	1.50	25.0	36.3		ug/L	11/24/15
A150587	P351421F	50	1.50	25.0	36.4		ug/L	11/24/15
A150592	P351422F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150716	P351423F	50	1.50	25.0	1.50	U	ug/L	11/24/15
A150718	P351424F	2	0.060	1.00	0.060	U	ug/L	11/25/15
A150593	P351425F	50	1.50	25.0	1.50	U	ug/L	11/24/15
WB10-1124	WB10-1124	1	0.030	0.50	0.030	U	ug/L	11/24/15
WB10-1125	WB10-1125	1	0.030	0.50	0.030	U	ug/L	11/25/15
WB11-1124	WB11-1124	1	0.030	0.50	0.030	U	ug/L	11/24/15

*=See case narrative
U=Not detected at specified detection limit
E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: **OSU Food Science**

Date Received: 10/30/15
Type: See C.O.C.
Matrix: Water

Lab Information

Lab Batch ID: **P3514**

Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Result	Qual	Units	Date Analyzed
Chromium: E200.8								
Dissolved Metals								
A150718	P351424F	2	0.20	2.00	0.20	U	ug/L	11/25/15
WB10-1125	WB10-1125	1	0.10	1.00	0.10	U	ug/L	11/25/15

*=See case narrative
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E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: OSU Food Science

Date Received: 10/30/15
Type: See C.O.C.
Matrix: Water

Lab Information

Lab Batch ID: P3514

Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Result	Qual	Units	Date Analyzed
Copper: E200.8								
Dissolved Metals								
A150718	P351424F	2	1.00	4.00	1.00	U	ug/L	11/25/15
WB10-1125	WB10-1125	1	0.50	2.00	0.50	U	ug/L	11/25/15

*=See case narrative
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E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: OSU Food Science

Date Received: 10/30/15
Type: See C.O.C.
Matrix: Water

Lab Information

Lab Batch ID: P3514

Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Result	Qual	Units	Date Analyzed
Zinc: E200.8								
Dissolved Metals								
A150718	P351424F	2	5.00	20.0	5.00	U	ug/L	11/25/15
WB10-1125	WB10-1125	1	2.50	10.0	2.50	U	ug/L	11/25/15

*=See case narrative
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E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information		Lab Information	
		Blank Spike ID:	**BS10W1124**
Project Name:	OSU Food Science	Report Revision No:	0
Type:	QC	Dilution Factor:	1
Matrix:	Water		

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Arsenic	20.0	19.0	ug/L	95	E200.8	FLDFLT	11/24/15

*=See case narrative
U=Not detected at specified detection limit
E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: OSU Food Science
Type: QC
Matrix: Water

Lab Information

Blank Spike ID: BS10W1125

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Arsenic	20.0	20.5	ug/L	102	E200.8	FLDFLT	11/25/15
Chromium	20.0	20.2	ug/L	101	E200.8	FLDFLT	11/25/15
Copper	20.0	20.0	ug/L	100	E200.8	FLDFLT	11/25/15
Zinc	20.0	20.6	ug/L	103	E200.8	FLDFLT	11/25/15

*=See case narrative
U=Not detected at specified detection limit
E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: OSU Food Science
Type: QC
Matrix: Water

Lab Information

Blank Spike ID: BS11W1124

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Arsenic	20.0	19.1	ug/L	96	E200.8	FLDFLT	11/24/15

*=See case narrative
U=Not detected at specified detection limit
E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2MHILL Applied Sciences Laboratory
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

Chain of Custody Record

1100 NE Circle Blvd. Suite 300
Corvallis, OR 97330
(541) 768-3120

Client Contact	Analysis Turnaround Time
Project Name: F15-14 MCB 2015	TAT is Calander days
Project # or PO #: ATX028	TAT if different from below ______
Company Name: FSES Program, OSU	☐ 21 days (STD)
Address: 1007 ALS	☐ 14 days * ☐ 3 day *
City/State/Zip: Corvallis, OR 97331	☐ 7 days * ☐ 2 days *
Project Manager: Kevin Hobbie	☐ 5 days * ☐ 1 day *
Phone #: 541-737-1766	
Report to email: kevin.hobbie@oregonstate.edu	* (Surcharges will apply)

Preservation Used / Analysis Requested: ICP-As

For Lab Use Only:
SDG: P3514
Custody Seals intact? ☐ Yes ☒ No
Hand delivered? ☒ Yes ☐ No
Cooler Temp: 20.8 °C
Therm ID No.: 173 Therm Exp. 1/16
Packing Material: Circle Below
Ice Blue Ice Box Bubble Wrap NA
Radiological Screen? ☐ Yes ☒ No

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, Soil, Air)	Total # of Cont.	ICP-As	Sample Specific Notes:	Lab ID:
A150526				DGT		✓		1
~~A150526~~ A150528 KH 10/29/15				↓		↓		2
A150530								3
A150532								4
A150535								5
A150536								6
A150538								7
A150543								8
A150544								9
A150548								10
A150550								11
A150554								12
A150556				↓		↓		13

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ______

Possible Hazard Identification:
Are samples hazardous? ☐ Yes ☐ No
If yes, select hazard(s): ☐ Listed ☐ Ignitable ☐ Corrosive ☐ Reactive ☐ Toxic
If YES or NO is not checked above, samples will be assumed hazardous and hazardous disposal fees will be applied.

Sample Disposal (A fee may be added if samples are retained longer than 30 day per client request, samples are returned to client, or classified as hazardous.)
☒ Return to Client ☐ Disposal by Lab ☐ Archive for ______ months

Sampled By:	Date/Time:	Relinquished by: Kevin Hobbie [signature]	Date/Time: 16:23 10/29/15
Received by:	Date/Time:	Relinquished by:	Date/Time:
Received in Laboratory by: [signature] Castro	Date/Time: 10/30/15 0900	Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☐ Other	Tracking #:

Special Instructions/QC Requirements

DOC CONTROL ID: ASL1001-0011

Chain of Custody Record

1100 NE Circle Blvd. Suite 300
Corvallis, OR 97330
(541) 768-3120

F15-14 Mcb Report 3/29/2016

Client Contact	Analysis Turnaround Time	Preservation Used	For Lab Use Only:
Project Name: F15-14 MCB 2015	TAT is Calander days		SDG: P3514
Project # or PO #: ATX028	TAT if different from below ____	Analysis Requested	Custody Seals intact? ☐ Yes ☒ No
Company Name: FSES Program, OSU	☐ 21 days (STD)	ICP-As	Hand delivered? ☒ Yes ☐ No
Address: 1007 ALS	☐ 14 days * ☐ 3 day *	ICP-Cu, Cr, Zn	Cooler Temp: 20.8 °C
City/State/Zip: Corvallis, OR 97331	☐ 7 days * ☐ 2 days *		Therm ID No.: 173 Therm Exp. 1/16
Project Manager: Kevin Hobbie	☐ 5 days * ☐ 1 day *		Packing Material: Circle Below
Phone #: 541-737-1766	* (Surcharges will apply)		Ice Blue Ice Box Bubble Wrap NA
Report to email: kevin.hobbie@oregonstate.edu			Radiological Screen? ☐ Yes ☒ No

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, Soil, Air)	Total # of Cont.	ICP-As	ICP-Cu, Cr, Zn	Sample Specific Notes:	Lab ID:
A150558				DGT		✓			14
A150560				|		✓			15
A150562				|		✓			16
A150564				|		✓			17
A150566				|		✓			18
A150570				|		✓			19
A150585				|		✓			20
A150587				|		✓			21
A150592				|		✓			22
~~A150593~~ (VE) KM 10/29/15				|		~~✓~~			
A150716	10/29/15			⊥		✓			23
A150718	⊥			Water		✓	✓		24
A150593				DGT		✓			25

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ____

Possible Hazard Identification:
Are samples hazardous? ☐ Yes ☐ No
If yes, select hazard(s): ☐ Listed ☐ Ignitable ☐ Corrosive ☐ Reactive ☐ Toxic
If YES or NO is not checked above, samples will be assumed hazardous and hazardous disposal fees will be applied.

Sample Disposal (A fee may be added if samples are retained longer than 30 day per client request, samples are returned to client, or classified as hazardous.)
☒ Return to Client ☐ Disposal by Lab ☐ Archive for ____ months

Sampled By: Date/Time:
Relinquished by: Kevin Hobbie [signature] Date/Time: 16:23 10/29/15
Received by: Date/Time:
Relinquished by: Date/Time:
Received in Laboratory by: [signature] Castro Date/Time: 10/30/15 0900
Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☐ Other Tracking #:

Special Instructions/QC Requirements

CH2MHILL
Applied Sciences Laboratory (ASL)

Sample Receipt Record

SDG ID: P3514 | Date Received: 10/30/15

Client/Project: OSU Food Science | Received By: PC

Were custody seals intact and on the outside of the cooler?	☐ Yes ☐ No ☑ N/A
Shipping Record:	☑ Hand Delivered ☐ On File ☐ COC
Radiological Screening for DoD	☐ Yes ☐ No ☑ N/A
Packing Material:	☑ Hand Delivered ☐ Ice ☐ Blue Ice ☐ Box
Temp OK? (<6C) Therm ID: TH173 Exp. 1/16 — 20.8 °C	☐ Yes ☐ No ☑ N/A
Was a Chain of Custody (CoC) Provided?	☑ Yes ☐ No ☐ N/A
Was the CoC correctly filled out (If No, document below)	☑ Yes ☐ No ☐ N/A
Did sample labels agree with COC? (If No, document below)	☑ Yes ☐ No ☐ N/A
Did the CoC list a correct bottle count and the preservative types (No=Correct on CoC)	☑ Yes ☐ No ☐ N/A
Were the sample containers in good condition (broken or leaking)?	☑ Yes ☐ No ☐ N/A
Was enough sample volume provided for analysis? (If No, document below)	☑ Yes ☐ No ☐ N/A
Containers supplied by ASL?	☐ Yes ☑ No ☐ N/A
Any sample with < 1/2 holding time remaining? If so contact LPM	☐ Yes ☑ No ☐ N/A
Samples have multi-phase? If yes, document on SRER	☐ Yes ☑ No ☐ N/A
All water VOCs free of air bubbles? No, document on SRER	☐ Yes ☐ No ☑ N/A
pH of all samples met criteria on receipt? If "No", preserve and document below.	☐ Yes ☑ No ☐ N/A
Dissolved/Soluble metals filtered in the field?	☐ Yes ☐ No ☑ N/A
Dissolved/Soluble metals have sediment in bottom of container? If so document below.	☐ Yes ☐ No ☑ N/A

Preservation Adjustment

Sample ID	Reagent	Reagent Lot Number	Volume Added	Initials/Time	24 hour pH check Initials/Time
-24MET1	HNO3	15037D/E5/15/20	10ul	PC/14:00	PC/11-2-15@1025

Did pH of all metals samples preserved upon receipt meet criteria 24 hours after preservation? ☑ Yes ☐ No

Sample Exception Report (The following exceptions were noted)

1. COC did not indicate sampling date or times. Drop off date was used.

Client was notified on: Client contact:

Resolution to Exception:

DOC CONTROL ID: ASL593-0714

Analytical Report for

OSU Food Science - F15-14 MCB 2015

Ag & Life Science Bldg
Room 1007
Corvallis, OR 97331

ASL Report #: P3515
Project ID: 921425.OTC

Attn: Kevin Hobbie

Authorized and Released By:

Laboratory Project Manager
Kathy McKinley
(541) 758-0235 ext.23144
November 30, 2015

This data package meets standards requested by client and is not intended or implied to meet any other standard.

All analyses performed by CH2M HILL are clearly indicated. Any subcontracted analyses are included as appended reports as received from the subcontracted laboratory. The results included in this report only relate to the samples listed on the following Sample Cross-Reference page. This report shall not be reproduced except in full, without the written approval of the laboratory.

Any unusual difficulties encountered during the analysis of your samples are discussed in the attached case narratives.

CH2M – Applied Sciences Laboratory
1100 NE Circle Boulevard, Suite 300
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www.ch2m.com

ASL Report #: P3515

Sample Receipt Comments

We certify that the test results meet all standard ASL requirements.

Sample Cross-Reference

ASL Sample ID	Client Sample ID	Date/Time Collected	Date Received
P351501	A150528	10/29/15 08:00	10/30/15
P351502	A150532	10/29/15 08:00	10/30/15
P351503	A150535	10/29/15 08:00	10/30/15
P351504	A150536	10/29/15 08:00	10/30/15
P351505	A150538	10/29/15 08:00	10/30/15
P351506	A150543	10/29/15 08:00	10/30/15
P351507	A150544	10/29/15 08:00	10/30/15
P351508	A150548	10/29/15 08:00	10/30/15
P351509	A150550	10/29/15 08:00	10/30/15
P351510	A150554	10/29/15 08:00	10/30/15
P351511	A150558	10/29/15 08:00	10/30/15
P351512	A150562	10/29/15 08:00	10/30/15
P351513	A150564	10/29/15 08:00	10/30/15
P351514	A150566	10/29/15 08:00	10/30/15
P351515	A150568	10/29/15 08:00	10/30/15
P351516	A150570	10/29/15 08:00	10/30/15
P351517	A150587	10/29/15 08:00	10/30/15
P351518	A150592	10/29/15 08:00	10/30/15
P351519	A150593	10/29/15 08:00	10/30/15
P351520	A1505717	10/29/15 08:00	10/30/15

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CASE NARRATIVE
METALS ANALYSIS

Lab Name: CH2M HILL ASL **ASL SDG#:** P3515

Project: OSU Food Science **Project #:** 921425.OTC

With the exceptions noted as flags, footnotes, or detailed in the section below; standard operating procedures were followed in the analysis of the samples and no problems were encountered or anomalies observed.

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Method(s):
E200.8: FLDFLT

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: OSU Food Science

Date Received: 10/30/15
Type: See C.O.C.
Matrix: Water

Lab Information

Lab Batch ID: P3515

Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Result	Qual	Units	Date Analyzed
Chromium: E200.8								
Dissolved Metals								
A150528	P351501F	2	0.20	2.00	0.34	J	ug/L	11/24/15
A150532	P351502F	2	0.20	2.00	0.39	J	ug/L	11/24/15
A150535	P351503F	2	0.20	2.00	21.3		ug/L	11/25/15
A150536	P351504F	2	0.20	2.00	3.16		ug/L	11/25/15
A150538	P351505F	2	0.20	2.00	0.36	J	ug/L	11/25/15
A150543	P351506F	2	0.20	2.00	0.47	J	ug/L	11/25/15
A150544	P351507F	2	0.20	2.00	0.28	J	ug/L	11/25/15
A150548	P351508F	2	0.20	2.00	0.53	J	ug/L	11/25/15
A150550	P351509F	2	0.20	2.00	0.31	J	ug/L	11/25/15
A150554	P351510F	2	0.20	2.00	0.35	J	ug/L	11/25/15
A150558	P351511F	2	0.20	2.00	0.34	J	ug/L	11/25/15
A150562	P351512F	2	0.20	2.00	0.32	J	ug/L	11/25/15
A150564	P351513F	2	0.20	2.00	0.93	J	ug/L	11/25/15
A150566	P351514F	2	0.20	2.00	0.31	J	ug/L	11/25/15
A150568	P351515F	2	0.20	2.00	24.2		ug/L	11/25/15
A150570	P351516F	2	0.20	2.00	0.24	J	ug/L	11/25/15
A150587	P351517F	2	0.20	2.00	0.25	J	ug/L	11/25/15
A150592	P351518F	2	0.20	2.00	0.26	J	ug/L	11/25/15
A150593	P351519F	2	0.20	2.00	0.23	J	ug/L	11/25/15
A1505717	P351520F	2	0.20	2.00	0.65	J	ug/L	11/25/15
WB10-1125	WB10-1125	1	0.10	1.00	0.10	U	ug/L	11/25/15
WB11-1124	WB11-1124	1	0.10	1.00	0.10	U	ug/L	11/24/15

*=See case narrative
U=Not detected at specified detection limit
E=Estimated value above calibration range
J=Estimated value below reporting limit

1100 NE Circle Blvd., Suite 300
Corvallis, OR 97330
Tel 541-768-3120 Fax 541-752-0276

CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: OSU Food Science

Date Received: 10/30/15
Type: See C.O.C.
Matrix: Water

Lab Information

Lab Batch ID: P3515

Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Result	Qual	Units	Date Analyzed
Copper: E200.8								
Dissolved Metals								
A150528	P351501F	2	1.00	4.00	5.78		ug/L	11/24/15
A150532	P351502F	2	1.00	4.00	5.40		ug/L	11/24/15
A150535	P351503F	2	1.00	4.00	254		ug/L	11/25/15
A150536	P351504F	2	1.00	4.00	50.2		ug/L	11/25/15
A150538	P351505F	2	1.00	4.00	9.99		ug/L	11/25/15
A150543	P351506F	2	1.00	4.00	8.07		ug/L	11/25/15
A150544	P351507F	2	1.00	4.00	8.19		ug/L	11/25/15
A150548	P351508F	2	1.00	4.00	8.33		ug/L	11/25/15
A150550	P351509F	2	1.00	4.00	7.48		ug/L	11/25/15
A150554	P351510F	2	1.00	4.00	7.81		ug/L	11/25/15
A150558	P351511F	2	1.00	4.00	7.37		ug/L	11/25/15
A150562	P351512F	2	1.00	4.00	6.74		ug/L	11/25/15
A150564	P351513F	2	1.00	4.00	16.0		ug/L	11/25/15
A150566	P351514F	2	1.00	4.00	6.95		ug/L	11/25/15
A150568	P351515F	2	1.00	4.00	10.8		ug/L	11/25/15
A150570	P351516F	2	1.00	4.00	5.70		ug/L	11/25/15
A150587	P351517F	2	1.00	4.00	7.75		ug/L	11/25/15
A150592	P351518F	2	1.00	4.00	1.00	U	ug/L	11/25/15
A150593	P351519F	2	1.00	4.00	1.00	U	ug/L	11/25/15
A1505717	P351520F	2	1.00	4.00	1.00	U	ug/L	11/25/15
WB10-1125	WB10-1125	1	0.50	2.00	0.50	U	ug/L	11/25/15
WB11-1124	WB11-1124	1	0.50	2.00	0.50	U	ug/L	11/24/15

*=See case narrative
U=Not detected at specified detection limit
E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: OSU Food Science

Date Received: 10/30/15
Type: See C.O.C.
Matrix: Water

Lab Information

Lab Batch ID: P3515

Report Revision No.: 0

Client Sample ID	Lab Sample ID	Dilution Factor	DL	RL	Result	Qual	Units	Date Analyzed
Zinc: E200.8								
Dissolved Metals								
A150528	P351501F	2	5.00	20.0	174		ug/L	11/24/15
A150532	P351502F	2	5.00	20.0	32.7		ug/L	11/24/15
A150535	P351503F	2	5.00	20.0	411		ug/L	11/25/15
A150536	P351504F	2	5.00	20.0	573		ug/L	11/25/15
A150538	P351505F	2	5.00	20.0	56.8		ug/L	11/25/15
A150543	P351506F	2	5.00	20.0	70.0		ug/L	11/25/15
A150544	P351507F	2	5.00	20.0	67.6		ug/L	11/25/15
A150548	P351508F	2	5.00	20.0	145		ug/L	11/25/15
A150550	P351509F	2	5.00	20.0	70.9		ug/L	11/25/15
A150554	P351510F	2	5.00	20.0	41.9		ug/L	11/25/15
A150558	P351511F	2	5.00	20.0	239		ug/L	11/25/15
A150562	P351512F	2	5.00	20.0	53.6		ug/L	11/25/15
A150564	P351513F	2	5.00	20.0	66.5		ug/L	11/25/15
A150566	P351514F	2	5.00	20.0	175		ug/L	11/25/15
A150568	P351515F	2	5.00	20.0	169		ug/L	11/25/15
A150570	P351516F	2	5.00	20.0	50.9		ug/L	11/25/15
A150587	P351517F	2	5.00	20.0	536		ug/L	11/25/15
A150592	P351518F	2	5.00	20.0	42.1		ug/L	11/25/15
A150593	P351519F	2	5.00	20.0	55.0		ug/L	11/25/15
A1505717	P351520F	2	5.00	20.0	7.82	J	ug/L	11/25/15
WB10-1125	WB10-1125	1	2.50	10.0	2.50	U	ug/L	11/25/15
WB11-1124	WB11-1124	1	2.50	10.0	2.50	U	ug/L	11/24/15

*=See case narrative
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J=Estimated value below reporting limit

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: OSU Food Science
Type: QC
Matrix: Water

Lab Information

Blank Spike ID: BS10W1125

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Chromium	20.0	20.2	ug/L	101	E200.8	FLDFLT	11/25/15
Copper	20.0	20.0	ug/L	100	E200.8	FLDFLT	11/25/15
Zinc	20.0	20.6	ug/L	103	E200.8	FLDFLT	11/25/15

*=See case narrative
U=Not detected at specified detection limit
E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2M HILL Applied Sciences Laboratory (ASL)

Client Information

Project Name: OSU Food Science
Type: QC
Matrix: Water

Lab Information

Blank Spike ID: BS11W1124

Report Revision No: 0
Dilution Factor: 1

Analyte	Spike Amount	Result	Units	%Recovery	Analysis Method	Prep Method	Date Analyzed
Metals							
Chromium	20.0	19.8	ug/L	99	E200.8	FLDFLT	11/24/15
Copper	20.0	18.6	ug/L	93	E200.8	FLDFLT	11/24/15
Zinc	20.0	19.3	ug/L	96	E200.8	FLDFLT	11/24/15

*=See case narrative
U=Not detected at specified detection limit
E=Estimated value above calibration range
J=Estimated value below reporting limit

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CH2MHILL Applied Sciences Laboratory
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

Chain of Custody Record

1100 NE Circle Blvd Suite 300
Corvallis, OR 97330
(541) 768-3120

Client Contact	Analysis Turnaround Time
Project Name: F15-14 MCB 2015	TAT is Calander days
Project # or PO #: ATX028	TAT if different from below ____
Company Name: FSES Program, OSU	☐ 21 days (STD)
Address: 1007 ALS	☐ 14 days * ☐ 3 day *
City/State/Zip: Corvallis, OR 97331	☐ 7 days * ☐ 2 days *
Project Manager: Kevin Hobbie	☐ 5 days * ☐ 1 day *
Phone #: 541-737-1766	
Report to email: kevin.hobbie@oregonstate.edu	* (Surcharges will apply)

For Lab Use Only:
SDG: P3515
Custody Seals intact? ☐ Yes ☒ No
Hand delivered? ☒ Yes ☐ No
Cooler Temp: 20.8 C
Therm ID No.: 173 Therm Exp. 1/16
Packing Material: Circle Below
Ice Blue Ice Box Bubble Wrap NA
Radiological Screen? ☐ Yes ☒ No

Preservation Used / Analysis Requested

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, Soil, Air)	Total # of Cont.	ICP-Cu, Cr, Zn								Sample Specific Notes:	Lab ID:
A150528				DGT		✓									1
A150532				↓		↓									2
A150535															3
A150536															4
A150538															5
A150543															6
A150544															7
A150548															8
A150550															9
A150554															10
A150558															11
A150562															12
A150564															13

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ____

Possible Hazard Identification:
Are samples hazardous? ☐ Yes ☐ No
If yes, select hazard(s): ☐ Listed ☐ Ignitable ☐ Corrosive ☐ Reactive ☐ Toxic
If YES or NO is not checked above, samples will be assumed hazardous and hazardous disposal fees will be applied.

Sample Disposal (A fee may be added if samples are retained longer than 30 day per client request, samples are returned to client, or classified as hazardous.)
☒ Return to Client ☐ Disposal by Lab ☐ Archive for ____ months

Sampled By:	Date/Time:	Relinquished by: Kevin Hobbie [signature]	Date/Time: 16:23 10/29/15
Received by:	Date/Time:	Relinquished by:	Date/Time:
Received in Laboratory by: [signature] Castro	Date/Time: 10/30/15 0900	Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☐ Other	Tracking #:

Special Instructions/QC Requirements

CH2MHILL Applied Sciences Laboratory
CHAIN OF CUSTODY RECORD
AND AGREEMENT TO PERFORM SERVICES

Chain of Custody Record

1100 NE Circle Blvd, Suite 300
Corvallis, OR 97330
(541) 768-3120
(Overprinted here, partly legible: "File", "Report", "9/2016".)

Client Contact	Analysis Turnaround Time	Preservation Used	For Lab Use Only:
Project Name: F15-14 MCB 2015	TAT is Calander days		SDG: P3515
Project # or PO #: ATX028	TAT if different from below ____	Analysis Requested	Custody Seals intact? ☐ Yes ☒ No
Company Name: FSES Program, OSU	☐ 21 days (STD)		Hand delivered? ☒ Yes ☐ No
Address: 1007 ALS	☐ 14 days * ☐ 3 day *		Cooler Temp 20.8°C
City/State/Zip: Corvallis, OR 97331	☐ 7 days * ☐ 2 days *		Therm ID No.: 173 Therm Exp. 1/16
Project Manager: Kevin Hobbie	☐ 5 days * ☐ 1 day *		Packing Material: Circle Below
Phone #: 541-737-1766	* (Surcharges will apply)		Ice Blue Ice Box Bubble Wrap NA
Report to email: kevin.hobbie@oregonstate.edu			Radiological Screen? ☐ Yes ☒ No

Sample Identification (Limit of 20 characters)	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix (Water, Soil, Air)	Total # of Cont.	ICP-Cu, Cr, Zn									Sample Specific Notes:	Lab ID:
A150566				DGT		↓										14
A150568				↓		↓										15
A150570				↓		↓										16
A150587				↓		↓										17
A150592				↓		↓										18
A150593				↓		↓										19
A150717	10/29/15			↓		↓										20

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ______

Possible Hazard Identification:
Are samples hazardous? ☐ Yes ☐ No
If yes, select hazard(s): ☐ Listed ☐ Ignitable ☐ Corrosive ☐ Reactive ☐ Toxic
If YES or NO is not checked above, samples will be assumed hazardous and hazardous disposal fees will be applied.

Sample Disposal (A fee may be added if samples are retained longer than 30 day per client request, samples are returned to client, or classified as hazardous.)
☒ Return to Client ☐ Disposal by Lab ☐ Archive for ______ months

Sampled By:	Date/Time:	Relinquished by: Kevin Hobbie [signature]	Date/Time: 16:23 10/29/15
Received by:	Date/Time:	Relinquished by:	Date/Time:
Received in Laboratory by: [signature]	Date/Time: 10/30/15 0900	Shipped Via: ☐ UPS ☐ Fed-Ex ☐ USPS ☐ Other	Tracking #:

Special Instructions/QC Requirements

DOC CONTROL ID: ASL1001-0014

CH2MHILL
Applied Sciences Laboratory (ASL)

Sample Receipt Record

SDG ID: P3515 | Date Received: 10/30/15

Client/Project: OSU Food Science | Received By: PC

Were custody seals intact and on the outside of the cooler?	☐ Yes	☐ No	☑ N/A
Shipping Record:	☑ Hand Delivered	☐ On File	☐ COC
Radiological Screening for DoD	☐ Yes	☐ No	☑ N/A
Packing Material: ☑ Hand Delivered	☐ Ice	☐ Blue Ice	☐ Box
Temp OK? (<6C) Therm ID: TH173 Exp. 1/16 — 20.8 °C	☐ Yes	☐ No	☑ N/A
Was a Chain of Custody (CoC) Provided?	☑ Yes	☐ No	☐ N/A
Was the CoC correctly filled out (If No, document below)	☑ Yes	☐ No	☐ N/A
Did sample labels agree with COC? (If No, document below)	☑ Yes	☐ No	☐ N/A
Did the CoC list a correct bottle count and the preservative types (No=Correct on CoC)	☑ Yes	☐ No	☐ N/A
Were the sample containers in good condition (broken or leaking)?	☑ Yes	☐ No	☐ N/A
Was enough sample volume provided for analysis? (If No, document below)	☑ Yes	☐ No	☐ N/A
Containers supplied by ASL?	☐ Yes	☑ No	☐ N/A
Any sample with < 1/2 holding time remaining? If so contact LPM	☐ Yes	☑ No	☐ N/A
Samples have multi-phase? If yes, document on SRER	☐ Yes	☑ No	☐ N/A
All water VOCs free of air bubbles? No, document on SRER	☐ Yes	☐ No	☑ N/A
pH of all samples met criteria on receipt? If "No", preserve and document below.	☑ Yes	☐ No	☐ N/A
Dissolved/Soluble metals filtered in the field?	☐ Yes	☐ No	☑ N/A
Dissolved/Soluble metals have sediment in bottom of container? If so document below.	☐ Yes	☐ No	☑ N/A

Preservation Adjustment

Sample ID	Reagent	Reagent Lot Number	Volume Added	Initials/Time	24 hour pH check Initials/Time

Did pH of all metals samples preserved upon receipt meet criteria 24 hours after preservation? ☐ Yes ☐ No

Sample Exception Report (The following exceptions were noted)

Client was notified on: Client contact:

Resolution to Exception:

DOC CONTROL ID: ASL593-0714

Venue Name:	Food Safety & Environmental Stewardship Lab
Address:	Ag & Life Science Bldg, Room 1007
Phone:	(541)737-1766

COC#/Notes: N/A

Case Number:	15OCT06-01

FSES PSD Login

FSES Sample Number	Sample Name	Client/Project	Deploy Date	Retrieve Date	Sampled By	Type/size of contatiner, Vol. Received, Condition upon receipt	Sample Matrix, # of PSD's, Spike Sol.	Test Requested	FSES Storage Location, Condition	Received Date	Received By
A150525	MBSWPE1015-A (MCB A)	DEQ	2015-09-15	10/6/2015 8:38:00 AM	JM	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150526	MBSWDGT1015-A (MCB A)	DEQ	2015-09-15	10/6/2015 8:38:00 AM	JM	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150527	MBSWPE1015-B (MCB B)	DEQ	2015-09-15	10/6/2015 8:20:00 AM	CD	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150528	MBSWDGT1015-B (MCB B)	DEQ	2015-09-15	10/6/2015 8:20:00 AM	CD	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150529	MBIAPE1015-B (MCB B)	DEQ	2015-09-15	10/6/2015 8:20:00 AM	CD	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150530	MBIADGT1015-B (MCB B)	DEQ	2015-09-15	10/6/2015 8:20:00 AM	CD	LDPE Bag, N/A, chelex100 DGT filter possibly compromised	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150531	MBSWPE1015-C (MCB C)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150532	MBSWDGT1015-C (MCB C)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150533	MBIAPE1015-C (MCB C)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150534	MBIAPE1015-C-Dup (MCB C)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150535	MBIADGT1015-C (MCB C)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	LDPE Bag, N/A, good	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie

FSES PSD Login

Case Number: 15OCT06-01

FSES Sample Number	Sample Name	Client/Project	Deploy Date	Retrieve Date	Sampled By	Type/size of contatiner, Vol. Received, Condition upon receipt	Sample Matrix, # of PSD's, Spike Sol.	Test Requested	FSES Storage Location, Condition	Received Date	Received By
A150536	MBIADGT1015-C-Dup (MCB C)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	LDPE Bag, N/A, good	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150537	MBSWPE1015-D (MCB D)	DEQ	2015-09-15	10/6/2015 1:54:00 PM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150538	MBSWDGT1015-D (MCB D)	DEQ	2015-09-15	10/6/2015 1:54:00 PM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150539	MBIAPE1015-D (MCB D)	DEQ	2015-09-15	10/6/2015 1:54:00 PM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150540	MBIADGT1015-D (MCB D)	DEQ	2015-09-15	10/6/2015 1:54:00 PM	KAH	LDPE Bag, N/A, both DGT filters possibly compromised	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150541	MBSWPE1015-E (MCB E)	DEQ	2015-09-15	10/6/2015 1:42:00 PM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150542	MBSWPE1015-E-Dup (MCB E)	DEQ	2015-09-15	10/6/2015 1:42:00 PM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150543	MBSWDGT1015-E (MCB E)	DEQ	2015-09-15	10/6/2015 1:42:00 PM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150544	MBSWDGT1015-E-Dup (MCB E)	DEQ	2015-09-15	10/6/2015 1:42:00 PM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150545	MBIAPE1015-E (MCB E)	DEQ	2015-09-15	10/6/2015 1:42:00 PM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150546	MBIADGT1015-E (MCB E)	DEQ	2015-09-15	10/6/2015 1:42:00 PM	KAH	LDPE Bag, N/A, good	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150547	MBSWPE1015-F (MCB 13-SW)	DEQ	2015-09-15	10/6/2015 10:03:00 AM	HD	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150548	MBSWDGT1015-F (MCB 13-SW)	DEQ	2015-09-15	10/6/2015 10:03:00 AM	HD	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie

FSES PSD Login

Case Number: 15OCT06-01

FSES Sample Number	Sample Name	Client/Project	Deploy Date	Retrieve Date	Sampled By	Type/size of contatiner, Vol. Received, Condition upon receipt	Sample Matrix, # of PSD's, Spike Sol.	Test Requested	FSES Storage Location, Condition	Received Date	Received By
A150549	MBSWPE1015-G (MCB G)	DEQ	2015-09-15	10/6/2015 1:02:00 PM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150550	MBSWDGT1015-G (MCB G)	DEQ	2015-09-15	10/6/2015 1:02:00 PM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150551	MBIAPE1015-G (MCB G)	DEQ	2015-09-15	10/6/2015 1:02:00 PM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150552	MBIADGT1015-G (MCB G)	DEQ	2015-09-15	10/6/2015 1:02:00 PM	KAH	LDPE Bag, N/A, Chelex100 filter possibly compromised	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150553	MBSWPE1015-H (MCB H)	DEQ	2015-09-15	10/6/2015 1:25:00 PM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150554	MBSWDGT1015-H (MCB H)	DEQ	2015-09-15	10/6/2015 1:25:00 PM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150555	MBIAPE1015-H (MCB H)	DEQ	2015-09-15	10/6/2015 1:25:00 PM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150556	MBIADGT1015-H (MCB H)	DEQ	2015-09-15	10/6/2015 1:25:00 PM	KAH	LDPE Bag, N/A, good	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150557	MBSWPE1015-I (MCB I)	DEQ	2015-09-15	10/6/2015 12:15:00 PM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150558	MBSWDGT1015-I (MCB I)	DEQ	2015-09-15	10/6/2015 12:15:00 PM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150559	MBIAPE1015-I (MCB I)	DEQ	2015-09-15	10/6/2015 12:15:00 PM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150560	MBIADGT1015-I (MCB I)	DEQ	2015-09-15	10/6/2015 12:15:00 PM	KAH	LDPE Bag, N/A, good	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150561	MBSWPE1015-J (MCB J)	DEQ	2015-09-15	10/6/2015 11:10:00 AM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie

FSES PSD Login

Case Number: 15OCT06-01

FSES Sample Number	Sample Name	Client/Project	Deploy Date	Retrieve Date	Sampled By	Type/size of contatiner, Vol. Received, Condition upon receipt	Sample Matrix, # of PSD's, Spike Sol.	Test Requested	FSES Storage Location, Condition	Received Date	Received By
A150562	MBSWDGT1015-J (MCB J)	DEQ	2015-09-15	10/6/2015 11:10:00 AM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150563	MBIAPE1015-J (MCB J)	DEQ	2015-09-15	10/6/2015 11:10:00 AM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150564	MBIADGT1015-J (MCB J)	DEQ	2015-09-15	10/6/2015 11:10:00 AM	KAH	LDPE Bag, N/A, good	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150565	MBSWPE1015-K (MCB K)	DEQ	2015-09-15	10/6/2015 11:40:00 AM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150566	MBSWDGT1015-K (MCB K)	DEQ	2015-09-15	10/6/2015 11:40:00 AM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150567	MBIAPE1015-K (MCB K)	DEQ	2015-09-15	10/6/2015 11:40:00 AM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150568	MBIADGT1015-K (MCB K)	DEQ	2015-09-15	10/6/2015 11:40:00 AM	KAH	LDPE Bag, N/A, good	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150569	MBSWPE1015-L (MCB L)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150570	MBSWDGT1015-L (MCB L)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150571	MBIAPE1015-L (MCB L)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150572	MBIADGT1015-L (MCB L)	DEQ	2015-09-16	10/6/2015 3:20:00 PM	KAH	LDPE Bag, N/A, visible sediment in both DGT caps	PSD-Pore Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150573	MBSWPE1015-5 (MCB 5)	DEQ	2015-09-15	10/6/2015 9:00:00 AM	CD	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150574	MBIAPE1015-5 (MCB 5)	DEQ	2015-09-15	10/6/2015 9:00:00 AM	CD	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie

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FSES Sample Number	Sample Name	Client/Project	Deploy Date	Retrieve Date	Sampled By	Type/size of contatiner, Vol. Received, Condition upon receipt	Sample Matrix, # of PSD's, Spike Sol.	Test Requested	FSES Storage Location, Condition	Received Date	Received By
A150575	MBSAPE1015-5 (MCB 5)	DEQ	2015-09-15	10/6/2015 9:00:00 AM	CD	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150576	MBSWPE1015-12 (MCB 12-SW)	DEQ	2015-09-15	10/6/2015 9:38:00 AM	HD	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150577	MBIAPE1015-12 (MCB 12)	DEQ	2015-09-15	10/6/2015 9:38:00 AM	HD	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150578	MBSAPE1015-12 (MCB 12)	DEQ	2015-09-15	10/6/2015 9:38:00 AM	HD	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150579	MBIAPE1015-13 (MCB 13)	DEQ	2015-09-15	10/6/2015 10:06:00 AM	HD	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150580	MBSAPE1015-13 (MCB 13)	DEQ	2015-09-15	10/6/2015 10:06:00 AM	HD	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150581	MBSWPE1015-16 (MCB 16)	DEQ	2015-09-16	10/6/2015 10:52:00 AM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150582	MBIAPE1015-16 (MCB 16)	DEQ	2015-09-16	10/6/2015 10:52:00 AM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150583	MBSAPE1015-16 (MCB 16)	DEQ	2015-09-16	10/6/2015 10:52:00 AM	KAH	Amber Glass, N/A, good	PSD-Pore Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150584	MBSWPE1015-1 (MCB 1)	DEQ	2015-09-16	10/6/2015 9:45:00 AM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150585	MBSWDGT1015-1 (MCB 1)	DEQ	2015-09-16	10/6/2015 9:45:00 AM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Cdgt, ICP - Metals CH2MHILL	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150586	MBSWPE1015-27 (MCB 27)	DEQ	2015-09-16	10/6/2015 10:00:00 AM	KAH	Amber Glass, N/A, good	PSD-Water, 1, COM-1139	LDPE Dialysis, LDPE Post Deployment Cleaning, GC-QQQ - 55 PAHs, PAHs LDPE Water Cfree, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150587	MBSWDGT1015-27 (MCB 27)	DEQ	2015-09-16	10/6/2015 10:00:00 AM	KAH	LDPE Bag, N/A, good	PSD-Water, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL, ICP - Cdgt	N/A, Refrigerated ~4C	10/6/2015 6:00:00 PM	Kevin Hobbie

FSES PSD Login

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FSES Sample Number	Sample Name	Client/Project	Deploy Date	Retrieve Date	Sampled By	Type/size of contatiner, Vol. Received, Condition upon receipt	Sample Matrix, # of PSD's, Spike Sol.	Test Requested	FSES Storage Location, Condition	Received Date	Received By
A150588	Deploy Trip Blk	DEQ	2015-09-15	9/16/2015 12:00:00 AM	KAH	Amber Glass, N/A, good	PSD-QC, 1, COM-1139	LDPE Dialysis, GC-QQQ - 55 PAHs, GC-QQQ - PCP	N/A, Frozen ~-20C	9/16/2015 6:00:00 PM	Kevin Hobbie
A150589	Deploy Field Blk (MCB 12)	DEQ	2015-09-15	9/16/2015 12:00:00 AM	KAH	Amber Glass, N/A, good	PSD-QC, 1, COM-1139	LDPE Dialysis, GC-QQQ - 55 PAHs, GC-QQQ - PCP	N/A, Frozen ~-20C	9/16/2015 6:00:00 PM	Kevin Hobbie
A150590	Retr Trip Blk	DEQ	2015-10-06	10/6/2015 12:00:00 AM	KAH	Amber Glass, N/A, good	PSD-QC, 1, COM-1139	LDPE Dialysis, GC-QQQ - 55 PAHs, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150591	Retr Field Blk (MCB B)	DEQ	2015-10-06	10/6/2015 12:00:00 AM	KAH	Amber Glass, N/A, good	PSD-QC, 1, COM-1139	LDPE Dialysis, GC-QQQ - 55 PAHs, GC-QQQ - PCP	N/A, Frozen ~-20C	10/6/2015 6:00:00 PM	Kevin Hobbie
A150592	Deploy DGT Trip Blk	DEQ	2015-09-15	9/16/2015 12:00:00 AM	KAH	LDPE Bag, N/A, good	PSD-QC, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL	N/A, Refrigerated ~4C	9/16/2015 6:00:00 PM	Kevin Hobbie
A150593	Retr DGT Trip Blk	DEQ	2015-10-06	9/16/2015 12:00:00 AM	KAH	LDPE Bag, N/A, good	PSD-QC, 2, N/A	DGT Chelex 100 Digestion, DGT FeOxide Digestion, ICP - Metals CH2MHILL	N/A, Refrigerated ~4C	9/16/2015 6:00:00 PM	Kevin Hobbie

APPENDIX B2
EPA Dive Report for Surface, Inter-armoring, and Sub-armoring Water Sampling

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

DIVE REPORT – November 2, 2015

From: **Chad Schulze, Deputy Unit Diving Officer, Divemaster**
Rob Rau, Divemaster

Through: **Sean Sheldrake, Unit Diving Officer**

Dates of dives: September 15 – 16 and
October 6, 2015

To: **Anne Christopher, Office of Environmental Cleanup**
Scott Manzano, Oregon Department of Environmental Quality
Mark Filippini, Unit Manager, Environmental Services Unit, OEA
Ann Williamson, Acting OEA Director

Project: **McCormick and Baxter Superfund Site, 5 Year Review Performance Monitoring Study**
Requested by: **EPA Region 10 - Office of Environmental Cleanup/ Oregon Department of Environmental Quality**

Site Acct code: 10P900 T 303DD2 10P9RA00 RA
Local Waterbody: Willamette River, Portland, Oregon
General Location: 45.57783 -122.74368

Scientific Diving Purpose: The Region 10 Dive Unit supported the Office of Environmental Cleanup and the Oregon Department of Environmental Quality by conducting underwater sampling for the McCormick and Baxter Superfund Site (M&B) 5 year review sediment cap performance monitoring study. This study was undertaken to determine if the remedy is functional and performing as designed (Record of Decision (ROD) criteria) and if the remedy is protective of current Human Health and the Environment based on Ecological Ambient Water Quality Criteria (AWQC).

Detailed Scientific Objectives:

Divers placed and retrieved Polyethylene (PE) and Diffuse Gradient Thin (DGT) film sampling devices at 11 locations around the M&B cap. The sampling locations were divided into two sets, “Compliance Monitoring Locations” and “Early Warning Sampling Locations.” Divers placed surface water and inter-armoring sampling devices at the Compliance Monitoring Locations, and surface water, inter-armoring, and sub-armoring sampling devices at the Early Warning Sampling Locations. **Figure** 1 shows the proposed sampling locations and the actual sampling locations visited during sample deployment. As illustrated by the figure, most of the probes were placed on or very near to the proposed site location. The location of Site D was intentionally modified due to shallow water.

Both the *Monitor* and *Wooldive* were on site during sample deployment and retrieval. The dive operations were managed from the Monitor while the *Wooldive* prepared the probes and marker buoys, set the samples at the proposed coordinates and retrieved and processed the samples. Representatives from Oregon Department of Environmental Quality (DEQ), GSI Water Solutions (GSI) and Oregon State University (OSU) preformed the work on the *Wooldive.*

Deployment:

Figure 1. Proposed and actual sampling locations at McCormick and Baxter.

As stated in the August 11, 2015, M&B Dive Plan, the cap is principally made of two layers, the armoring layer (up to 1 foot in depth) and the sand cap layer (up to 2 feet in depth). The armoring layer encountered during diving was generally 6 to 10 inch minus angular cobble. Divers placed inter-armoring and sub-armoring sampling devices within the cap at specific depths. Inter armoring sample probes were placed approximately 10 – 11 inches into the cap so that the perforated section of the probes were 3 to 9 inches into the armoring. The divers ensured that the top of the probes were essentially flush with the surface of the armoring. For the two Early Warning Sampling Locations (5 and 16), divers hammered the sub-armoring probes to a depth of approximately 21 inches. Again, the probe was inserted until the top of the probe was flush with the surface of the armoring (see **Figure 2**).

Dive Details:

For detailed descriptions of each site location see **Table 1.** For dive statistics see **Table 2.**

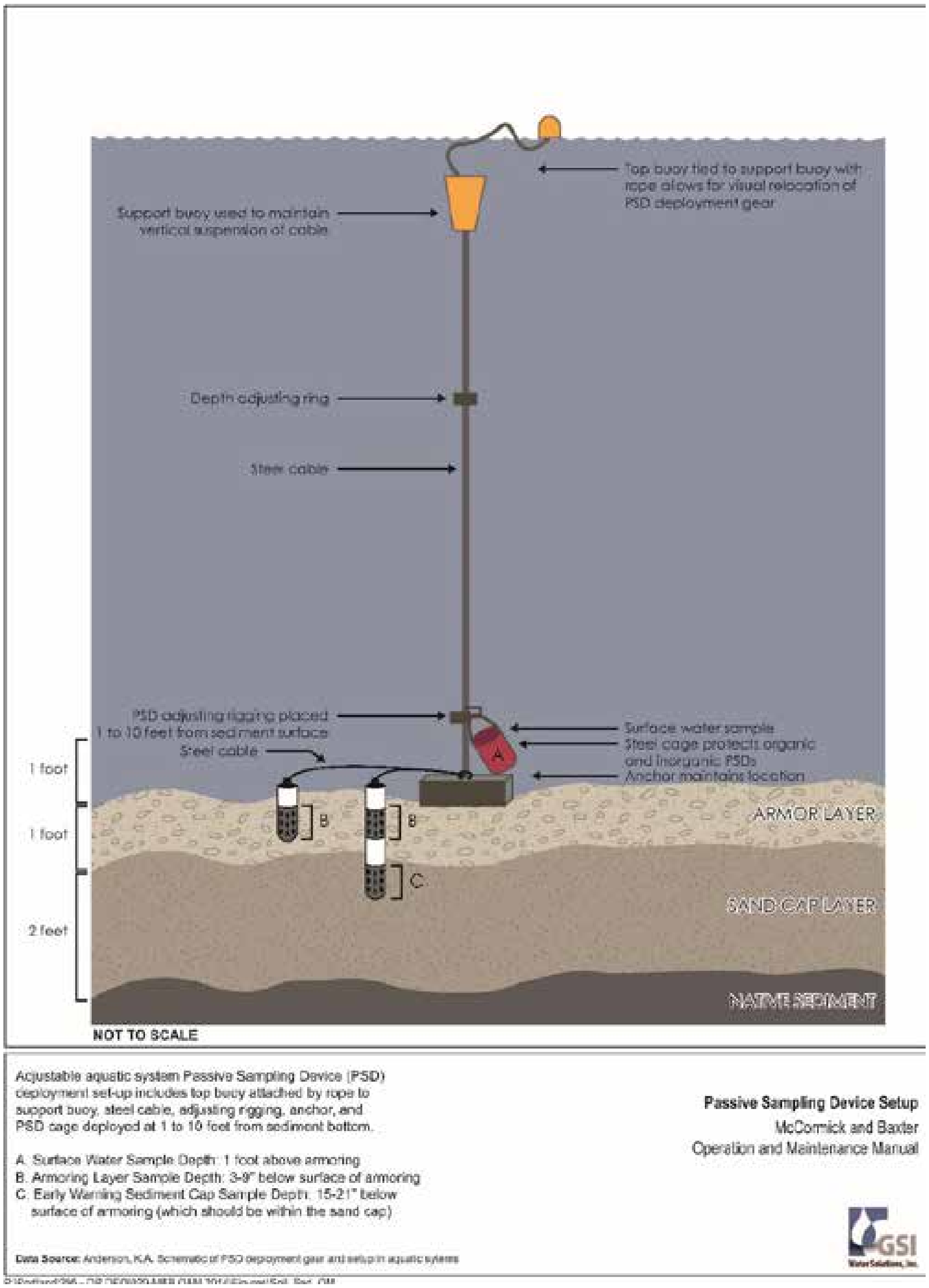

Figure 2. Passive Sampling Device set-up.

Station ID	Station Type	Diver Depth at Deployment (FFW)	Diver	Station Description	
5	Early Warning	5	BR	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- 4" of silt and sand - No armoring - Level - 190˚@ 2' from anchor, top of probe flush with sediment - Non noted
16	Early Warning	41	AH	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- 1" to 2" of silt on top of armoring - 4" to 6" minus rock, [X] thickness - 5˚ - 270˚ @ 1' from anchor, top of probe flush with armoring - Non noted
C (DUP)	Compliance	10	BR	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- 0.08" (2 mm) of brown, dead algae - Large 6" to 12" rock, did not reach bottom of armoring - 45˚ - 190˚ @ 2' from anchor, probe wedged down in armoring - Non noted
D (MOD)	Compliance	13	SS	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- 0.08" (2 mm) of silt on top of armoring - 6" to 10" rock, then 1/2", armoring thickness unknown - 10˚ - 270˚ @ 1' from anchor, top of probe flush with armoring - fresh water clam shells
E	Compliance	13	SS	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- Light silt on top of armoring - 6" to 10" rock, then 1/2" plus sand, thickness unknown - 20˚ - 270˚ @ 1' from anchor, top of probe flush with armoring - fresh water clam shells
G	Compliance	26	AH	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- 1/4" or less of silt on top of armoring - [X]" rock, [X] thickness - Level - 270˚ @ 1' from anchor, top of probe flush with armoring - fresh water clam shells
H	Compliance	18	SS	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- Trace of silt ontop of armoring - 6" to 10" rock, then 1/2" plus sand, thickness unknown - Level - 270˚ @ 1' from anchor, top of probe flush with armoring - fresh water clam shells
I (DUP)	Compliance	38	AH	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- 6" or less of silt ontop of armoring - [X]" rock, [X] thickness - Level - 270˚ @ 1' from anchor, top of probes flush with armoring - Non Noted
J	Compliance	20	AC	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- Thin film of silt on top of armoring - 6" to 10" rock, 10" to 11" thick - 15˚ - 270˚ @ 1' from anchor, top of probe flush with armoring - Briefly saw fish ... possibly a bass
K	Compliance	16	AC	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- Thin layer of silt on top of armoring - 6" to 10" rock, hit sand quickly, armoring may be thin - 15˚ - 270˚ @ 1' from anchor, top of probe flush with armoring - Non noted
L	Compliance	5	CS	- Sedimentation: - Armoring: - Slope: - Probe Position: - Benthic Life:	- 2" layer of silt/sand/algae on top of armoring - 6" rock, armoring only 6" thick - Level - ~270˚ @ 1' from anchor, top of probes flush with armoring - Non noted

Table 1. Site depths and descriptions (Text in red notes missing data due to the diver not being able to dig below the full extent of the layer). See **Attachment 1** for full site descriptions.

Dive Project	Type of Dive	Date	Dive Seq#	Diver	Max Depth (ft)	Start Time	End Time	Bottom Time (min)	Comments
McCormick & Baxter	WK	9/15/2015	1	SS	13	10:35	10:45	10	**Site E: Placed inter armor probe and checked surf---ace water cage**
McCormick & Baxter	WK	9/15/2015	2	SS	13	11:05	11:29	24	**Site D (mod): Placed inter armor probe and checked surface water cage**
McCormick & Baxter	WK	9/15/2015	3	SS	18	11:44	11:52	8	**Site H: Placed inter armor probe and checked surface water cage**
McCormick & Baxter	WK	9/15/2015	4	AH	26	12:49	13:06	17	**Site G: Placed inter armor probe and checked surface water cage**
McCormick & Baxter	WK	9/15/2015	5	AH	38	13:30	13:53	23	**Site I: Placed two (DUP) inter armor probes and checked surface water cage**
McCormick & Baxter	WK	9/15/2015	6	AC	20	14:30	14:45	15	**Site J: Placed inter armor probe and checked surface water cage**
McCormick & Baxter	WK	9/15/2015	7	AC	16	15:03	15:12	9	**Site K: Placed inter armor probe and checked surface water cage**
McCormick & Baxter	WK	9/16/2015	1	BR	10	9:17	9:22	5	**Prep for Sites C and #5, check mask and weight**
McCormick & Baxter	WK	9/16/2015	2	BR	5	9:33	10:00	27	**Site C: Placed two (DUP) inter armor probes and checked surface water cage. Site #5: Placed inter armor/sub armor probe and checked surface water cage**
McCormick & Baxter	WK	9/16/2015	3	CS	5	10:59	11:13	14	**Site L: Placed inter armor probe and checked surface water cage**
McCormick & Baxter	WK	9/16/2015	4	AH	41	11:57	12:33	36	**Site #16: Placed inter armor/sub armor probe and checked surface water cage**
McCormick & Baxter	TD	9/16/2015	5	AC	42	13:05	13:06	11	**Attempted to video Site #16 but current too strong. Explored bottom substrate near site.**
McCormick & Baxter	WK	10/6/15	1	JM	35	10:30	10:42	12	**Site #16 Retrieval**
McCormick & Baxter	WK	10/6/15	2	JM	20	10:55	11:02	7	**Site J Retrieval**
McCormick & Baxter	WK	10/6/15	3	AC	15	11:31	11:35	4	**Site K Retrieval**
McCormick & Baxter	WK	10/6/15	4	AC	37	11:52	11:58	6	**Site I Retrieval**
McCormick & Baxter	WK	10/6/15	5	AB	27	12:37	12:40	3	**Site G Retrieval**
McCormick & Baxter	WK	10/6/15	6	AB	18	12:50	1:02	12	**Site H Retrieval**
McCormick & Baxter	WK	10/6/15	7	RR	15	1:31	1:35	4	**Site E Retrieval**
McCormick & Baxter	WK	10/6/15	8	RR	14	1:49	1:53	5	**Site D Retrieval**
McCormick & Baxter	WK	10/6/15	9	RR	6	3:11	3:26	15	**Site D Retrieval**
McCormick & Baxter	WK	10/6/15	1	RR	24	9:30	9:48	18	**Willamette Cove Visual Survey: East -West**
McCormick & Baxter	WK	10/6/15	2	AB	32	10:06	10:18	12	**Willamette Cove Visual Survey: South-North**

Table 2. Dive Statistics for probe deployment and retrieval.

Retrieval:

Retrieval of all Compliance Monitoring and Early Warning probes took place on October 6, 2015. As with the deployment, dive operations were conducted from the *Monitor* while sample processing chain-of-custody work took place on the *Wooldive*. Marker buoys at each of the 11 sampling locations were still in place from the deployment which allowed for the quick location and identification of each sample station. Once on location, divers deployed a three-point anchoring system (1 on the bow and 2 on each stern corner) to keep the *Monitor* on station. Divers descended the buoy line to the bottom where all elements of each station (probes, surface samplers, anchor blocks & buoy lines) were all connected together with line. Divers captured video of the site, manually pulled up each probe and backfilled the hole with cobbles from the armoring, then returned to the surface. Once the diver was back onboard the *Monitor*, support crew aboard the *Wooldive* pulled up all sampling devices for processing. The *Wooldive* was live boating throughout all dive operations. The sub-armoring probe at Early Warning Location 16 was removed with the slide hammer, while Early Warning Location 5 was removed from shore by technicians wearing hip waders. Other shallow probe locations such as Compliance Monitoring Stations D and E were removed at high tide which occurred at 2:00 PM (Morrison Street Bridge Station). Scott Manzano/DEQ and Erin Carroll Hughes/GSI Water Solutions were on board to watch live video feed of the sampler in-situ before their removal. Unfortunately, the drop camera videos did not save properly and could not be recovered.

Willamette Cove Visual Bottom Survey:

At the request of DEQ, the R10 Dive Unit was asked to conduct a reconnaissance bottom survey of Willamette Cove located immediately down river and adjacent to the M&B if time allowed. Since probe retrieval was completed in a single day on October 6, it was agreed that this survey would be conducted on the morning of October 7. Initially, the Monitor completed side scan sonar surveys of the area and identified two major areas of bottom debris: 1) an area of sunken logs on the downstream end of the cove and towards the channel next to the permanent marker buoy; and, 2) a nearshore area that appeared to be concrete and metal debris adjacent to the old pier and the large metal object on the shore. Surface supplied dives were conducted in each of these two areas, and were videotaped using hand-held, tray mounted, GoPro cameras with Sola lights. With the *Monitor* anchored at coordinate location N45.57961, W122.74676, the first survey dive was conducted from east to west while the second dive was from south to north. Unfortunately, due to visibility at or near zero in the mud bottom cove, the results of these visual surveys were largely inconclusive. In order to assess bottom debris in Willamette Cove, it is recommended that a detailed GPS enabled side scan survey be conducted in the area. Utilizing the ROV might be a good method to further survey the site.

--

<u>PERSONNEL</u>

Divemaster: **9/14/2015 –** Chad Schulze
10/5/2015 – Rob Rau

Divers: **9/14/2015 –** Sean Sheldrake, Annie Christopher, Alan Humphrey (ERT),
10/5/2015 - Annie Christopher, Adam Baron, Jon McBurney (ERT),

Cox'n: **9/14/2015 –** Brent Richmond/ Dino Marshalonis
10/5/2015 – Chris Castner/ Eric Peterson

Backup Diver: **9/14/2015 –** Rob Pedersen
10/5/2015 – Kris Leefers

Hazards and Hazard Management: The biggest hazard during the project was entanglement. Entanglement hazards were mitigated by the divemaster discussing hand and body positioning throughout the dive so the divers could keep entanglement prone areas clear of lines (e.g., tank yokes). Also, a single diver was used on surface supplied air with integrated air, communication and pneumatic lines to reduce entanglement hazards.

Exposures: (Temperature/Chemical/Biological): None noted. Water temperature was in the high 60’s to low 70’s and even though the site is known to have creosote, PAHs, PCBs, and phthalates in sediment nearby, no contamination was observed.

Diver /Equipment Issues:

1. AGA #14 had a slight leak near the nose cover assembly between mask and visor area. CS noted debris between mask and visor and removed the mask from service. Mask/visor interface needs through cleaning. CS Completed 9/22/2015.
2. Both EGS bottles needed hydro’s and vip’s. SS brought to shop. CS picked up and AB/RR reassembled EGS system prior to retrieval dives. Completed 10/5/2015.

3. Deployment tanks (6) dropped off, filled and picked-up. Completed 9/21/2015
4. AB tore the latex face seal on his dry suit
5. AB's umbilical air was accidentally shut-off during his dive. This issue will be written-up in a separate report and be throughly discussed in a Dive Unit meeting scheduled for November 10, 2015.
6. RR ditched weight belt in shallow water at Station D and was unable to retrieve it. This won't be replaced as all weight belts stored at the lab will be relegated to spares inventory when surface supply EGS bottles are changed out to steel 72s. Divers will then go back to using their own personal weight belts for all diving modes.

First Aid Supplies Expended: None

Decontamination: Potable water rinse conducted for gear upkeep.

Follow-up to Issues (diver initials then task**)**:

1. The SS Control Box needs a new gel cell battery. BR to Complete
2. BR suit patch (at the left knee) and new hood. BR to Complete
3. RR to bring AB dry suit to UWS for repair

Photos:

Figure 3. Diver Brent Richmond enters the water to place the inter-armoring and sub-armoring probes at sites C and 5.

Figure 4. Diver Chad Schulze walks over a sand bar to place an inter-armoring probe at site L.

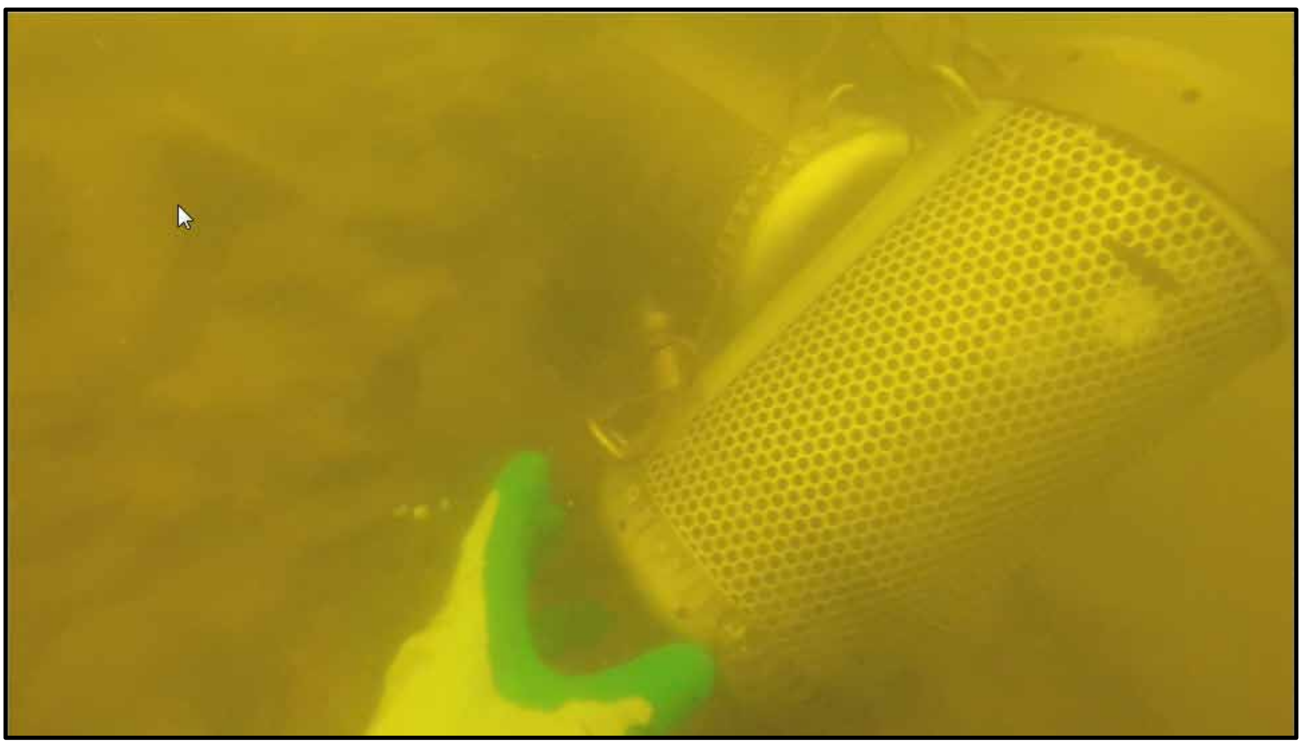

Figure 5. Diver Sean Sheldrake approaches the surface water sampling cages at site E.

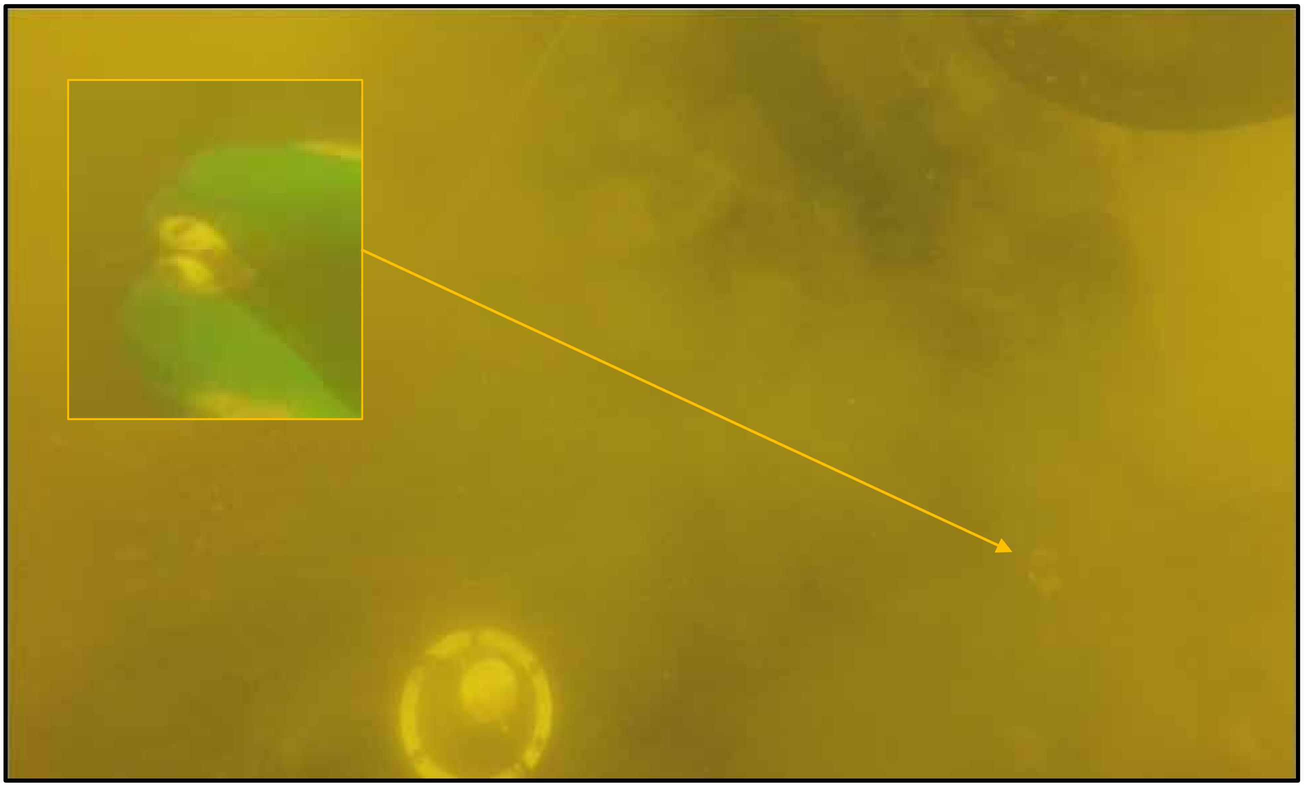

Figure 6. Site E probe inserted into sediment. Note fresh water bivalve at site.

Figure 7. Sean Sheldrake deploys to set site H samples.


Figure 8. Diver Brent Richmond arrives at site C to set the probe.

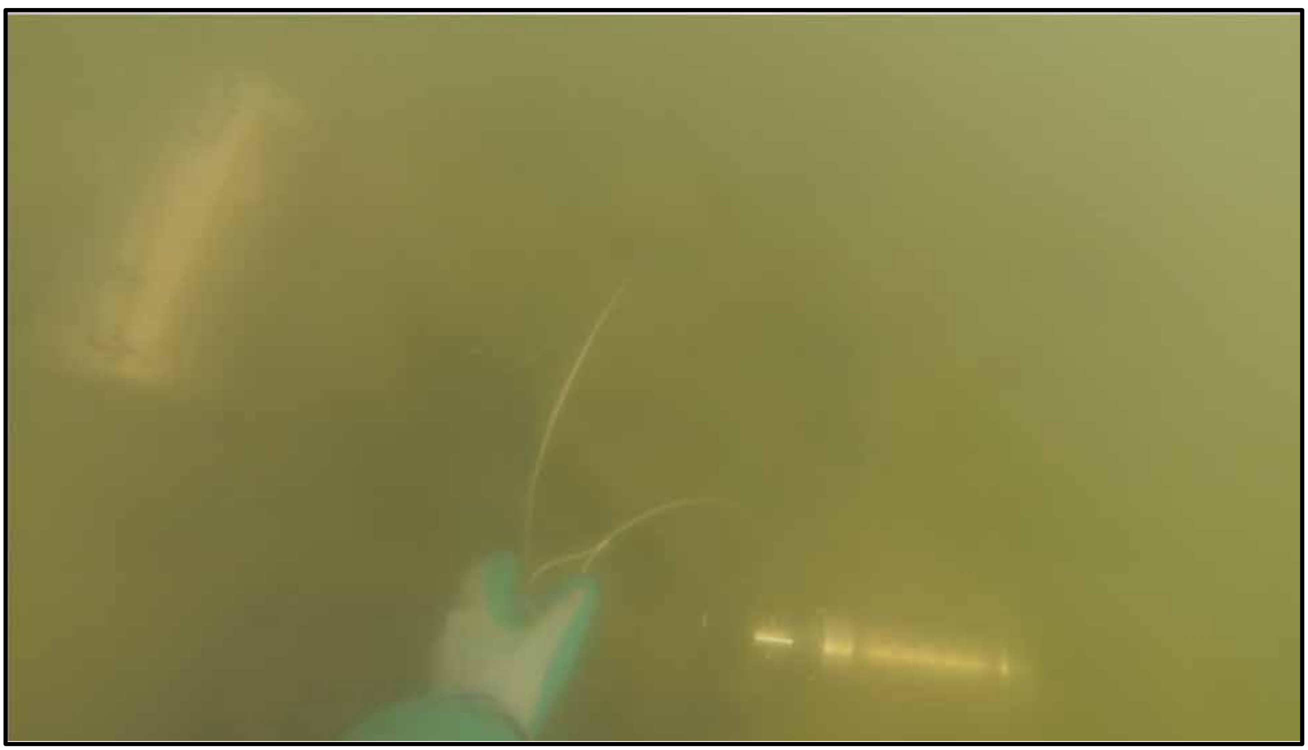
Figure 9. Diver Chad Schulze arrives at site L to place the probe.

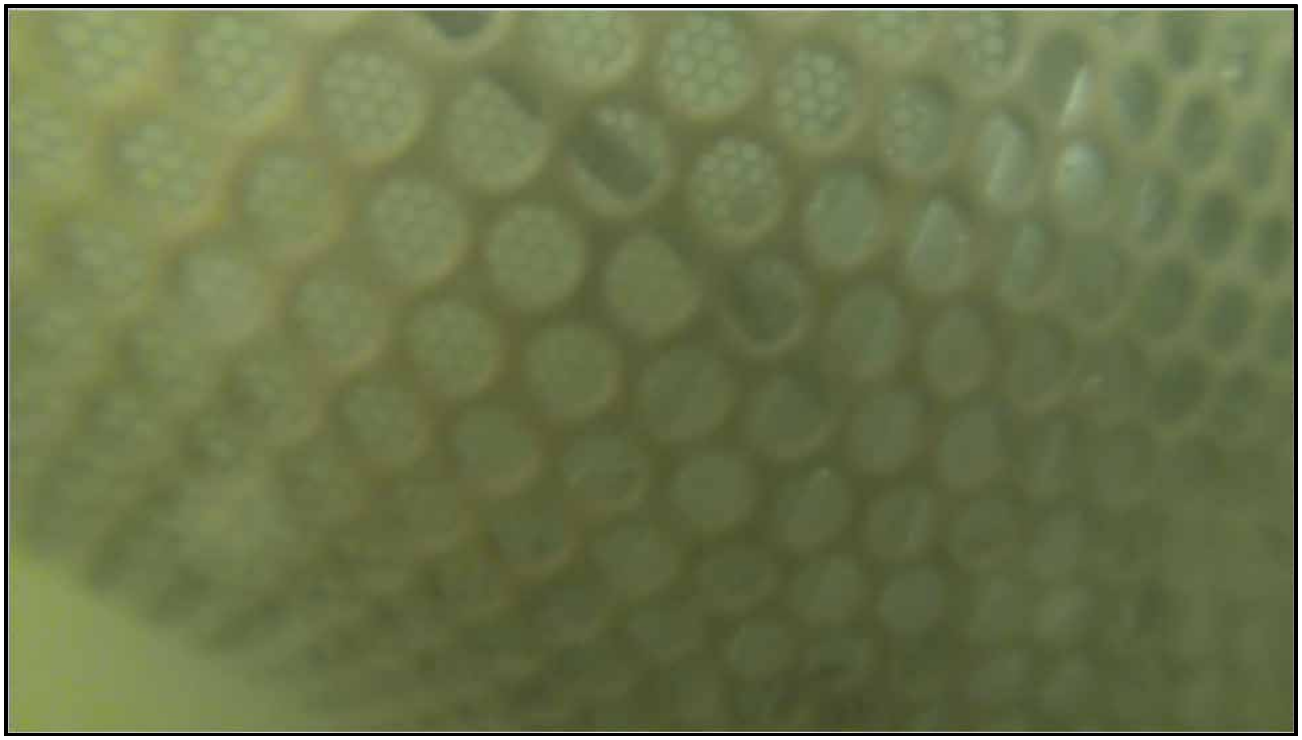

Figure 10. Polyethlene film in surface water cage at site 5.

Figure 11. Rob Rau and Jon McBurney tend diver Annie Christopher during recovery

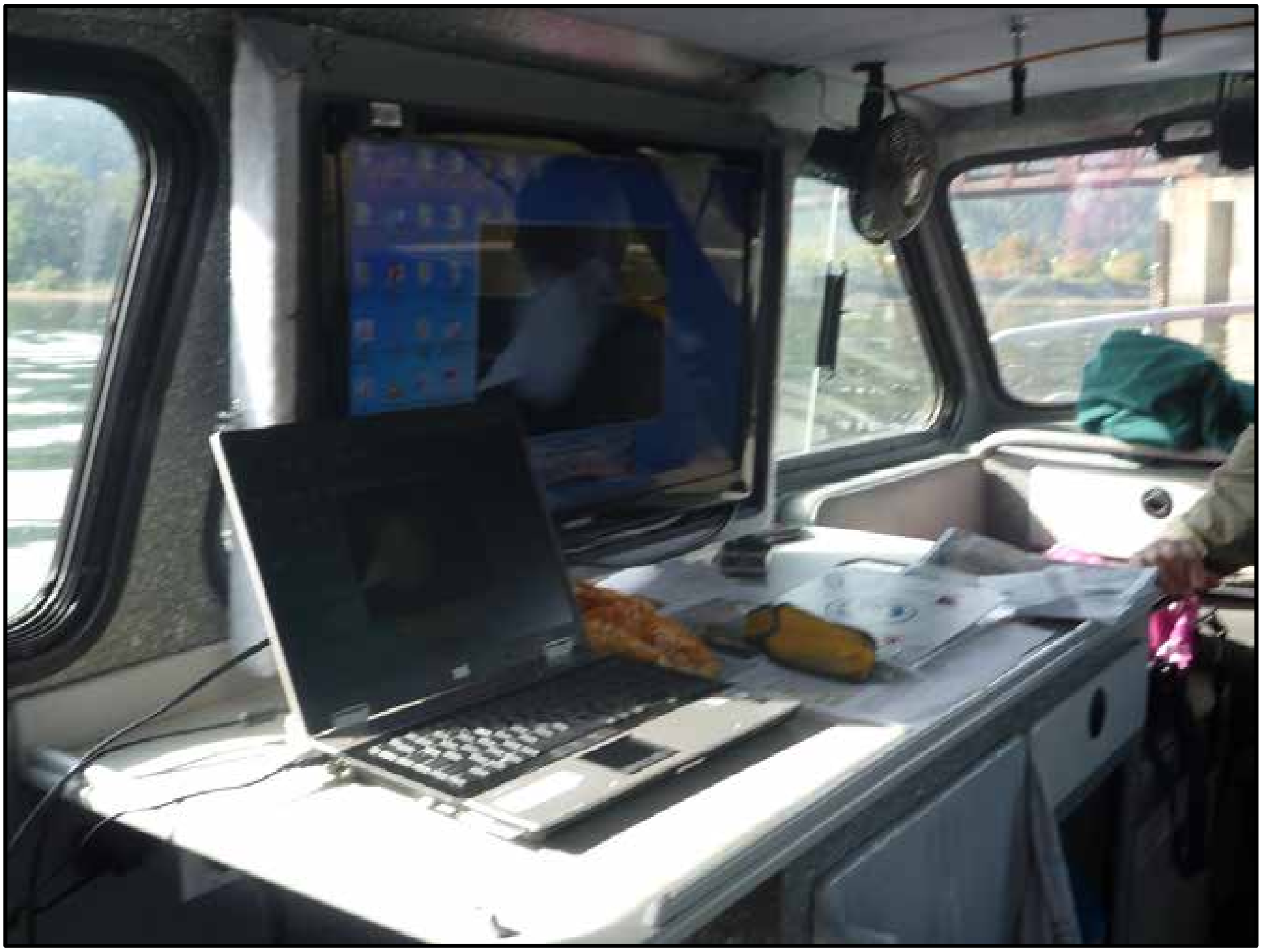

Figure 12. Live, real-time drop camera images of probe retrieval.

APPENDIX B3

Organophilic Clay Core Logs and Photographs

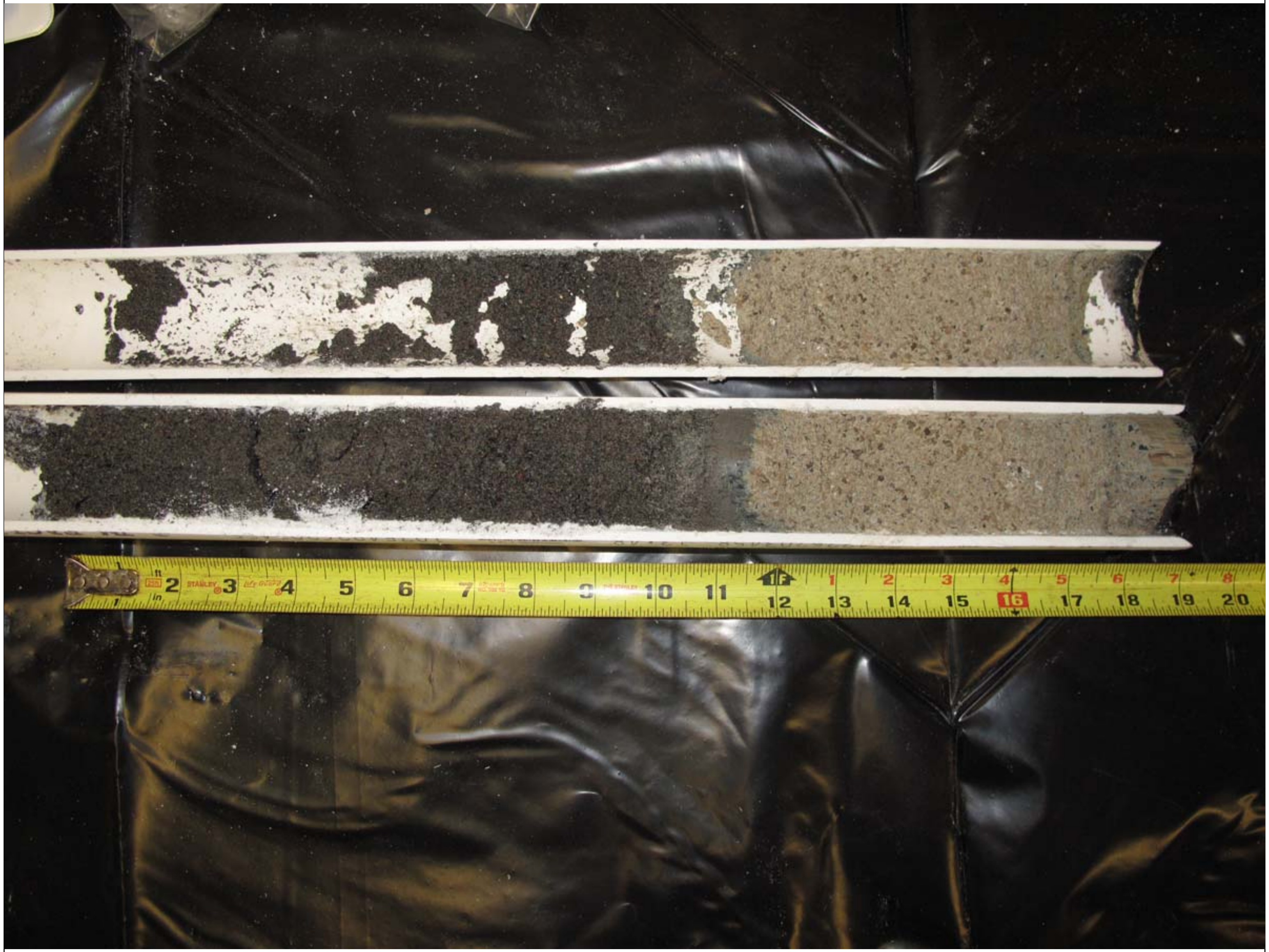

FIGURE B3-A

Organophilic Clay Boring: MBOC2015-01

Collection Date: September 14, 2015

McCormick and Baxter
2015 Annual Report

GSI Water Solutions, Inc.

FIGURE B3-B

Organophilic Clay Boring: MBOC2015-02

Collection Date: September 14, 2015

McCormick and Baxter
2015 Annual Report

GSI Water Solutions, Inc.

Boring Number: MBOC2015-01

Client: Oregon Dept of Environmental Quality
Project: McCormick and Baxter Superfund Site
Location: Willamette Cove, Oregon
Project Number: 205.020.005

Driller: GSI and Hart Crowser
Drilling Method: Manual Coring (2-inch PVC)
Sampling Method: Continuous Core
Logged by: E. C. Hughes
Start/Finish Date: September 14, 2015

Depth (ft)	Recovery	Graphic Log	Soil Description	Sample Interval	Comments
			Mudline		
0			Articulated Concrete Blocks (ACB)		ACB and gravel manually removed prior to coring.
			GRAVEL, 1-inch minus fill		
	70%		SAND CAP (SP), loose, dark grey, moist, sand is moderately to well sorted, medium grained with red and white lithics Sand is finer grained from 19 to 20 inches below mudline (1.58 to 1.67 feet)		No odor or sheen
			ORGANOCLAY (CL), soft, light grey Dark grey at upper boundary with sand cap		MCBOC2015-01_1-3.5 MCBOC2015-01_3.5-6
			Native Sediment: Poorly graded SAND (SP), medium dense, black, moist, sand is moderately to well sorted		No visible creosote
			End of Log		
5					
10					

Latitude: 45.579223 NAD83
Longitude: -122.745130 NAD83
Mudline Elevation: 8.61 feet NAVD88

Notes:
- Sample identification depths reflect the value in inches, relative to the top of the organoclay.
- Drive length = 27 inches below top of sand cap.
- Recovery length = 19 inches below top of sand cap (70% recovery).
- Borehole backfilled with granular organoclay and ACB replaced.

Boring Number: MBOC2015-02

Sheet: 1 of 1

Client: Oregon Dept of Environmental Quality
Project: McCormick and Baxter Superfund Site
Location: Willamette Cove, Oregon
Project Number: 205.020.005

Driller: GSI and Hart Crowser
Drilling Method: Manual Coring (2-inch PVC)
Sampling Method: Continuous Core
Logged by: E. C. Hughes
Start/Finish Date: September 14, 2015

Depth (ft)	Recovery	Graphic Log	Soil Description	Sample Interval	Comments
0			Mudline		
			Articulated Concrete Blocks (ACB)		ACB and gravel manually removed prior to coring.
			GRAVEL, 1-inch minus fill		
			SAND CAP (SP), loose, dark grey, moist, moderately to well sorted, sand is medium grained with red and white lithics		No odor or sheen
	72%		ORGANOCLAY (CL), soft, light grey Dark grey at upper boundary with sand cap		MCBOC2015-02_0.5-3.5 MCBOC2015-02_3.5-6.5
			Native Sediment: Poorly graded SAND (SP), medium dense, black, moist, moderately to well sorted sand		No visible creosote
			End of Log		
5					
10					

Latitude: 45.579149 NAD83
Longitude: -122.745262 NAD83
Mudline Elevation: 7.34 feet NAVD88

Notes:
- Sample identification depths relfect the value in inches, relative to the top of the organoclay.
- Drive length = 25 inches below top of sand cap.
- Recovery length = 18 inches below top of sand cap (72% recovery).
- Borehole backfilled with granular organoclay and ACB replaced.

APPENDIX B4
ESC Laboratory Report for Organophilic Clay Core Samples and QA Checklist

ANALYTICAL REPORT

October 21, 2015

ESC LAB SCIENCES — YOUR LAB OF CHOICE

myESC — REAL TIME DATA ACCESS

Oregon Dept. of Env. Quality - ODEQ

Sample Delivery Group:	L789001
Samples Received:	09/16/2015
Project Number:	15670-10
Description:	ODEQ - McCormick and Baxter
Report To:	Scott Manzano 700 NE Multnoma St, Suite 600 Portland, OR 97232

Entire Report Reviewed By:

Jarred Willis
Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

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MBOC2015-01-1-3.5 L789001-01 Solid

Collected by: Chris Martin | Collected date/time: 09/14/15 12:18 | Received date/time: 09/16/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Wet Chemistry by Method D2974	WG817451	1	09/27/15 23:49	09/27/15 23:49	MF
Wet Chemistry by Method USDA LOI	WG816358	1	09/20/15 07:32	09/22/15 05:17	JM

MB0C2015-01-3.5-6 L789001-02 Solid

Collected by: Chris Martin | Collected date/time: 09/14/15 12:25 | Received date/time: 09/16/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Wet Chemistry by Method D2974	WG817451	1	09/27/15 23:49	09/27/15 23:49	MF
Wet Chemistry by Method USDA LOI	WG816358	1	09/20/15 07:32	09/22/15 05:17	JM

MB0C2015-02-0.5-3.5 L789001-03 Solid

Collected by: Chris Martin | Collected date/time: 09/14/15 12:56 | Received date/time: 09/16/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Wet Chemistry by Method D2974	WG817451	1	09/27/15 23:50	09/27/15 23:50	MF
Wet Chemistry by Method USDA LOI	WG816358	1	09/20/15 07:32	09/22/15 05:18	JM

MB0C2015-02-3.5-6.5 L789001-04 Solid

Collected by: Chris Martin | Collected date/time: 09/14/15 13:01 | Received date/time: 09/16/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Wet Chemistry by Method D2974	WG817451	1	09/27/15 23:50	09/27/15 23:50	MF
Wet Chemistry by Method USDA LOI	WG816358	1	09/20/15 07:32	09/22/15 05:17	JM

MB0C2015-01-1-3.5 L789001-05 Solid

Collected by: Chris Martin | Collected date/time: 09/14/15 12:18 | Received date/time: 09/16/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG815759	2	09/18/15 08:51	09/19/15 07:36	KMP
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG815759	20	09/18/15 08:51	09/21/15 22:30	KMP
Total Solids by Method 2540 G-2011	WG815825	1	09/17/15 11:07	09/18/15 07:26	KDW

MB0C2015-01-3.5-6 L789001-06 Solid

Collected by: Chris Martin | Collected date/time: 09/14/15 12:25 | Received date/time: 09/16/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG815759	2	09/18/15 08:51	09/19/15 08:40	KMP
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG815759	20	09/18/15 08:51	09/21/15 22:52	KMP
Total Solids by Method 2540 G-2011	WG815825	1	09/17/15 11:07	09/18/15 07:26	KDW

MB0C2015-02-0.5-3.5 L789001-07 Solid

Collected by: Chris Martin | Collected date/time: 09/14/15 12:56 | Received date/time: 09/16/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG815759	20	09/18/15 08:51	09/21/15 23:13	KMP
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG815759	5	09/18/15 08:51	09/19/15 10:04	KMP
Total Solids by Method 2540 G-2011	WG815825	1	09/17/15 11:07	09/18/15 07:26	KDW

MB0C2015-02-3.5-6.5 L789001-08 Solid

Collected by	Collected date/time	Received date/time
Chris Martin	09/14/15 13:01	09/16/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG815759	20	09/18/15 08:51	09/22/15 08:58	KMP
Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM	WG815759	5	09/18/15 08:51	09/19/15 10:25	KMP
Total Solids by Method 2540 G-2011	WG815825	1	09/17/15 11:07	09/18/15 07:27	KDW

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. All MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jarred Willis

Jarred Willis
Technical Service Representative

Wet Chemistry by Method D2974

Analyte	Result	Units	Qualifier	Dilution	Analysis date / time	Batch
Fractional Organic Carbon	0.0466	g C/g soil		1	09/27/2015 23:49	WG817451
Fractional Organic Matter	8.04	%		1	09/27/2015 23:49	WG817451

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	36700		3.33	10.0	1	09/22/2015 05:17	WG816358

Wet Chemistry by Method D2974

Analyte	Result	Units	Qualifier	Dilution	Analysis date / time	Batch
Fractional Organic Carbon	0.0497	g C/g soil		1	09/27/2015 23:49	WG817451
Fractional Organic Matter	8.57	%		1	09/27/2015 23:49	WG817451

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	38000		3.33	10.0	1	09/22/2015 05:17	WG816358

Wet Chemistry by Method D2974

Analyte	Result	Units	Qualifier	Dilution	Analysis date / time	Batch
Fractional Organic Carbon	0.0451	g C/g soil		1	09/27/2015 23:50	WG817451
Fractional Organic Matter	7.78	%		1	09/27/2015 23:50	WG817451

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	37300		3.33	10.0	1	09/22/2015 05:18	WG816358

Wet Chemistry by Method D2974

Analyte	Result	Units	Qualifier	Dilution	Analysis date / time	Batch
Fractional Organic Carbon	0.0572	g C/g soil		1	09/27/2015 23:50	WG817451
Fractional Organic Matter	9.85	%		1	09/27/2015 23:50	WG817451

Wet Chemistry by Method USDA LOI

Analyte	Result mg/kg	Qualifier	MDL mg/kg	RDL mg/kg	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	43400		3.33	10.0	1	09/22/2015 05:17	WG816358

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	67.8		1	09/18/2015 07:26	WG815825

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	0.00228	J	0.00120	0.0177	2	09/19/2015 07:36	WG815759
Acenaphthene	0.00427	J	0.00120	0.0177	2	09/19/2015 07:36	WG815759
Acenaphthylene	0.00380	J	0.00120	0.0177	2	09/19/2015 07:36	WG815759
Benzo(a)anthracene	U		0.0120	0.177	20	09/21/2015 22:30	WG815759
Benzo(a)pyrene	U		0.0120	0.177	20	09/21/2015 22:30	WG815759
Benzo(b)fluoranthene	U		0.0120	0.177	20	09/21/2015 22:30	WG815759
Benzo(g,h,i)perylene	0.0300	J	0.0120	0.177	20	09/21/2015 22:30	WG815759
Benzo(k)fluoranthene	U		0.0120	0.177	20	09/21/2015 22:30	WG815759
Chrysene	U		0.0120	0.177	20	09/21/2015 22:30	WG815759
Dibenz(a,h)anthracene	U		0.0120	0.177	20	09/21/2015 22:30	WG815759
Fluoranthene	0.00748	J	0.00120	0.0177	2	09/19/2015 07:36	WG815759
Fluorene	0.00641	J	0.00120	0.0177	2	09/19/2015 07:36	WG815759
Indeno(1,2,3-cd)pyrene	U		0.0120	0.177	20	09/21/2015 22:30	WG815759
Naphthalene	0.0521	J	0.00400	0.0590	2	09/19/2015 07:36	WG815759
Phenanthrene	0.0171	J	0.00120	0.0177	2	09/19/2015 07:36	WG815759
Pyrene	0.0181	J	0.0120	0.177	20	09/21/2015 22:30	WG815759
1-Methylnaphthalene	0.0304	J	0.00400	0.0590	2	09/19/2015 07:36	WG815759
2-Methylnaphthalene	0.0458	J	0.00400	0.0590	2	09/19/2015 07:36	WG815759
2-Chloronaphthalene	U		0.00400	0.0590	2	09/19/2015 07:36	WG815759
(S) Nitrobenzene-d5	*71.1*			*22.1-146*		*09/19/2015 07:36*	WG815759
(S) 2-Fluorobiphenyl	*70.8*			*40.6-122*		*09/19/2015 07:36*	WG815759
(S) p-Terphenyl-d14	*84.4*	J7		*32.2-131*		*09/21/2015 22:30*	WG815759

Sample Narrative:

8270D-SIM L789001-05 WG815759: Dilution due to matrix

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	68.3		1	09/18/2015 07:26	WG815825

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	0.00239	J	0.00120	0.0176	2	09/19/2015 08:40	WG815759
Acenaphthene	0.00259	J	0.00120	0.0176	2	09/19/2015 08:40	WG815759
Acenaphthylene	0.0231		0.00120	0.0176	2	09/19/2015 08:40	WG815759
Benzo(a)anthracene	U		0.0120	0.176	20	09/21/2015 22:52	WG815759
Benzo(a)pyrene	U		0.0120	0.176	20	09/21/2015 22:52	WG815759
Benzo(b)fluoranthene	U		0.0120	0.176	20	09/21/2015 22:52	WG815759
Benzo(g,h,i)perylene	0.0324	J	0.0120	0.176	20	09/21/2015 22:52	WG815759
Benzo(k)fluoranthene	U		0.0120	0.176	20	09/21/2015 22:52	WG815759
Chrysene	U		0.0120	0.176	20	09/21/2015 22:52	WG815759
Dibenz(a,h)anthracene	0.141	J	0.0120	0.176	20	09/21/2015 22:52	WG815759
Fluoranthene	0.00588	J	0.00120	0.0176	2	09/19/2015 08:40	WG815759
Fluorene	0.00309	J	0.00120	0.0176	2	09/19/2015 08:40	WG815759
Indeno(1,2,3-cd)pyrene	U		0.0120	0.176	20	09/21/2015 22:52	WG815759
Naphthalene	0.0294	J	0.00400	0.0586	2	09/19/2015 08:40	WG815759
Phenanthrene	0.0106	J	0.00120	0.0176	2	09/19/2015 08:40	WG815759
Pyrene	U		0.0120	0.176	20	09/21/2015 22:52	WG815759
1-Methylnaphthalene	0.0198	J	0.00400	0.0586	2	09/19/2015 08:40	WG815759
2-Methylnaphthalene	0.0327	J	0.00400	0.0586	2	09/19/2015 08:40	WG815759
2-Chloronaphthalene	U		0.00400	0.0586	2	09/19/2015 08:40	WG815759
(S) Nitrobenzene-d5	*61.1*			*22.1-146*		*09/19/2015 08:40*	WG815759
(S) 2-Fluorobiphenyl	*69.9*			*40.6-122*		*09/19/2015 08:40*	WG815759
(S) p-Terphenyl-d14	*94.0*	J7		*32.2-131*		*09/21/2015 22:52*	WG815759

Sample Narrative:

8270D-SIM L789001-06 WG815759: Dilution due to matrix

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	63.0		1	09/18/2015 07:26	WG815825

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	0.0134	J	0.00300	0.0476	5	09/19/2015 10:04	WG815759
Acenaphthene	0.0241	J	0.00300	0.0476	5	09/19/2015 10:04	WG815759
Acenaphthylene	0.00603	J	0.00300	0.0476	5	09/19/2015 10:04	WG815759
Benzo(a)anthracene	U		0.0120	0.191	20	09/21/2015 23:13	WG815759
Benzo(a)pyrene	0.0872	J	0.0120	0.191	20	09/21/2015 23:13	WG815759
Benzo(b)fluoranthene	U		0.0120	0.191	20	09/21/2015 23:13	WG815759
Benzo(g,h,i)perylene	0.0489	J	0.0120	0.191	20	09/21/2015 23:13	WG815759
Benzo(k)fluoranthene	U		0.0120	0.191	20	09/21/2015 23:13	WG815759
Chrysene	U		0.0120	0.191	20	09/21/2015 23:13	WG815759
Dibenz(a,h)anthracene	0.323		0.0120	0.191	20	09/21/2015 23:13	WG815759
Fluoranthene	0.0409	J	0.00300	0.0476	5	09/19/2015 10:04	WG815759
Fluorene	0.0235	J	0.00300	0.0476	5	09/19/2015 10:04	WG815759
Indeno(1,2,3-cd)pyrene	U		0.0120	0.191	20	09/21/2015 23:13	WG815759
Naphthalene	0.0925	J	0.0100	0.159	5	09/19/2015 10:04	WG815759
Phenanthrene	0.0649		0.00300	0.0476	5	09/19/2015 10:04	WG815759
Pyrene	0.0481	J	0.0120	0.191	20	09/21/2015 23:13	WG815759
1-Methylnaphthalene	0.0639	J	0.0100	0.159	5	09/19/2015 10:04	WG815759
2-Methylnaphthalene	0.0780	J	0.0100	0.159	5	09/19/2015 10:04	WG815759
2-Chloronaphthalene	U		0.0100	0.159	5	09/19/2015 10:04	WG815759
(S) Nitrobenzene-d5	*62.3*			*22.1-146*		*09/19/2015 10:04*	WG815759
(S) 2-Fluorobiphenyl	*65.3*			*40.6-122*		*09/19/2015 10:04*	WG815759
(S) p-Terphenyl-d14	*74.9*	J7		*32.2-131*		*09/21/2015 23:13*	WG815759

Sample Narrative:

8270D-SIM L789001-07 WG815759: Dilution due to matrix

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	65.6		1	09/18/2015 07:27	WG815825

Semi Volatile Organic Compounds (GC/MS) by Method 8270D-SIM

Analyte	Result (dry) mg/kg	Qualifier	MDL mg/kg	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
Anthracene	0.0114	J	0.00300	0.0457	5	09/19/2015 10:25	WG815759
Acenaphthene	0.0285	J	0.00300	0.0457	5	09/19/2015 10:25	WG815759
Acenaphthylene	0.0530		0.00300	0.0457	5	09/19/2015 10:25	WG815759
Benzo(a)anthracene	U		0.0120	0.183	20	09/22/2015 08:58	WG815759
Benzo(a)pyrene	U		0.0120	0.183	20	09/22/2015 08:58	WG815759
Benzo(b)fluoranthene	U		0.0120	0.183	20	09/22/2015 08:58	WG815759
Benzo(g,h,i)perylene	0.0248	J	0.0120	0.183	20	09/22/2015 08:58	WG815759
Benzo(k)fluoranthene	U		0.0120	0.183	20	09/22/2015 08:58	WG815759
Chrysene	U		0.0120	0.183	20	09/22/2015 08:58	WG815759
Dibenz(a,h)anthracene	0.0448	J	0.0120	0.183	20	09/22/2015 08:58	WG815759
Fluoranthene	0.0278	J	0.00300	0.0457	5	09/19/2015 10:25	WG815759
Fluorene	0.0264	J	0.00300	0.0457	5	09/19/2015 10:25	WG815759
Indeno(1,2,3-cd)pyrene	U		0.0120	0.183	20	09/22/2015 08:58	WG815759
Naphthalene	0.0942	J	0.0100	0.152	5	09/19/2015 10:25	WG815759
Phenanthrene	0.0619		0.00300	0.0457	5	09/19/2015 10:25	WG815759
Pyrene	0.0402	J	0.0120	0.183	20	09/22/2015 08:58	WG815759
1-Methylnaphthalene	0.0531	J	0.0100	0.152	5	09/19/2015 10:25	WG815759
2-Methylnaphthalene	0.0830	J	0.0100	0.152	5	09/19/2015 10:25	WG815759
2-Chloronaphthalene	U		0.0100	0.152	5	09/19/2015 10:25	WG815759
(S) Nitrobenzene-d5	*60.2*			*22.1-146*		*09/19/2015 10:25*	WG815759
(S) 2-Fluorobiphenyl	*64.7*			*40.6-122*		*09/19/2015 10:25*	WG815759
(S) p-Terphenyl-d14	*70.3*	J7		*32.2-131*		*09/22/2015 08:58*	WG815759

Sample Narrative:

8270D-SIM L789001-08 WG815759: Dilution due to matrix

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) 09/18/15 07:24

Analyte	MB Result %	MB Qualifier	MB RDL %
Total Solids	0.000300		

L789001-08 Original Sample (OS) • Duplicate (DUP)

(OS) 09/18/15 07:27 • (DUP) 09/18/15 07:27

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	65.6	65.1	1	0.779		5

Laboratory Control Sample (LCS)

(LCS) 09/18/15 07:25

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) 09/27/15 23:49

Analyte	MB Result g C/g soil	MB Qualifier	MB RDL g C/g soil
Fractional Organic Carbon	0.000100		
Fractional Organic Matter	0.000100		

L789001-03 Original Sample (OS) • Duplicate (DUP)

(OS) 09/27/15 23:50 • (DUP) 09/27/15 23:50

Analyte	Original Result %	DUP Result g C/g soil	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Fractional Organic Carbon	0.0451	0.0450	1	0.380		20
Fractional Organic Matter	7.78	7.75	1	0.380		20

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) 09/22/15 05:16

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
TOC (Total Organic Carbon)	U		3.33	10.0

L789001-04 Original Sample (OS) • Duplicate (DUP)

(OS) 09/22/15 05:17 • (DUP) 09/22/15 05:18

Analyte	Original Result mg/kg	DUP Result mg/kg	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC (Total Organic Carbon)	43400	47100	1	8.06		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 09/22/15 05:17 • (LCSD) 09/22/15 05:17

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TOC (Total Organic Carbon)	4620	5500	5440	119	118	50.0-150			1.22	20

Method Blank (MB)

(MB) 09/19/15 04:26

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Anthracene	U		0.000600	0.00600
Acenaphthene	U		0.000600	0.00600
Acenaphthylene	U		0.000600	0.00600
Benzo(a)anthracene	U		0.000600	0.00600
Benzo(a)pyrene	U		0.000600	0.00600
Benzo(b)fluoranthene	U		0.000600	0.00600
Benzo(g,h,i)perylene	U		0.000600	0.00600
Benzo(k)fluoranthene	U		0.000600	0.00600
Chrysene	U		0.000600	0.00600
Dibenz(a,h)anthracene	U		0.000600	0.00600
Fluoranthene	U		0.000600	0.00600
Fluorene	U		0.000600	0.00600
Indeno(1,2,3-cd)pyrene	U		0.000600	0.00600
Naphthalene	U		0.00200	0.0200
Phenanthrene	U		0.000600	0.00600
Pyrene	U		0.000600	0.00600
1-Methylnaphthalene	U		0.00200	0.0200
2-Methylnaphthalene	U		0.00200	0.0200
2-Chloronaphthalene	U		0.00200	0.0200
(S) p-Terphenyl-d14	*84.3*			*32.2-131*
(S) Nitrobenzene-d5	*104*			*22.1-146*
(S) 2-Fluorobiphenyl	*94.1*			*40.6-122*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 09/19/15 03:44 • (LCSD) 09/19/15 04:05

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Anthracene	0.0800	0.0734	0.0707	91.8	88.4	50.3-130			3.78	20
Acenaphthene	0.0800	0.0682	0.0654	85.2	81.7	52.4-120			4.17	20
Acenaphthylene	0.0800	0.0714	0.0685	89.2	85.7	49.6-120			4.04	20
Benzo(a)anthracene	0.0800	0.0738	0.0705	92.2	88.1	46.7-125			4.49	20
Benzo(a)pyrene	0.0800	0.0728	0.0686	91.0	85.7	42.3-119			6.01	20
Benzo(b)fluoranthene	0.0800	0.0717	0.0708	89.6	88.5	43.6-124			1.29	20
Benzo(g,h,i)perylene	0.0800	0.0767	0.0723	95.9	90.4	45.1-132			5.86	20
Benzo(k)fluoranthene	0.0800	0.0786	0.0720	98.3	90.0	46.1-131			8.77	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 09/19/15 03:44 • (LCSD) 09/19/15 04:05

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Chrysene	0.0800	0.0729	0.0695	91.2	86.8	49.5-131			4.87	20
Dibenz(a,h)anthracene	0.0800	0.0840	0.0792	105	99.0	44.8-133			5.83	20
Fluoranthene	0.0800	0.0788	0.0759	98.5	94.9	49.3-128			3.66	20
Fluorene	0.0800	0.0716	0.0682	89.4	85.2	50.6-121			4.86	20
Indeno(1,2,3-cd)pyrene	0.0800	0.0793	0.0749	99.1	93.6	46.1-135			5.70	20
Naphthalene	0.0800	0.0644	0.0629	80.5	78.7	49.6-115			2.27	20
Phenanthrene	0.0800	0.0637	0.0615	79.6	76.9	48.8-121			3.49	20
Pyrene	0.0800	0.0663	0.0620	82.9	77.4	44.7-130			6.78	20
1-Methylnaphthalene	0.0800	0.0726	0.0709	90.7	88.6	50.6-122			2.40	20
2-Methylnaphthalene	0.0800	0.0733	0.0711	91.7	88.9	50.4-120			3.08	20
2-Chloronaphthalene	0.0800	0.0663	0.0646	82.8	80.7	53.9-121			2.57	20
(S) p-Terphenyl-d14				*88.2*	*80.5*	*32.2-131*				
(S) Nitrobenzene-d5				*112*	*102*	*22.1-146*				
(S) 2-Fluorobiphenyl				*97.8*	*92.2*	*40.6-122*				

L789000-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 09/19/15 04:47 • (MS) 09/19/15 05:09 • (MSD) 09/19/15 05:30

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Anthracene	0.0800	ND	0.0737	0.0700	92.1	87.5	1	26.5-141			5.07	21.2
Acenaphthene	0.0800	ND	0.0674	0.0647	84.2	80.8	1	31.9-130			4.06	20
Acenaphthylene	0.0800	ND	0.0716	0.0679	89.5	84.9	1	33.7-129			5.19	20
Benzo(a)anthracene	0.0800	ND	0.0720	0.0696	90.0	87.0	1	18.3-136			3.37	24.6
Benzo(a)pyrene	0.0800	ND	0.0742	0.0715	92.7	89.3	1	16.9-135			3.68	25.2
Benzo(b)fluoranthene	0.0800	0.000661	0.0742	0.0668	92.0	82.7	1	10.0-134			10.5	30.9
Benzo(g,h,i)perylene	0.0800	ND	0.0739	0.0709	92.4	88.6	1	14.1-140			4.13	25.5
Benzo(k)fluoranthene	0.0800	ND	0.0709	0.0723	88.7	90.3	1	18.2-138			1.88	25.6
Chrysene	0.0800	ND	0.0736	0.0694	92.0	86.8	1	17.1-145			5.77	24.2
Dibenz(a,h)anthracene	0.0800	ND	0.0796	0.0761	99.5	95.1	1	18.5-138			4.50	24.3
Fluoranthene	0.0800	0.00107	0.0800	0.0781	98.7	96.3	1	15.4-144			2.42	27.1
Fluorene	0.0800	ND	0.0704	0.0677	88.0	84.6	1	23.5-136			3.91	20
Indeno(1,2,3-cd)pyrene	0.0800	ND	0.0767	0.0732	95.8	91.5	1	14.5-142			4.66	25.8
Naphthalene	0.0800	ND	0.0616	0.0583	77.0	72.8	1	29.2-128			5.56	20
Phenanthrene	0.0800	ND	0.0640	0.0615	80.0	76.9	1	20.1-134			3.98	23.6
Pyrene	0.0800	0.000862	0.0640	0.0621	79.0	76.6	1	11.0-148			3.01	26.1

L789000-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 09/19/15 04:47 • (MS) 09/19/15 05:09 • (MSD) 09/19/15 05:30

Analyte	Spike Amount mg/kg	Original Result mg/kg	MS Result mg/kg	MSD Result mg/kg	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
1-Methylnaphthalene	0.0800	ND	0.0706	0.0671	88.2	83.9	1	28.4-137			5.01	20
2-Methylnaphthalene	0.0800	ND	0.0715	0.0680	89.4	85.1	1	26.6-137			4.95	20
2-Chloronaphthalene	0.0800	ND	0.0654	0.0650	81.7	81.2	1	38.6-126			0.670	20
(S) p-Terphenyl-d14					*83.3*	*81.7*		*32.2-131*				
(S) Nitrobenzene-d5					*111*	*106*		*22.1-146*				
(S) 2-Fluorobiphenyl					*98.6*	*98.0*		*40.6-122*				

Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND,U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Rec.	Recovery.
SDL	Sample Detection Limit.
MQL	Method Quantitation Limit.
Unadj. MQL	Unadjusted Method Quantitation Limit.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
J7	Surrogate recovery cannot be used for control limit evaluation due to dilution.

ACCREDITATIONS & LOCATIONS

ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our "one location" design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be **YOUR LAB OF CHOICE.**

State Accreditations

Alabama	40660	Nevada	TN-03-2002-34
Alaska	UST-080	New Hampshire	2975
Arizona	AZ0612	New Jersey–NELAP	TN002
Arkansas	88-0469	New Mexico	TN00003
California	01157CA	New York	11742
Colorado	TN00003	North Carolina	Env375
Conneticut	PH-0197	North Carolina [1]	DW21704
Florida	E87487	North Carolina [2]	41
Georgia	NELAP	North Dakota	R-140
Georgia [1]	923	Ohio–VAP	CL0069
Idaho	TN00003	Oklahoma	9915
Illinois	200008	Oregon	TN200002
Indiana	C-TN-01	Pennsylvania	68-02979
Iowa	364	Rhode Island	221
Kansas	E-10277	South Carolina	84004
Kentucky [1]	90010	South Dakota	n/a
Kentucky [2]	16	Tennessee [1,4]	2006
Louisiana	AI30792	Texas	T 104704245-07-TX
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	6157585858
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	109
Minnesota	047-999-395	Washington	C1915
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA
Nebraska	NE-OS-15-05		

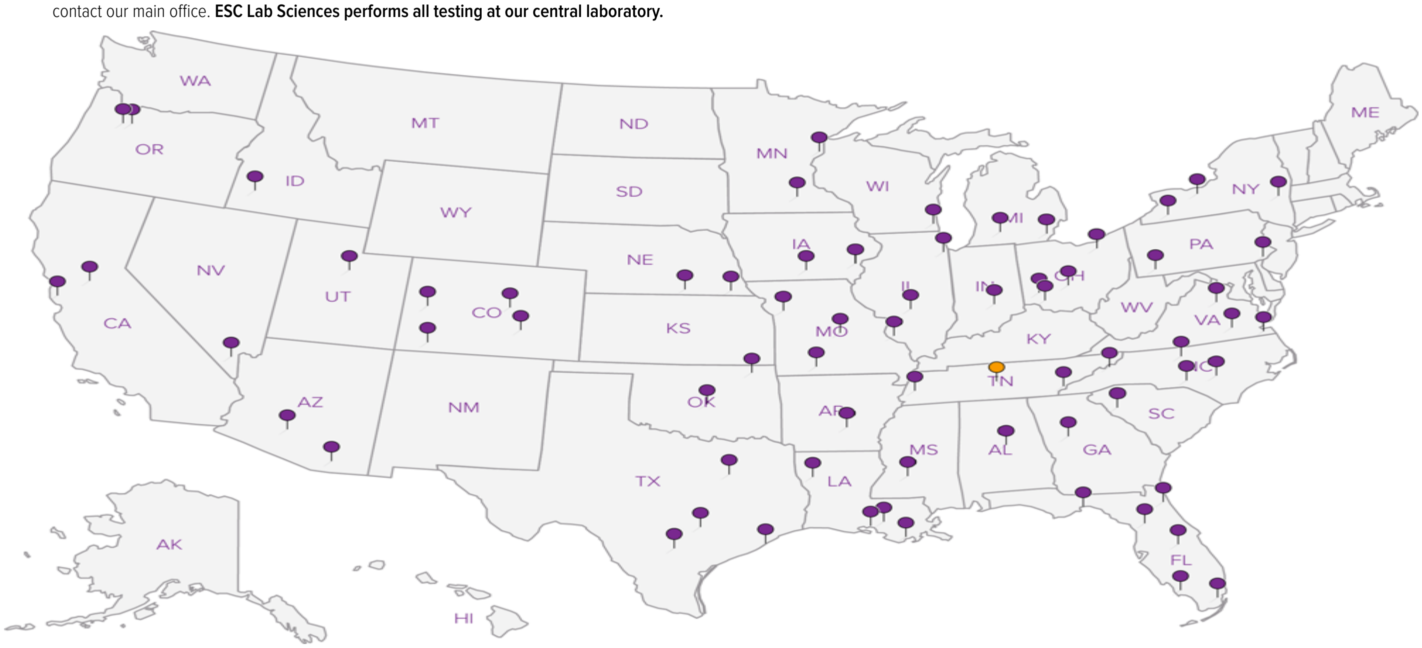
[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [n/a] Accreditation not applicable

Third Party & Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA	100789
Canada	1461.01	DOD	1461.01
EPA–Crypto	TN00003	USDA	S-67674

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. **ESC Lab Sciences performs all testing at our central laboratory.**



G034

OREGONDEQ State of Oregon Sample Chain of Custody OREGONDEQ

Agency, Authorized Purchaser or Agent:	
Send Lab Report To:	Phil Cordell & Scott Manzano
Address:	8910 SW Gemini Dr. / Beaverton, OR. 97008 — 700 NE Multnomah St Suite #600 Portland, OR 97232
Tel. #:	503-624-0928
E-mail:	Phil.cordell@hartcrowser.com

Contract Laboratory Name:

Lab Batch #:

Invoice To: ODEQ / Business Office
Address: 811 SW 6th Ave, Portland, OR 97204
Tel. #:

Lab Selection Criteria:
- ☐ Proximity (if TAT < 48 hrs)
- ☐ Prior work on same project
- ☐ Cost (for anticipated analyses)
- ☐ Other labs disqualified or unable to perform requested services
- ☐ Emergency work

Turn Around Time:
- ☒ 10 days (std.)
- ☐ 5 days
- ☐ 72 hours
- ☐ 48 hours
- ☐ 24 hours
- ☐ Other ______

Project Name: DEQ - McCormick and Baxter
Project #: ~~15670-10~~ 15670-10
Sampler Name: Chris Martin / Phil Cordell

Sample Preservative

OREGONDEQ

Requested Analyses

Sample ID#	Collection Date/Time	Matrix	Number of Containers	~~NW THP GX~~	~~NW THP DX~~	~~V82 60R BDM~~	~~Dis. Lead 6010~~	~~Trip Blank~~	* TOC	PAHs (8270D SIM low-level)			Comments
MBOC2015-01-1-3.5	9/14/15-1218	Soil	2						X	X			L789001-01 / 1-05
MBOC2015-01-3.5-6	-1225	↓	2						X	X			-02 / 1-06
MBOC2015-02-0.5-3.5	-1256	↓	2						X	X			-03 / 1-07
MBOC2015-02-3.5-6.5	-1301	↓	2						X	X			-04 / 1-08

Notes: * Report TOC & TC by ASTM F1647-02A; TOC as %; Total organic matter as Dry weight %

Relinquished By: Chris Martin	Agency/Agent: Hart Crowser	Received By: Robert Adana	Agency/Agent: ESC
Signature: [signature]	Time & Date: 9/15/15 0600	Signature: [signature]	Time & Date: 1405 9/15/15
Relinquished By:	Agency/Agent:	Received By: Greg Dearman	Agency/Agent: ESC
Signature:	Time & Date:	Signature: Greg Dearman	Time & Date: 9-16-15 0900

THIS PURCHASE IS SUBMITTED PURSUANT TO STATE OF OREGON SOLICITATION #102-1098-07 AND PRICE AGREEMENT # []. THE PRICE AGREEMENT INCLUDING CONTRACT TERMS AND CONDITIONS AND SPECIAL CONTRACT TERMS AND CONDITIONS (T'S &C'S) CONTAINED IN THE PRICE AGREEMENT ARE HEREBY INCORPORATED BY REFERENCE AND SHALL APPLY TO THIS PURCHASE AND SHALL TAKE PRECEDENCE OVER ALL OTHER CONFLICTING T'S AND C'S, EXPRESS OR IMPLIED.

2.4°c TDI

Version: 4/4/2008

8 4oz containers 6436 7133 9360

DATA QUALITY REVIEW

Job Number:	15670-10	**Review Date:**	11/16/15
Project:	ODEQ – M&B	**Reviewer:**	Conrad
Laboratory:	ESC	**Laboratory Job ID#:**	L789001

Sample ID Numbers:

MBOC2015-01-1-3.5, MBOC2015-01-3.5-6, MBOC201502-0.5-3.5, MBOC2015-02-3.5-6.5

Sample Receiving Discrepancies:

Notes on COC stated report TOC and TC by ASTM F1647-02A

Revised report dated October 21, 2015.

DATA QUALITY REVIEW

Job Number:	15670-10	**Review Date:**	11/16/15
Project:	M&B	**Reviewer:**	Conrad
Laboratory:	ESC	**Laboratory Job ID#:**	L789001
Analysis:	ASTM D2974 – fractional organic carbon	**Matrix:**	sediment

Sample ID Numbers:

MBOC2015-01-1-3.5, MBOC2015-01-3.5-6, MBOC201502-0.5-3.5, MBOC2015-02-3.5-6.5

Dup: MBOC201502-0.5-3.5

Sampling Date:	9/14/15	**Extraction Date:**	
Analysis Date:	9/27/15		

Holding Times and Reporting Limits:

Holding time in control.

Method, Trip, and Field Blanks:

Acceptable

Surrogate Recoveries:

na

Laboratory Control Samples (LCS):

na

Matrix Spike/Matrix Spike Duplicate (MS/MSD):

na

Laboratory Duplicate:

acceptable

Field Duplicate:

na

Calibration Criteria:

nr

Qualification Summary:

Not qualified.

DATA QUALITY REVIEW			
Job Number:	15670-10	**Review Date:**	11/16/15
Project:	M&B	**Reviewer:**	Conrad
Laboratory:	ESC	**Laboratory Job ID#:**	L789001
Analysis:	ASTM D2974 – fractional organic matter	**Matrix:**	sediment
Sample ID Numbers:			
MBOC2015-01-1-3.5, MBOC2015-01-3.5-6, MBOC201502-0.5-3.5, MBOC2015-02-3.5-6.5 Dup: MBOC201502-0.5-3.5			
Sampling Date:	9/14/15	**Extraction Date:**	
Analysis Date:	9/27/15		
Holding Times and Reporting Limits:			
Reported as percentage. Holding time in control.			
Method, Trip, and Field Blanks:			
acceptable			
Surrogate Recoveries:			
na			
Laboratory Control Samples (LCS):			
na			
Matrix Spike/Matrix Spike Duplicate (MS/MSD):			
na			
Laboratory Duplicate:			
acceptable			
Field Duplicate:			
na			
Calibration Criteria:			
nr			
Qualification Summary:			
Not qualified.			

DATA QUALITY REVIEW

Job Number:	15670-10	**Review Date:**	11/16/15
Project:	M&B	**Reviewer:**	Conrad
Laboratory:	ESC	**Laboratory Job ID#:**	L789001
Analysis:	USDA LOI – TOC	**Matrix:**	sediment

Sample ID Numbers:

MBOC2015-01-1-3.5, MBOC2015-01-3.5-6, MBOC201502-0.5-3.5, MBOC2015-02-3.5-6.5

Dup: MBOC2015-02-3.5-6.5

Sampling Date:	9/14/15	**Extraction Date:**	
Analysis Date:	9/22/15		

Holding Times and Reporting Limits:

acceptable

Method, Trip, and Field Blanks:

MB is ND

Surrogate Recoveries:

na

Laboratory Control Samples (LCS):

Recoveries and RPD acceptable

Matrix Spike/Matrix Spike Duplicate (MS/MSD):

na

Laboratory Duplicate:

acceptable

Field Duplicate:

na

Calibration Criteria:

nr

Qualification Summary:

Not qualified.

DATA QUALITY REVIEW

Job Number:	15670-10	**Review Date:**	11/16/15
Project:	M&B	**Reviewer:**	Conrad
Laboratory:	ESC	**Laboratory Job ID#:**	L789001
Analysis:	SM 2540G – total solids	**Matrix:**	sediment

Sample ID Numbers:

MBOC2015-01-1-3.5, MBOC2015-01-3.5-6, MBOC201502-0.5-3.5, MBOC2015-02-3.5-6.5

Dup: MBOC2015-02-3.5-6.5

Sampling Date:	9/14/15	**Extraction Date:**	na
Analysis Date:	9/18/15		

Holding Times and Reporting Limits:

Acceptable.

Method, Trip, and Field Blanks:

MB acceptable.

Surrogate Recoveries:

na

Laboratory Control Samples (LCS):

aceptable

Matrix Spike/Matrix Spike Duplicate (MS/MSD):

na

Laboratory Duplicate:

Acceptable

Field Duplicate:

na

Calibration Criteria:

na

Qualification Summary:

Not qualified.

DATA QUALITY REVIEW

Job Number:	15670-10	**Review Date:**	11/16/15
Project:	M&B	**Reviewer:**	Conrad
Laboratory:	ESC	**Laboratory Job ID#:**	L789001
Analysis:	EPA 8270D-SIM - PAHs	**Matrix:**	sediment

Sample ID Numbers:

MBOC2015-01-1-3.5, MBOC2015-01-3.5-6, MBOC201502-0.5-3.5, MBOC2015-02-3.5-6.5

MS: MBOC2015-01-1-3.5

Sampling Date:	9/14/15	**Extraction Date:**	
Analysis Date:	9/19/15, 9/21/15, 9/22/15		

Holding Times and Reporting Limits:

Results between MDL and RDL qualified as estimated (J). Samples analyzed at 20-fold dilution due to matrix. RL raised due to dilution

Method, Trip, and Field Blanks:

MB is ND

Surrogate Recoveries:

Lab reported one surrogate from the dilution, and flagged as J7. All recoveries within lab control limits.

Laboratory Control Samples (LCS):

Recoveries and RPD within lab control limits

Matrix Spike/Matrix Spike Duplicate (MS/MSD):

Recoveries and RPD within lab control limits

Laboratory Duplicate:

na

Field Duplicate:

na

Calibration Criteria:

nr

Qualification Summary:

Not qualified.

APPENDIX C
Site Activity Documentation

Table 2.2
Example Site Visitation Record
McCormick and Baxter Creosoting Company
Portland, Oregon

SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
9/11/14	0900	AM	1030	PM	Chris Martin	HC	NW Natural precon meeting
9/24/14	0945	AM	1200	PM	" "	" "	NW Natural oversight / LTM prep.
9/25/14	0945	AM	1700		" "	" "	Low tide NAPL [illegible]
9/25/14	0945	AM	1700		Kaylan Smyth	HC	low tide NAPL [illegible]
" "	" "	"	1800		Phil Cordell	HC	" "
" "	" "	"	1600		Anthony Chavez	HC	" "
9/26/14	0945	AM	1430		Phil Cordell	HC	Transducer Data + Maint
10/14/14	1300	PM	1515		Chris Martin	HC	Site inspection Meeting
"	"	"	↓		Heidi Blischke	GSI	↓
"	"	"	↓		Scott Manzano	DEQ	↓
"	"	"	↓		Sarah Miller	DEQ	↓
1/12/15	1300	PM	1500		Sarah Miller	DEQ	Site Inspection
"	"	"	1500		Heidi Blischke	GSI	↓
"	"	"	1700		Renee Fowler	GSI	↓
"	"	"	1730		Phil Cordell	HC	↓
1/20/15	1200	PM	1430		Renee Fowler	GSI	Transducer Maintenance
"	1200		1600		Phil Cordell	HC	O&M & Transducer Maint

Table 2.2
Example Site Visitation Record
McCormick and Baxter Creosoting Company
Portland, Oregon

SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
2/10/15	0800	AM	11:00	AM	Chris Martin	HC	Site Maintenance
3/12/15	0730	AM	12:00	PM	KAYLAN SMYTH	HC	Site Maintenance
4/30/15	1000	AM	11:30	AM	Scott Manzano	DEQ	Site Visit
↓	↓	↓	↓	↓	Sarah Miller	DEQ	↓
↓	↓	↓	↓	↓	Chris Martin	HC	↓
↓	↓	↓	↓	↓	Heidi Blischke	GSI	↓
6/9/15	0730	AM			Kaylan Smyth	HC	Low tide monitoring
↓	800	AM	1340		[illegible]	GSI	Install Transducers
↓	800	AM			Phil Cordell	HC	" "
↓	800	AM	1415		Chris Martin	HC	Low tide Monitoring
↓	[illegible]	A	1430		Anthony Chart	HC	"
7/17	10	AM	12:30PM		Erin Hughes	GSI	Quarterly Sitewalk
	↓	1000	12:30		Phil Cordell	HC	↓
	↓	↓	↓		Heidi Blischke	GSI	↓
	↓	↓	↓		Scott Manzano	DEQ	
↓	↓	↓	↓		[illegible]	DEQ	
		↓	↓		Anne Christopher	EPA	

Site Visitation Record
McCormick and Baxter Creosoting Company
Portland, Oregon

SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
9/14	0720	AM	1615	PM	Chris Martin	HC	Pore water ~~Sediment~~ / organoclay sampling
9/14	0820	AM		335	Erin Hughes	GSI	" "
9/14	820	AM		335	Heidi Blischke	GSI	" "
9/14	0730	AM	1615	PM	Phil Cordell	HC	" "
9/15	0815	AM	16:50	pm	Kevin Hobbie	OSU	" "
9/15	0815	AM	↓	↓	Steven O'Connell	OSU	" "
9/15	0815	AM	↓	↓	Jamie Miniel	OSU	" "
9/15	815	AM	↓	↓	Holly Dixon	OSU	" "
9/15	815	AM	4 PM		Chris Martin	HC	" "
9/15	0800	AM	1650	pm	Phil Cordell	HC	" "
9/15	400	AM	↓	↓	Erin Hughes	GSI	" "
9/16	730	AM			Phil Cordell	HC	" 1500
9/16	745	AM			Erin Hughes	GSI	" 1145
9/16	800	AM			Heidi Blischke	GSI	" 1145
9/16	800	AM			Steven OConnell	OSU	" 1145
9/16	800	AM			Kevin Hobbie	OSU	" 1145
9/16	800	AM			Jamie Miniel	OSU	" 1145

Site Visitation Record
McCormick and Baxter Creosoting Company
Portland, Oregon

SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
9/16					Holly Dixon	OSU	"
9/29					Kaylan Smith	HC	Maintenance
9/25					Anthony Chavez	HC	" "
10/2	0830	am	1330		Chris Martin	HC	Low-tide mon/GW sample 5?s
10/2	0845		1330		Kaylan Smyth	HC	" "
10/2	845	AM	1200		Anthony Chavez	HCF	" "
10/6	0730	AM	1715		Phil Cordell	HC	sample retrieval
10/6	0730	AM	1600		Jamie Minice	OSU	"
10/6	0730	AM	1600		Carey Donald	OSU	"
10/6	0730	AM	1600		Holly Dixon	OSU	"
10/6	0730	AM	1600		Kevin Hobbie	OSU	"
10/6	740	AM	1600		Erin Hughes	GSI	"
10/6	740	Am	1600		Sara L Miller	DEQ	"
10/6	800	"	1:30	PM	J Montenado	"	"
10/14	1020	AM	11:00	AM	Phil Cordell	HC	MW-5G sampling
10/21	1430	PM	1600	PM	" "	"	" "

Site Visitation Record
McCormick and Baxter Creosoting Company
Portland, Oregon

SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
11/4/15	0845	AM	1140	AM	Phil Cordell	HC	Site Inspection
↓	↓	↓	1050	AM	Sarah Miller	DEQ	↓
			1050	AM	Scott Manzano	DEQ	
↓	↓	↓	1050	AM	Erin Carroll Hughes	GSI	↓
11/17/15	0900	AM	1215	AM	Phil Cordell	HC	Procurement walk
10/7/16	0920	AM	1050	AM	4 employees	Amaral	Site walk w/ veg contractor
"	0920	AM	"	"	Phil Cordell	HC	" "
12/15/15	945	AM	1115	AM	Anthony Chavez	HC	Cover Maintenance
12/15	9:45	AM	11:15	AM	Amaral /2	Amaral	" "
12/15	1245	PM	1300	PM	Phil Cordell	HC	Replace upper gate lock
12/16	8:00	Am	[illegible]	[illegible]	Luis Amaral Jr + C	Amaral Nursery	
1/17	8:00	am	12:00	Pm	Amaral / 3	Amaral Nursery	" "
12/17	1400	PM	1515	PM	Phil Cordell	HC	Veg Inspection
12/18	1445	PM	1530	PM	" "	HC	" "
12/18	8:00	AM	5:00	PM	Amaral/4	Amaral Nursery	Work
[illegible]/22	8:00	AM	2:00	PM	Amaral / 2	" "	" "
[illegible]	9:00	Am	12:00	Pm	Amaral #1	" "	" "

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Monday 1/26/15
1:00 P.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Heidi Blischke	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Capital Asset Tech	DEQ
	Phil Cordell	Project Geologist	Hart Crowser
	Heidi Blischke	Technical Manager	GSI
	Renee Fowler	Staff Scientist	GSI

Site Status Meeting Notes

Site Walk and Inspection

Sarah Miller, Phil Cordell, Heidi Blischke, and Renee Fowler completed a thorough inspection of the entire site on Monday, January 26, 2015. The next inspection is scheduled for April 2015.

Site Walk – Shoreline

The following items were inspected during the shoreline site walk and inspection:

- Gravel overlay on ACB,
- Buoy locations,
- Stormwater discharge,
- Willamette River and Willamette Cove shoreline conditions, and
- Ebullition from sediment cap.

Gravel from the shoreline enhancement task (completed in October 2012) remains settled in the voids of the ACB armoring. Tidal fluctuations have distributed gravel from the top of the ACB, where it was originally applied, to where it has settled along the toe of the bank. Gravel has not settled into the mid-bank portion of the ACB armoring in areas where the slope is steeper.

The Willamette River at the time of inspection (between 1:00 PM and 3:00 PM) was between 11.5 and 12.0 NAVD88. Low tide was at approximately 7:00 PM with a tide of approximately 10.75 NAVD88.

Discharge from the outfall was approximately 10 gallons per minute. The outfall was in good condition and free of weeds.

The number of derelict boats anchored within Willamette Cove during the site walk was approximately three. The boats were not anchored on the ACB cap. Water level elevations were too high to walk into Willamette Cove.

The shoreline is relatively clean and free of debris.

Few locations of ebullition were observed in the area above the granular organophilic clay along the Willamette River shoreline. A camp fire ring was observed along the Willamette River shoreline.

Exposed ACB armoring cable loops were observed along the Willamette River shoreline.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin,
- Subsurface drainage (manhole),
- Soil cap (burrows, erosion, etc.), and
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal-sized burrows). The middle strand of barbed wire was severed along one section of the southeast perimeter fence; this was marked on a map for repair.

Stormwater drainage was observed by opening a manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches. Previous measurements in January, April, July, and October 2014, were 2.6 inches, 2.50 inches, 2.59 inches, and 2.59 inches, respectively. The measurements differences are likely a result of manual measurement error.

Various birds and scat were spotted in the upland portion of the cap. Feathers and scat observed near EW-1s/MW-23d suggest coyote activity at the site.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Complete buoy replacement.	Chris Martin	February 2015
■ O&M Activities (Repair signs, repair fence, fill voids beneath perimeter gates)	Phil Cordell/Chris Martin	February 2015
■ Replace transducers in MW-37D, MW-36S, MW-36D, and MW-53S	Phil Cordell/Renee Fowler	March 2015
■ Sediment cap monitoring	Heidi Blischke/Erin Carroll	Spring 2015

Site Activities / Miscellaneous Field Activities

- Transducer maintenance was performed in conjunction with this site inspection.
- NW Natural has decommissioned their underground line next to the site. The construction area has been cleaned up and drums of decontamination water was removed from the site.

Deliverables

- DEQ and GSI continue to work with OSU to prepare the sediment cap sampling plan.
- The Draft 2014 Operations and Maintenance Report will be delivered to the DEQ in mid-February.

Action Item:	Person Responsible:	Deadline:
Hart Crowser will prepare a subcontractor procurement document to implement the Shoreline Planting Plan, spot spraying of invasive weeds, and decommissioning of the existing irrigation system.	Chris Martin/Phil Cordell	March 2015
Hart Crowser and GSI will submit Draft 2014 O&M Annual Report.	Chris Martin/Heidi Blischke	February 2015
GSI will prepare the Work Plan and SAP for Porewater sampling.	Heidi Blischke	April 2015

Budget Status: November 2014 through January 2015 were at/or below the anticipated budget. BAPs were completed to extend Hart Crowser and GSI's Operation and Maintenance activities through June 2015, and to extend Operation and Functional activities through September 2015.

Meeting Status:

Date / Time	TBD – April 2015	
Location	McCormick & Baxter Facility	Site Office

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 4/30/15
10:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Heidi Blischke	Note Taker:	Chris Martin
Attendees:	Scott Manzano	Project Officer	DEQ
	Sarah Miller	Capital Asset Tech	DEQ
	Chris Martin	Site Manager	Hart Crowser
	Heidi Blischke	Technical Manager	GSI

Site Status Meeting Notes

Site Walk and Inspection

Scott Manzano, Sarah Miller, Chris Martin, and Heidi Blischke completed a thorough inspection of the entire site on Thursday, April 30, 2015. The next inspection is scheduled for July 2015.

Site Walk – Shoreline

The following items were inspected during the shoreline site walk and inspection:

- Gravel overlay on ACB,
- Buoy locations,
- Stormwater discharge,
- Willamette River and Willamette Cove shoreline conditions, and
- Ebullition from sediment cap.

Gravel from the shoreline enhancement task (completed in October 2012) remains settled in the voids of the ACB armoring. Tidal fluctuations have distributed gravel from the top of the ACB, where it was originally applied, to where it has settled along the toe of the bank. Gravel has not settled into the mid-bank portion of the ACB armoring in areas where the slope is steeper.

Buoy #4 was replaced on February 11, 2015. All five buoys were visible. The Willamette River at the time of inspection (between 10:00 AM and 12:00 PM) was between 8.3 and 7.7 NAVD88. Low tide was at approximately 1:00 PM with a tide of approximately 7.6 NAVD88.

Discharge from the outfall was approximately 3 gallons per minute and the outfall was in good condition with minimal weeds.

Few locations of ebullition were observed in the area above the granular organophilic clay along the Willamette River shoreline. No sheen was observed.

Exposed ACB armoring cable loops were observed along the Willamette River shoreline.

The number of derelict boats anchored within Willamette Cove during the site walk was about five. The boats were not anchored on the ACB cap. The shoreline is relatively clean and free of debris.

Wildlife spotted along the shoreline included Canada geese, seagulls, osprey, killdeer, and clamshells.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin,
- Subsurface drainage (manhole),
- Soil cap (burrows, erosion, etc.), and
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal-sized burrows).

Stormwater drainage was observed by opening a manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches. In January 2015, this distance was also measured at 2.75 inches. Previous measurements in January, April, July, and October 2014, were 2.6 inches, 2.50 inches, 2.59 inches, and 2.59 inches, respectively. The difference suggests that the ground surface may have settled an additional 0.16 in late 2014.

Various birds and scat were spotted in the upland portion of the cap.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Sample MW-59s.	Phil Cordell/Chris Martin	October 2015
■ Replace transducers in MW-37D, MW-36S, MW-36D, and MW-53S	Phil Cordell/Renee Fowler	June 2015
■ Sediment cap monitoring	Heidi Blischke/Erin Carroll	Sept/Oct 2015

Site Activities / Miscellaneous Field Activities

- Buoy #4 was replaced on February 11, 2015.
- Maintenance activities have been completed including filling animal burrows along the perimeter fence, resetting a perimeter warning sign, cutting exposed cable loops on the ACB armoring, and replacing the sump pump in the covered staging area.

Deliverables

- The Draft 2014 Operations and Maintenance Report was delivered to the DEQ on March 23, 2015.

Action Item:	Person Responsible:	Deadline:
Hart Crowser will prepare a subcontractor procurement document to implement the Shoreline Planting Plan, spot spraying of invasive weeds, and decommissioning of the existing irrigation system.	Chris Martin/Phil Cordell	Fall 2015
Hart Crowser and GSI will submit final 2014 O&M Annual Report.	Chris Martin/Heidi Blischke	May 2015
GSI will prepare the Work Plan and SAP for Porewater sampling.	Heidi Blischke	May 2015

Budget Status: February 2015 through April 2015 were at/or below the anticipated budget. Operation and Maintenance activities are currently funded through June 2015, and Operation and Functional activities are funded through September 2015.

Meeting Status:

Date / Time	TBD – July 2015	
Location	McCormick & Baxter Facility	Site Office

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Friday 7/17/2015
10:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Heidi Blischke	Note Taker:	Phil Cordell
Attendees:	Scott Manzano	Project Officer	DEQ
	Sarah Miller	Capital Asset Tech	DEQ
	Anne Christopher	Project Manager	EPA
	Phil Cordell	Asst Site Manager	Hart Crowser
	Heidi Blischke	Technical Manager	GSI
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on Friday, July 17, 2015. The next inspection is scheduled for October 2015.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.

Gravel from the shoreline enhancement task (completed in October 2012) remains settled in the voids of the ACB armoring. Tidal fluctuations have distributed gravel from the top of the ACB, where it was originally applied, to where it has settled along the toe of the bank. Gravel has not settled into the mid-bank portion of the ACB armoring in areas where the slope is steeper.

The Willamette River at the time of inspection (between 10:00 AM and 12:00 PM) was between 3.83 and 3.12 feet COP (or 8.83 – 8.12 NAVD88). Low tide was at approximately 4:30PM with a tide of approximately 1.66 feet COP (or 6.66 NAVD88). All buoys were visible.

There was no discharge from the outfall. The outfall is in good condition, although the discharge basin is full of weeds.

Approximately 5 derelict boats anchored within Willamette Cove were observed during the site walk. The shoreline is relatively clean and free of debris.

Infrequent ebullition was observed in the area above the granular organoclay along the Willamette River shoreline and above the granular organoclay within Willamette Cove.

Algae (possibly toxic blue-green algae) was observed along the shoreline in Willamette Cove and reported to the public health department by the DEQ.

Wildlife spotted along the shoreline included Canada geese and seagulls.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows).

No drainage was observed at the shoreline outfall, so manholes were not inspected.

The distance between the inner and outer casing of MW-23d was 2.75 inches, similar to previous measurements indicating no ground movement.

Various small birds and scat were spotted in the upland portion of the cap.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Prepare O&F & O&M BAP which includes sediment cap performance monitoring field work.	Phil Cordell	July/August 2015
■ Riparian area drought tolerance assessment	Phil Cordell	July 2015
■ Vegetation planting plan and irrigation system decommissioning	Phil Cordell	Fall 2015
■ Low Tide Monitoring and GW sample from MW-59s	Phil Cordell	Oct 2015
■ Sediment Cap Monitoring	Heidi Blischke/Erin Hughes	Sept/Oct 2015
■ Five year review and O&M report	Phil Cordell/Erin Hughes	Fall/Winter 2015

Site Activities / Miscellaneous Field Activities

- Low-tide monitoring and the vegetative inspection was conducted in June 2015.
- DEQ and GSI continue to work with OSU to prepare the sediment cap sampling plan.
- Drought tolerance assessment will be completed by Hart Crowser in July 2015.
- Hart Crowser will prepare a subcontractor procurement document to implement the Shoreline Planting Plan, spot spraying of invasive weeds, and decommissioning of the existing irrigation system.

Deliverables
Final Annual O&M Report: Delivered to the DEQ on July 9, 2015. **Revised Surface Water, Inter-armoring Water, and Sub-armoring Water Sampling and Analysis Plan:** Delivered via email on July 9, 2015. **Revised Organophilic Clay Coring Plan:** Delivered to DEQ via email on July 14, 2015.
Budget Status: April 2015 through July 2015 were at/or below the anticipated budget. BAPs are being completed to extend Hart Crowser and GSI's Operation and Maintenance, and Operation and Functional activities through June 2016.

Meeting Status:		
Date / Time	November 4, 2015	
Location	McCormick & Baxter Facility	Site Office

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Wednesday 11/4/2015
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Scott Manzano	Note Taker:	Phil Cordell
Attendees:	Scott Manzano	Project Officer	DEQ
	Sarah Miller	Capital Asset Tech	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on Wednesday, November 4, 2015. The next inspection is scheduled for January 2016.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.

Gravel from the shoreline enhancement task (completed in October 2012) remains settled in the voids of the ACB armoring. Tidal fluctuations have distributed gravel from the top of the ACB, where it was originally applied, to where it has settled along the toe of the bank. Gravel has not settled into the mid-bank portion of the ACB armoring in areas where the slope is steeper.

The Willamette River at the time of inspection (between 9:00 AM and 11:00 AM) was between 1.29 and 3.18 feet COP (or 6.29 – 8.18 NAVD88). Low tide was at approximately 8:15 AM with a tide of approximately 1.13 feet COP (or 6.13 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at 1-2 gallons per minute. The outfall is in good condition, although the discharge basin is full of weeds.

Approximately 6 derelict boats anchored within Willamette Cove were observed during the site walk. The shoreline is relatively clean and free of debris.

Infrequent ebullition was observed in the area above the granular organoclay along the Willamette River shoreline and above the granular organoclay within Willamette Cove.

Wildlife spotted along the shoreline included Canada geese and seagulls.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows).

Stormwater drainage was observed by opening a manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, similar to previous measurements indicating no ground movement.

Various small birds and scat were spotted in the upland portion of the cap. Feathers and scat observed near EW-1s/MW-23d suggest coyote activity at the site.

Action Items:	**Person Responsible**	**Deadline**
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Shoreline repairs, irrigation system decommissioning, herbicide application, and vegetation inspection	Phil Cordell	December 2015-January 2016
■ Winter transducer inspection and install 4 new transducers	Phil Cordell	January 2015
■ Fill burrows beneath perimeter fence	Phil Cordell	Winter 2015

Site Activities / Miscellaneous Field Activities

- Low-tide monitoring was conducted in October 2015.
- DEQ, EPA, GSI, Hart Crowser, and OSU conducted the sediment cap monitoring in September and October 2015.

Deliverables

None submitted.

Action Item:	Person Responsible:	Deadline:
Hart Crowser will prepare a subcontractor procurement document to implement the Shoreline Planting Plan, spot spraying of invasive weeds, and decommissioning of the existing irrigation system.	Phil Cordell	November 2015
Hart Crowser and GSI will submit Draft 2015 O&M Annual Report.	Phil Cordell/Erin Hughes	February 2016
Hart Crowser and GSI will assist DEQ with the five year review	Phil Cordell/Erin Hughes	Winter -Spring 2016
Hart Crowser and GSI will update the O&M Manual	Phil Cordell/Erin Hughes	January 2016

Budget Status: July 2015 through November 2015 were at/or below the anticipated budget. BAPs are being completed to complete vegetation management tasks.

Meeting Status:

Date / Time	TBD – January 2016	
Location	McCormick & Baxter Facility	Site Office

01/26/2015

Site Observations Form - Soil Cap
Quarterly

tbl_site_observations	
Category	**Observation**
Gate Conditions (quarterly)	All locked and secure
Perimeter Fence (quarterly)	Good
Trespassers, Entry Point	None Observed
Avg. High Temp (week of observation)	48°F
Avg. Low temp (week of observation)	36°F
Wind Speed (day of observation)	Light wind ~ 5 mph
Total Precipitation (week of observation)	0.09 inches
Erosion	
Around Manholes	None Observed
Headway Retention Pond	None Observed
Eastern Edge of Property	None Observed
Spillway Area	None Observed
Outfall Area	Fair
Animal Burrows / Disturbance	Animal burrows near extra ACB and randomly throughout site
Manhole Conditions	Good
Debris, Flow, General Condition	No debris, moderate flow, approximately 10 gpm
Flow in Collection Piping	Moderate flow, approximately 10 gpm
Outfall and Spillway	
Note Approx. Flow Volume	Moderate flow, approximately 10 gpm
Sprinkler System	In place but not in use
Vegetation Conditions	Fair
Wildlife	Birds, geese
Daily Activities	Site Inspection
Obsevations or Notes	
Follow Up Inspection	**Yes** **No** **Date:**

04/30/2015

Site Observations Form - Soil Cap
Quarterly

tbl_site_observations

Category	Observation
Gate Conditions (quarterly)	All locked and secure
Perimeter Fence (quarterly)	Good
Trespassers, Entry Point	None Observed
Avg. High Temp (week of observation)	64°F
Avg. Low temp (week of observation)	45°F
Wind Speed (day of observation)	Light wind 7 mph
Total Precipitation (week of observation)	0.02 inches
Erosion	
Around Manholes	None Observed
Headway Retention Pond	None Observed
Eastern Edge of Property	None Observed
Spillway Area	None Observed
Outfall Area	Fair
Animal Burrows / Disturbance	Animal burrows near extra ACB and randomly throughout site
Manhole Conditions	Good
Debris, Flow, General Condition	No debris, low flow, approximately <3 gpm
Flow in Collection Piping	low flow, approximately <3 gpm
Outfall and Spillway	
Note Approx. Flow Volume	Low flow, approximately 3 gpm
Sprinkler System	In place but not in use
Vegetation Conditions	Fair
Wildlife	Osprey, geese, kingfisher, hawks
Daily Activities	Site Inspection
Obsevations or Notes	
Follow Up Inspection	Yes No Date:

07/17/2015

Site Observations Form - Soil Cap
Quarterly

tbl_site_observations

Category	Observation
Gate Conditions (quarterly)	All locked and in good condition.
Perimeter Fence (quarterly)	Good
Trespassers, Entry Point	None Observed
Avg. High Temp (week of observation)	81°F
Avg. Low temp (week of observation)	58°F
Wind Speed (day of observation)	Light wind < 5 mph
Total Precipitation (week of observation)	0.00 inches
Erosion	
Around Manholes	None Observed
Headway Retention Pond	None Observed
Eastern Edge of Property	None Observed
Spillway Area	None Observed
Outfall Area	Fair
Animal Burrows / Disturbance	Animal burrows near extra ACB and randomly throughout site
Manhole Conditions	Good
Debris, Flow, General Condition	No debris and no flow.
Flow in Collection Piping	No flow.
Outfall and Spillway	
Note Approx. Flow Volume	No flow.
Sprinkler System	In place but not in use
Vegetation Conditions	Stressed due to drought.
Wildlife	Birds, geese, ground squirrels
Daily Activities	Site Inspection
Obsevations or Notes	
Follow Up Inspection	**Yes No Date:**

A vegetation drought tolerance assessment was completed on July 21, 2015 do evaluate health of stressed vegetation observed primarily in the riparian area. On July 27, 2015, approximately 5,500 gallons of water was applied to stressed vegetation in the riparian area. A second watering event was completed on August 18, 2015, when 4,000 gallons of water was applied to the riparian area.

11/4/2015

Site Observations Form - Soil Cap
Quarterly

tbl_site_observations

Category	Observation
Gate Conditions (quarterly)	All locked and in good condition.
Perimeter Fence (quarterly)	Good
Trespassers, Entry Point	None Observed
Avg. High Temp (week of observation)	56°F
Avg. Low temp (week of observation)	42°F
Wind Speed (day of observation)	Light wind ~5mph
Total Precipitation (week of observation)	0.78 inches
Erosion	
Around Manholes	None Observed
Headway Retention Pond	None Observed
Eastern Edge of Property	None Observed
Spillway Area	None Observed
Outfall Area	Fair
Animal Burrows / Disturbance	Animal burrows near extra ACB and randomly throughout site
Manhole Conditions	Good
Debris, Flow, General Condition	No debris, low flow (~2gpm).
Flow in Collection Piping	Low flow, ~ 2 gpm.
Outfall and Spillway	
Note Approx. Flow Volume	Low flow, ~ 2 gpm.
Sprinkler System	In place but not in use
Vegetation Conditions	Good
Wildlife	Birds, geese,
Daily Activities	Site Inspection
Obsevations or Notes	
Follow Up Inspection	☐Yes ☒No Date:

1/26/2015

Site Observations Form - Sediment Cap
Quarterly

tbl_site_observations

Category	Observation
Gate Conditions (quarterly)	All locked and secure.
Avg. High Temp (week of observation)	48°F
Avg. Low Temp (week of observation)	36°F
Wind Speed (day of observation)	Light wind ~5 mph
Total Precipitation (week of observation)	0.09 inches
Sheen Observations (see table below)	None Observed
Size and Location	None Observed
Source (gas bubble, debris, etc.)	None Observed
ACB and Riprap Armoring	Good
Changes in Location	Good
Displaced blocks	Good
Vandalism	None Observed
River relative to top of ACB	20 to 30 plus feet (~12 feet NAVD88)
Organoclay Mats (extreme low water)	None Observed
Edges of mats visible?	None Observed
Overlying Armoring conditions	Good
Evidence of movement?	None Observed
WC OC/Seep Area	Good
TFA OC/Seep Area	Good
Wildlife	
Fish / Crayfish / Clams	None Observed
Other	Birds
Warning Signs Condition	Good
Buoy Condition / Location	Four of the five buoys visible and in good condition, Buoy #4 missing
Cove Shoreline (general)	Good
FWDA Shoreline (general)	Good
Bulkhead Shoreline (general)	Good
TFA Shoreline (general)	Good
Observations or Notes	
Follow Up Inspection	☐ Yes ☒ No Date:
Sheen Description	

Location (TFA, FWDA, Willamette Cove) indicate if located on map and attach map	Character (NS, BS, SS, MS, HS)	Size and dimension (inches)	Odor (no odor, petroleum odor. creosote odor, other odor)

04/30/2014

Site Observations Form - Sediment Cap
Quarterly

tbl_site_observations

Category	Observation
Gate Conditions (quarterly)	All locked and secure
Avg. High Temp (week of observation)	64°F
Avg. Low Temp (week of observation)	45°F
Wind Speed (day of observation)	Light wind 7 mph
Total Precipitation (week of observation)	0.02 inches
Sheen Observations (see table below)	None Observed
Size and Location	None Observed
Source (gas bubble, debris, etc.)	None Observed
ACB and Riprap Armoring	Good
Changes in Location	Good
Displaced blocks	Good
Vandalism	None Observed
River relative to top of ACB	20 to 30 plus feet (~8 feet NAVD88)
Organoclay Mats (extreme low water)	None Observed
Edges of mats visible?	None Observed
Overlying Armoring conditions	Good
Evidence of movement?	None Observed
WC OC/Seep Area	Good
TFA OC/Seep Area	Good
Wildlife	
Fish / Crayfish / Clams	None Observed
Other	Birds
Warning Signs Condition	Good
Buoy Condition / Location	Five buoys visible and in good condition.
Cove Shoreline (general)	Good
FWDA Shoreline (general)	Good
Bulkhead Shoreline (general)	Good
TFA Shoreline (general)	Good
Observations or Notes	
Follow Up Inspection	☐ Yes ☒ No Date:
Sheen Description	

Location (TFA, FWDA, Willamette Cove) indicate if located on map and attach map	Character (NS, BS, SS, MS, HS)	Size and dimension (inches)	Odor (no odor, petroleum odor. creosote odor, other odor)

07/17/2015

Site Observations Form - Sediment Cap
Quarterly

tbl_site_observations

Category	Observation
Gate Conditions (quarterly)	All locked and secure
Avg. High Temp (week of observation)	81°F
Avg. Low Temp (week of observation)	58°F
Wind Speed (day of observation)	Light wind <5 mph
Total Precipitation (week of observation)	0.00 inches
Sheen Observations (see table below)	None Observed
Size and Location	None Observed
Source (gas bubble, debris, etc.)	Ebulation observed in areas above granular oganophilic clay.
ACB and Riprap Armoring	Good
Changes in Location	Good
Displaced blocks	Good
Vandalism	None Observed
River relative to top of ACB	20 to 30 plus feet (~8 feet NAVD)
Organoclay Mats (extreme low water)	None Observed
Edges of mats visible?	None Observed
Overlying Armoring conditions	Good
Evidence of movement?	None Observed
WC OC/Seep Area	Good
TFA OC/Seep Area	Good
Wildlife	
Fish / Crayfish / Clams	None Observed
Other	Birds
Warning Signs Condition	Good
Buoy Condition / Location	Five buoys visible and in good condition.
Cove Shoreline (general)	Good
FWDA Shoreline (general)	Good
Bulkhead Shoreline (general)	Good
TFA Shoreline (general)	Good
Observations or Notes	
Follow Up Inspection	☐ Yes ☒ No Date:
Sheen Description	

Location (TFA, FWDA, Willamette Cove) indicate if located on map and attach map	Character (NS, BS, SS, MS, HS)	Size and dimension (inches)	Odor (no odor, petroleum odor. creosote odor, other odor)

11/4/2015

Site Observations Form - Sediment Cap
Quarterly

tbl_site_observations

Category	Observation
Gate Conditions (quarterly)	All locked and secure
Avg. High Temp (week of observation)	56°F
Avg. Low Temp (week of observation)	42°F
Wind Speed (day of observation)	Light wind <5 mph
Total Precipitation (week of observation)	0.78 inches
Sheen Observations (see table below)	None Observed
Size and Location	None Observed
Source (gas bubble, debris, etc.)	Infrquent ebulation observed in areas above granular oganophilic clay.
ACB and Riprap Armoring	Good
Changes in Location	Good
Displaced blocks	Good
Vandalism	None Observed
River relative to top of ACB	20 to 40 plus feet. (3 feet NAVD)
Organoclay Mats (extreme low water)	None Observed
Edges of mats visible?	None Observed
Overlying Armoring conditions	Good
Evidence of movement?	None Observed
WC OC/Seep Area	Good
TFA OC/Seep Area	Good
Wildlife	
Fish / Crayfish / Clams	None observed
Other	Birds
Warning Signs Condition	Good
Buoy Condition / Location	Five buoys visible and in good condition.
Cove Shoreline (general)	Good
FWDA Shoreline (general)	Good
Bulkhead Shoreline (general)	Good
TFA Shoreline (general)	Good
Observations or Notes	
Follow Up Inspection	☐ Yes ☒ No Date:
Sheen Description	

Location (TFA, FWDA, Willamette Cove) indicate if located on map and attach map	Character (NS, BS, SS, MS, HS)	Size and dimension (inches)	Odor (no odor, petroleum odor. creosote odor, other odor)

APPENDIX D
Infiltration Pond Groundwater Quality Assessment

Appendix D Contents

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TABLE

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D-2 MW-59s Groundwater Quality Data

ATTACHMENT A

Data Quality Review, Field Notes, and Laboratory Analytical Report for MW-59s Sampling

APPENDIX D
INFILTRATION POND GROUNDWATER QUALITY ASSESSMENT

1.0 INTRODUCTION

This Appendix to the January 1, 2015 through December 31, 2015 Operation and Maintenance (O&M) Report summarizes the October 2015 groundwater sampling activities and analytical results for the sampling of monitoring well MW-59s at the McCormick and Baxter Superfund site (site). The location of the site, the site layout, and surface elevations are shown on Figures 1-1 through 1-3 in the main section of the O&M Report.

In 2005, a soil cap was installed at the site as part of the remedial action. One component of the soil cap is an infiltration pond constructed at the southeast corner of the site to collect surface water runoff from the site. A groundwater monitoring well, MW-59s, was installed downgradient from the infiltration pond to monitor contaminant levels in groundwater. Figure D-1 shows the location of monitoring well MW-59s relative to the infiltration pond and the drainage ditch leading to the infiltration pond. During storm events, stormwater from the upland soil cap, excluding the area within the barrier wall, drains to the infiltration pond. During typical precipitation events, stormwater infiltrates directly without appreciable runoff reaching the infiltration pond.

In accordance with the site O&M Plan (DEQ 2014) groundwater samples were collected from MW-59s to evaluate the potential for subsurface contaminants to be mobilized by the infiltration pond. In October 2015, the sample from MW-59s was analyzed for the groundwater contaminants of concern (COCs) excluding pentachlorophenol (PCP) as identified in the Record of Decision (ROD) (EPA 1996). COCs analyzed include:

- Metals (arsenic, chromium, copper, and zinc); and
- Polynuclear aromatic hydrocarbons (PAH).

PCP in groundwater from MW-59s was below low level detection limits for the four events between November 2006 and August 2008. Therefore, the DEQ made the decision to discontinue PCP analysis in 2009.

2.0 SAMPLING METHODOLOGY, HANDLING, AND ANALYSIS

This section describes the methodology for sampling monitoring well MW-59s. Ecology and Environment, Inc. (E&E), conducted sampling prior to the August 2008 sampling event. The methods for these sampling events, between April 2006 and October 2007, are described in Attachment I of the O&M Report October 2005 through December 2006 (E&E 2007). During those first four sampling events, a submersible pump was employed using a low-flow sampling approach. Since February 2008, Hart Crowser has been the consultant in charge of the O&M procedures at the site and has used the sampling methodology, sample handling procedures, and laboratory analyses described below.

3.0 SAMPLE METHODOLOGY

Groundwater samples were collected from monitoring well MW-59s using a variable-speed peristaltic pump. Pump tubing was lowered to the screened interval of the well. This ensures water slowly withdrawn could be pulled in from the surrounding aquifer and was representative of the groundwater. The pumping rate was set at no more than 0.5 liter per minute (lpm). Care was taken to monitor drawdown in the well so that it did not exceed 4 inches. A water quality meter equipped with a flow-through cell was used to monitor the following water quality parameters: pH, electrical conductance (EC), temperature, oxidation-reduction potential (ORP), and dissolved oxygen (DO).

Disposable polyethylene tubing was used to collect the groundwater samples. A minimum of 1 liter was purged before recording the initial water quality parameters. Field water quality parameters were recorded after each liter of water was purged from the well. The final field water quality parameters are included in Table D-1.

Purge water was collected in a 5-gallon bucket and transferred to a 55-gallon steel drum. Sample collection proceeded after water quality parameters had stabilized to within the following criteria: pH ±0.1 pH units, EC ±3 percent milliSiemens/centimeter (mS/cm), ORP ±10 millivolts, and DO to 10 percent. Although turbidity was not measured during purging, visual observations indicated groundwater during sampling was semi-turbid to clear with small amounts of visible sediment. After parameters had stabilized, groundwater samples were collected directly from the pump tubing into laboratory-supplied sample containers. Turbidity measurements at the time of sampling are important to understanding the relationship between analyte concentrations and suspended solids in the groundwater sample. Since turbidity could not be measured in the field, an additional volume of groundwater was collected and analyzed for total suspended solids.

3.1 Sample Handling and Analysis

Upon collection, samples were labeled, sealed in plastic bags, and immediately placed on ice in a cooler for transport to the contract laboratory. Analytical services were provided by ESC Laboratories of Mt. Juliet, Tennessee, under contract to the Oregon Department of Environmental Quality (DEQ). Proper chain-of-custody procedures were followed from sample collection to analysis. Groundwater samples were analyzed using the following methods:

- Total metals (arsenic, copper, chromium, iron, and zinc) by EPA Method 6020;
- PAHs by EPA Method 8270C-SIM; and
- Total Suspended Solids (TSS) by SM 2540D.

4.0 SAMPLING RESULTS

This section describes the analytical results for groundwater samples collected from MW-59s for the October 2015 sampling event. The complete laboratory report from October 2015 is provided in

Attachment A. Field notes and a data quality review for this sampling event can also be found in Attachment A. A summary of analytical results from the October 2015 and all previous sampling events are presented in Table D-1. Figure D-2 plots the MW-59s COC concentrations since sampling began.

Alternate Concentration Limits (ACLs) were established in the ROD (EPA 1996) as protective cleanup levels for groundwater at the site as the result of the technical impracticability of restoring groundwater to drinking water standards. However, as described in the Second Five-Year Review (DEQ 2006), the EPA has determined that ACLs are not valid as substitutes for Primary Drinking Water Standard Maximum Contaminant Levels (MCLs) in groundwater at the site. Therefore, MCLs are provided as a “point of reference” in Table D-1 until the ROD is amended with appropriate protective levels for groundwater at the site.

4.1 Total Metals

Groundwater from MW-59s was analyzed for total arsenic, chromium, copper, iron, and zinc by EPA Method 6020. The results for October 2015 are summarized below.

In October 2015 the total arsenic concentration in MW-59s was reported as 0.0453 milligrams per liter (mg/L). As part of the third Five-Year Review (the third Five-Year Review document was completed in Fall 2011 by DEQ/EPA) in Spring 2010, arsenic was detected in all 10 wells sampled at concentrations ranging from 0.00062 to 0.0388 mg/L. The 2010 sampling results indicate site-wide arsenic concentrations remain relatively consistent; however, total arsenic in MW-59s has gradually increased since spring 2006, rising slightly from around 0.03 mg/L in 2010. Arsenic concentrations are consistently above the MCL of 0.01 mg/L.

The total chromium concentration in MW-59s was detected at an estimated 0.000543 mg/L. The concentration was estimated because the concentration was below the method reporting limit (MRL) of 0.002 mg/L, but above the method detection limit (MDL) of the lab equipment. During the 2010 sampling event, chromium was detected in groundwater from 9 of 10 site wells with concentrations ranging from 0.00041 to 0.00250 mg/L. Total chromium in groundwater from MW-59s and other site wells has remained consistent and is well below the MCL for chromium of 0.10 mg/L.

In October 2015 the total copper concentration in MW-59s was reported as 0.000646 mg/L. The concentration was estimated because the concentration was below the MRL of 0.005 mg/L, but above the MDL of the lab equipment. In spring 2010, copper was detected in 9 of 10 site wells at concentrations ranging from 0.00120 to 0.00710 mg/L. Copper concentrations are roughly equivalent to the last measured concentration in 2010 (0.00066 mg/L). Results are consistently below the MCL of 1.30 mg/L.

Total zinc concentrations in MW-59s was detected at an estimated 0.00567 mg/L. The concentration was estimated because the concentration was below the MRL of 0.025 mg/L, but above the MDL of the lab equipment. In spring 2010, zinc was detected in 9 of 10 site wells at concentrations ranging from 0.002 to 0.0341 mg/L. Zinc concentrations have declined slightly from the October 2010 concentration (0.0081 mg/L). Results are consistently below the MCL of 5.00 mg/L.

4.2 Polynuclear Aromatic Hydrocarbons

Groundwater samples were analyzed for PAHs by EPA Method 8270-SIM. The MRL for PAHs ranged from 0.25 to 0.05 micrograms per liter (µg/L).

During the October 2015 sampling event, five low-molecular weight PAHs (LPAHs) were detected, acenaphthene, anthracene, fluorene, naphthalene, and phenanthrene, ranging from 0.0139 µg/L to 0.0865 µg/L. Total LPAH concentrations (0.222 µg/L) were less than the total LPAHs from the last sampling event in October 2010 (0.087 µg/L).

Two high-molecular weight PAHs (HPAHs) were detected, benz(a)anthracene and fluoranthene at concentrations of 0.000902 µg/L and 0.0306 µg/L, respectively. Benz(a)anthracene was the only carcinogenic PAHs (CPAHs) detected.

Due to lower detection limits used since earlier sampling events, more PAHs are now being detected at lower concentrations. Although more PAHs are detected, PAH concentrations have stabilized at relatively low levels in MW-59s since 2007. Total PAH concentrations have doubled since 2010, but remain at low levels.

4.3 Total Suspended Solids

Total suspended solids (TSS) analysis began in October 2010 to understand whether total metals concentrations are associated with particulates present in the dissolved phase. TSS results (84 mg/L) indicated slightly-turbid sampling conditions in October 2015. Despite the slightly elevated TSS conditions, elevated concentrations of metals were not detected in groundwater.

5.0 SUMMARY

During 2015, concentrations for chromium, copper, and zinc remained at similar levels to 2010 measurements. Arsenic concentrations have risen slightly and remain above federal MCLs. Since the lowering of detection limits, trace amounts of PAHs have been recorded in every sample. As COC concentrations have stabilized at low levels, there does not appear to be a risk of subsurface contaminant mobilization by the infiltration pond. We recommend discontinuing sampling of MW-59s.

6.0 REFERENCES

DEQ 2006. *Second Five-Year Review, McCormick and Baxter Creosoting Company Superfund Site, Portland, Oregon.* September 2006.

DEQ 2007. *Draft Final Operation and Maintenance Plan, McCormick and Baxter Creosoting Company Superfund Site, Portland, Oregon*. March 2007.

E&E 2007. *Operation and Maintenance Report (October 2005 through December 2006), McCormick & Baxter Creosoting Company, Portland, Oregon.* March 2007.

EPA 1996*. Record of Decision, McCormick and Baxter Creosoting Company, Portland, Oregon.* March 1996.

Table D-1 - Groundwater Analytical Results: MW-59s
McCormick and Baxter Superfund Site
Portland, Oregon

SAMPLE LOCATION		EPA Primary Drinking Water Standard Maximum Contaminant Levels (for reference only)	MW-59s (2nd Quarter 2006)	MW-59s (4th Quarter 2006)	MW-59s (1st Quarter 2007)	MW-59s (3rd Quarter 2007)	MW-59s (3rd Quarter 2008)	MW-59s (3rd Quarter 2009)	MW-59s (4th Quarter 2010)	MW-59s (2015)	
Sample Date			**4/26/2006**	**11/3/2006**	**2/28/2007**	**10/3/2007**	**8/21/2008**	**8/31/2009**	**10/7/2010**	**10/2/2015**	**10/21/2015**
Sample Time			**18:01**	**14:47**	**12:00**	**9:58**	**9:50**	**17:19**	**14:52**	**8:55**	**16:00**
Well Depth			**shallow**	**shallow**	**shallow**	**shallow**	**shallow**	**shallow**	**shallow**	**shallow**	**shallow**
CONTAMINANT OF CONCERN		MCL									
Total Metals (mg/L)											
Arsenic		0.01	**0.0080**	**0.0197**	**0.0122**	**0.0225**	**0.0301**	**0.0301**	**0.0302**	NA	**0.0453**
Chromium		0.10	**0.0011**	**0.0015**	**0.00319**	**0.00474**	**0.0466**	**0.00073**	**0.00048** J	NA	**0.000543** J
Copper		1.30	**0.0005** J	**0.0011** J	**0.000520** J	**0.00107** J	**0.0584**	**0.0011**	**0.00066**	NA	**0.000646** J
Iron		NA	NA	NA	NA	NA	NA	**52.6**	NA	NA	**50.5**
Zinc		5.00	**0.0056**	**0.0075**	**0.00707**	**0.00845**	**0.140**	**0.0102**	**0.0081**	NA	**0.00567** J
PAHs (µg/L)											
Acenaphthene	L		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0476 U	0.019 U	0.0032 U	**0.0139** J	**NA**
Acenaphthylene	L		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0476 U	0.019 U	0.0030 U	0.012 U	**NA**
Anthracene	L		0.0472 U	0.0500 U	0.0495 U	**0.0121** J	**0.0397**	**0.064**	**0.039** J	**0.0485** J	**NA**
Benz (a) anthracene	H, C		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0119 U	**0.033**	0.0023 U	**0.00902** J	**NA**
Benzo (a) pyrene	H, C	0.2	0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0119 U	0.078 U	0.0030 U	0.0116 U	**NA**
Benzo (b) fluoranthene	H, C		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0119 U	0.11 U	0.020 U	0.00212 U	**NA**
Benzo (k) fluoranthene	H, C		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0119 U	**0.021**	0.0039 U	0.0136 U	**NA**
Benzo (ghi) perylene	H, C		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0119 U	**0.035**	0.0055 U	0.00227 U	**NA**
Chrysene	H, C		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0119 U	**0.033**	0.0032 U	0.0108 U	**NA**
Dibenzo (a,h) anthracene	H, C		0.0943 U	0.1000 U	0.0990 U	0.0238 U	0.0238 U	0.019 U	0.0076 U	0.00396 U	**NA**
Fluoranthene	H		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0119 U	**0.041**	**0.031** J	**0.0306** J	**NA**
Fluorene	L		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0476 U	**0.026**	0.0034 U	**0.0211** J	**NA**
Indeno (1,2,3-cd) pyrene	H, C		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0119 U	0.064 U	0.0062 U	0.0148 U	**NA**
Naphthalene	L		0.0472 U	0.0500 U	0.0495 U	**0.257**	0.0119 U	**0.042** J	0.0057 U	**0.0865** J	**NA**
Pentachlorophenol	L	1	NA	1.0000 U	0.9900 U	0.238 U	0.238 U	NA	NA	NA	**NA**
Phenanthrene	L		0.0472 U	0.0500 U	0.0495 U	**0.0259**	**0.0357**	**0.085**	**0.048**	**0.0522**	**NA**
Pyrene	H		0.0472 U	0.0500 U	0.0495 U	0.0119 U	0.0119 U	**0.032**	**0.020** J	**0.0219** J	**NA**
Total LPAHs			0.1416 U	0.6500 U	0.6435 U	**0.2950** J	**0.0754**	**0.217** J	**0.087** J	**0.222** J	**NA**
Total HPAHs			0.2596 U	0.2750 U	0.2723 U	0.0655 U	0.0655 U	**0.195**	**0.051** J	**0.062** J	**NA**
Total Carcinogenic PAHs			0.2124 U	0.2250 U	0.2228 U	0.0536 U	0.0536 U	**0.122**	0.0259 U	**0.0090** J	**NA**
Total PAHs			0.4012 U	0.9250 U	0.9158 U	**0.2950** J	**0.0754**	**0.412** J	**0.138** J	**0.284** J	**NA**
FIELD PARAMETERS											
Groundwater Elevation (ft NAVD88)			**17.10**	**12.01**	**16.52**	**23.73**	**14.63**	**13.06**	**22.90**	**12.30**	**12.21**
Temperature (°C)			**14.60**	**14.02**	**10.51**	**14.43**	**15.21**	**17.4**	**14.71**	**14.20**	**14.64**
Oxidation-Reduction Potential (mV)			**-20.00**	**13.60**	**44.7**	**-19.50**	**-15.69**	**-33**	**11.6**	**-27.9**	**-26.6**
pH			**5.94**	**5.77**	**5.89**	**5.90**	**6.09**	**6.23**	**6.00**	**6.08**	**5.94**
Specific Conductance (mS/cm)			**0.54**	**0.36**	**0.264**	**0.52**	**0.559**	**0.480**	**0.441**	**0.597**	**0.601**
Turbidity (NTU)			**40.80**	**11.60**	**3.42**	**9.15**	**78.70**	NA	NA	NA	NA
Total Suspended Solids (mg/L)			NA	NA	NA	NA	NA	NA	**257**	**NA**	**84**
Dissolved Oxygen (mg/L)			NA	**0.40**	**0.7**	**0.32**	**0.78**	NA	**0.39**	**0.53**	**0.54**

Notes:
MCL = Primary Drinking Water Standard Maximum Contaminant Level
bold = Indicates the analyte was detected above MDL
bold and shaded = Indicates the analyte was detected in excess of MCL
J = Estimated Value
U = Value Below MDL (value represents MDL)
NA = Not available

PAH = polynuclear aromatic hydrocarbon
NTU = nephelometric turbidity unit
L = Low Molecular Weight PAH (LPAH)
H = High Molecular Weight PAH (HPAH)
C = Carcinogenic PAH

µg/L = micrograms per liter
mg/L = milligrams per liter
mS/cm = milliSiemens/centimeter
mV = millivolts

LEGEND

- Groundwater Monitoring Wells
- Infiltration Pond
- Subsurface Barrier Wall
- Drainage Swale Flow Direction Arrow

NOTE: Aerial photo taken on September 22, 2006

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Monitoring Well MW-59s and Infiltration Pond Location Map

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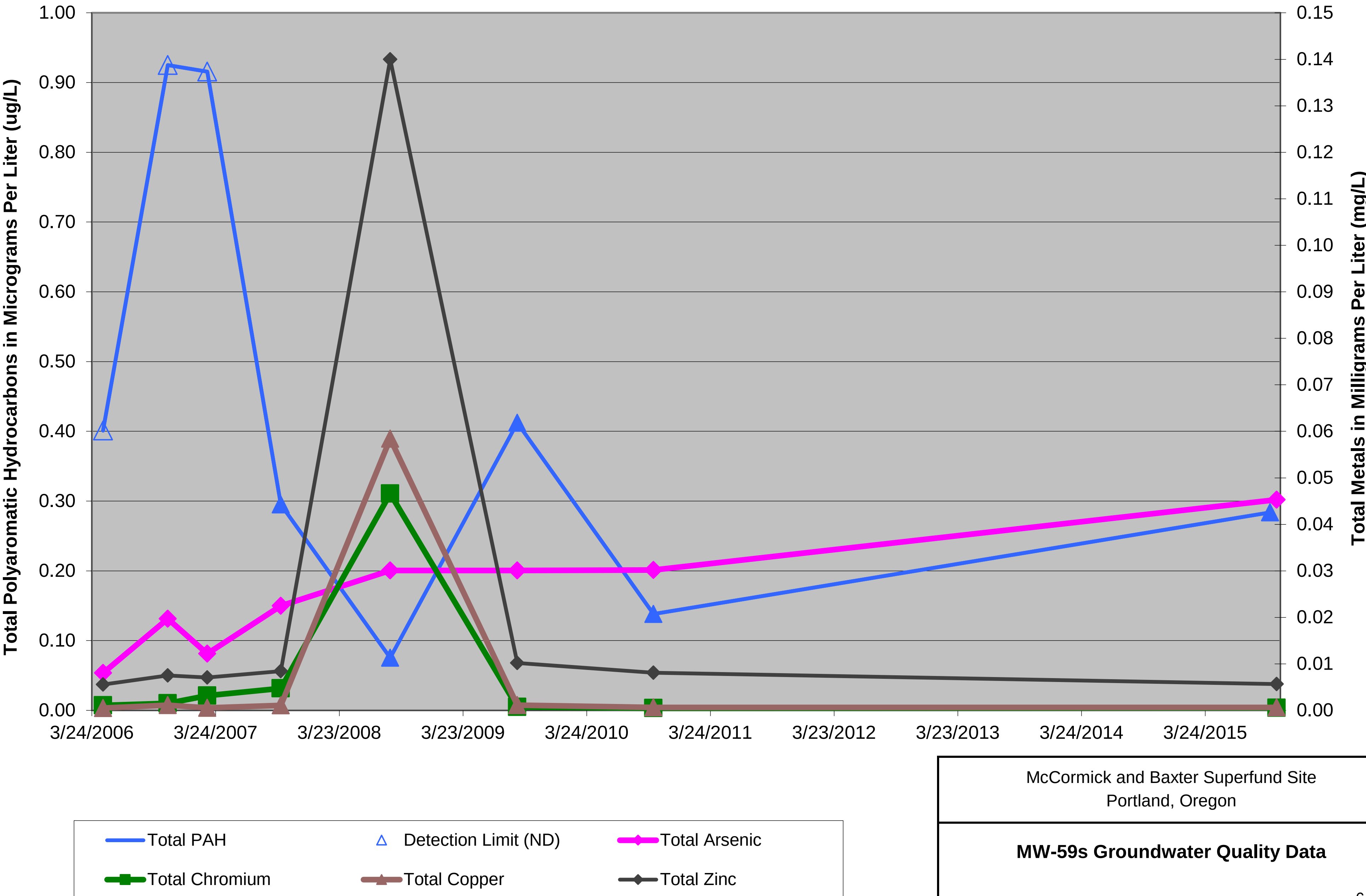
HARTCROWSER GSI Water Solutions, Inc.

Figure

D-1

File Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project_GIS\Project_mxds\2010_Annual_Report\FigureE-1_GW_Monitoring_Well_MW-59s_Location_Map.mxd, Date: April 27, 2011 3:47:01 PM



McCormick and Baxter Superfund Site
Portland, Oregon

MW-59s Groundwater Quality Data

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HARTCROWSER

Figure
D-2

Analytical Laboratory Testing Program and Documentation

Analytical Laboratory Testing Program and Documentation

This appendix documents the results of a quality assurance (QA) review of the analytical data for samples collected during the September 2015 investigation activities at the McCormick and Baxter site in Portland, Oregon. ESC Lab Sciences (ESC) of Mt. Juliet, Tennessee, under their Price Agreement with the State of Oregon, performed analyses on soil, groundwater, and air samples from the site. A copy of the analytical laboratory report is included in this appendix.

The QA review included examination and validation of the laboratory's summary reports, including:

- Analytical methods;
- Detection limits;
- Sample holding times;
- Custody records;
- Surrogates, spikes, and blanks; and
- Duplicates.

The QA review did not include a review of raw data.

1.0 Analytical Methods and Reporting Limits

This section describes the analytical methods and detection/reporting limits for the chemical analyses.

1.1 Analytical Methods

Soil Analyses. Chemical analyses on soil samples consisted of one or more of the following:

- Total carbon and total organic carbon by ASTM Method F1647-02A;
- Semi volatile organic compounds (SVOCs) by Environmental Protection Agency (EPA) Method 8270D-SIM; and
- Polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270D-SIM.

1.2 Method Reporting and Detection Limits

Reporting detection limits (RDLs) are set by the laboratory and are based on instrumentation abilities, sample matrix, and suggested RDLs by the EPA or the DEQ. In some cases, the RDL is raised due to high analyte concentrations in the samples, matrix interferences, or percent dry weight (soil samples). RDLs are generally consistent with industry standards and where possible below risk-based concentrations (RBCs) if not raised as discussed above. The method detection limit (MDL) represents the lowest concentration that the instrumentation can detect a compound; however, the concentration between the RDL and MDL can be only estimated and is J-flagged in the report tables.

2.0 Data Quality Assurance

Data quality is indicated by assessing their completeness, representativeness, accuracy, precision, and comparability. An evaluation of the data follows.

2.1 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid. The completeness goal is essentially a sufficient amount of valid data that is generated to meet the objectives of the data (i.e., assess subsurface conditions). One laboratory report was received and is included in this appendix. No sample results were rejected based on the data validation. The data completeness for the samples is 100 percent for all requested analyses.

2.2 Representativeness

Representativeness is a measure of how closely the results reflect the actual concentration of the parameters in the medium sampled. It is not possible to measure this directly, so representativeness is controlled and ensured by using standard protocols for sample handling and custody, analyzing samples within prescribed holding times, and analyzing blank samples.

Sample Handling and Custody. Samples were collected in general accordance with industry standards. These included requirements for collection, containers, labeling, packaging, shipping, and storage. Compliance with these procedures has been documented on chain of custody forms. Copies of the chain of custody forms are included with the laboratory report.

Holding Times. Collection dates for all samples submitted are documented on the chain of custody form. Collection and analyses dates are indicated in the laboratory report. Holding times were met for all samples.

Sample Quality. All samples were collected in general accordance with industry standards. Sample containers for VOC analysis were fully filled, leaving no observed headspace.

Method Blanks. Method blanks are prepared by the laboratory and analyzed to check for the possibility that the sample may become contaminated during the analysis process. Blanks were analyzed for all analytical tests requested. All method blank data were acceptable.

2.3 Accuracy

Accuracy or bias measures the closeness of the measured value to the true value. Accuracy is the agreement between a measured value and its true or accepted value. While it is not possible to determine absolute accuracy for environmental samples, the analyses of standards and spiked samples provides an indirect assessment of accuracy.

Surrogates. In a surrogate analysis, a known amount of a compound similar to the constituent of interest is added to a sample and measured. The surrogate analyses assesses the accuracy of a chemical measurement by comparing the measured value to the actual spiked value. Up to four surrogates are added to each sample for organic analyses. Surrogate recoveries were all within acceptable limits.

Matrix Spike Samples. Matrix spike (MS) analyses are performed on samples submitted to the laboratory that are of the same matrix as the actual sample. This is spiked with known levels of the constituents of interest. These analyses are used to assess the potential for matrix interference with recovery or detection of the constituents of interest and the accuracy of the determination. The spiked sample results are compared to the expected result (i.e., sample concentration plus spike amount) and are reported as percent recovery. MS analytical results were all within acceptable ranges.

Laboratory Control Samples. Laboratory control samples (LCS) were used by the laboratory to assess the accuracy of the analytical equipment in analyzing all requested analytes. The sample is prepared from the analyte-free matrix, which is then spiked with known levels of the constituents of interest (i.e., a standard). The concentrations are measured, and the results are compared to the known spiked levels. This comparison is expressed as percent recovery. All LCS results were within acceptable limits.

2.4 Precision

Precision is the degree of reproducibility or agreement between independent or repeated measurements. Analytical variability is expressed as the relative percent difference (RPD) between field or laboratory replicates and between the primary and duplicate MS and LCS analyses.

Laboratory Sample Duplicates. A laboratory duplicate is a second analysis of a sample. A second bottle or aliquot of a sample is prepared along with the original. It is analyzed and compared to the first to assess the precision of the analytical method. The laboratory duplicate sample RPDs were within the acceptability criteria.

Matrix Spike Sample Duplicate. A second MS sample (a.k.a., the MS duplicate [MSD]) is prepared as above and analyzed. This is compared to the initial MS to assess the precision of the analytical method by calculating the RPD. For this method, both a percent recovery and an RPD are reported. The MSD RPDs were within the acceptability criteria.

Laboratory Control Sample Duplicate. A duplicate is a second analysis of an LCS. The duplicate is then prepared along with the original. It is analyzed and compared to the first to assess the precision of the analytical method. The LCS RPDs were within the acceptability criteria with the following exceptions.

2.5 Comparability

Generally, all samples were analyzed in accordance with accepted methods of the EPA or DEQ. Because similar or the same methods were used, the quality of the data collected is consistent for all data sets and are therefore, comparable.

ANALYTICAL REPORT

October 11, 2015

Oregon Dept. of Env. Quality - ODEQ

Sample Delivery Group:	L792468
Samples Received:	10/03/2015
Project Number:	15670-11 / TASK 2
Description:	McCormick and Baxter
Report To:	Scott Manzano / Connie Thorstad 2020 SW 4th Ave, Suite 400 Portland, OR 97201

Entire Report Reviewed By:

Jason Romer
Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

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MW-59S L792468-01 GW

Collected by	Collected date/time	Received date/time
Chris Martin	10/02/15 09:34	10/03/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Semi Volatile Organic Compounds (GC/MS) by Method 8270C-SIM	WG819686	1	10/05/15 18:29	10/07/15 15:17	FMB

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. All MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jason Romer
Technical Service Representative

Semi Volatile Organic Compounds (GC/MS) by Method 8270C-SIM

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Anthracene	0.0485	J	0.0140	0.0500	1	10/07/2015 15:17	WG819686
Acenaphthene	0.0139	J	0.0100	0.0500	1	10/07/2015 15:17	WG819686
Acenaphthylene	U		0.0120	0.0500	1	10/07/2015 15:17	WG819686
Benzo(a)anthracene	0.00902	J	0.00410	0.0500	1	10/07/2015 15:17	WG819686
Benzo(a)pyrene	U		0.0116	0.0500	1	10/07/2015 15:17	WG819686
Benzo(b)fluoranthene	U		0.00212	0.0500	1	10/07/2015 15:17	WG819686
Benzo(g,h,i)perylene	U		0.00227	0.0500	1	10/07/2015 15:17	WG819686
Benzo(k)fluoranthene	U		0.0136	0.0500	1	10/07/2015 15:17	WG819686
Chrysene	U		0.0108	0.0500	1	10/07/2015 15:17	WG819686
Dibenz(a,h)anthracene	U		0.00396	0.0500	1	10/07/2015 15:17	WG819686
Fluoranthene	0.0306	J	0.0157	0.0500	1	10/07/2015 15:17	WG819686
Fluorene	0.0211	J	0.00850	0.0500	1	10/07/2015 15:17	WG819686
Indeno(1,2,3-cd)pyrene	U		0.0148	0.0500	1	10/07/2015 15:17	WG819686
Naphthalene	0.0865	J	0.0198	0.250	1	10/07/2015 15:17	WG819686
Phenanthrene	0.0522		0.00820	0.0500	1	10/07/2015 15:17	WG819686
Pyrene	0.0219	J	0.0117	0.0500	1	10/07/2015 15:17	WG819686
1-Methylnaphthalene	0.0113	J	0.00821	0.250	1	10/07/2015 15:17	WG819686
2-Methylnaphthalene	0.0138	J	0.00902	0.250	1	10/07/2015 15:17	WG819686
2-Chloronaphthalene	U		0.00647	0.250	1	10/07/2015 15:17	WG819686
(S) Nitrobenzene-d5	*118*			*45.1-170*		*10/07/2015 15:17*	WG819686
(S) 2-Fluorobiphenyl	*116*			*57.7-153*		*10/07/2015 15:17*	WG819686
(S) p-Terphenyl-d14	*108*			*53.2-156*		*10/07/2015 15:17*	WG819686

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) 10/07/15 16:13

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Anthracene	U		0.0000140	0.0000500
Acenaphthene	U		0.0000100	0.0000500
Acenaphthylene	U		0.0000120	0.0000500
Benzo(a)anthracene	0.00000919		0.00000410	0.0000500
Benzo(a)pyrene	U		0.0000116	0.0000500
Benzo(b)fluoranthene	0.00000389		0.00000212	0.0000500
Benzo(g,h,i)perylene	U		0.00000227	0.0000500
Benzo(k)fluoranthene	U		0.0000136	0.0000500
Chrysene	U		0.0000108	0.0000500
Dibenz(a,h)anthracene	U		0.00000396	0.0000500
Fluoranthene	0.0000242		0.0000157	0.0000500
Fluorene	0.0000128		0.00000850	0.0000500
Indeno(1,2,3-cd)pyrene	U		0.0000148	0.0000500
Naphthalene	0.0000558		0.0000198	0.000250
Phenanthrene	U		0.00000820	0.0000500
Pyrene	U		0.0000117	0.0000500
1-Methylnaphthalene	U		0.00000821	0.000250
2-Methylnaphthalene	U		0.00000902	0.000250
2-Chloronaphthalene	U		0.00000647	0.000250
(S) Nitrobenzene-d5	*116*			*45.1-170*
(S) 2-Fluorobiphenyl	*102*			*57.7-153*
(S) p-Terphenyl-d14	*96.4*			*53.2-156*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/07/15 15:29 • (LCSD) 10/07/15 15:51

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Anthracene	0.00200	0.00203	0.00209	102	105	68.9-153			2.99	20
Acenaphthene	0.00200	0.00202	0.00202	101	101	67.7-141			0.240	20
Acenaphthylene	0.00200	0.00202	0.00205	101	102	66.9-141			1.53	20
Benzo(a)anthracene	0.00200	0.00207	0.00209	103	105	63.1-147			1.30	20
Benzo(a)pyrene	0.00200	0.00199	0.00201	99.6	100	62.2-150			0.840	20
Benzo(b)fluoranthene	0.00200	0.00203	0.00206	102	103	58.4-148			1.09	20
Benzo(g,h,i)perylene	0.00200	0.00204	0.00205	102	103	57.4-152			0.670	20
Benzo(k)fluoranthene	0.00200	0.00203	0.00198	101	98.9	60.5-154			2.55	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/07/15 15:29 • (LCSD) 10/07/15 15:51

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Chrysene	0.00200	0.00198	0.00200	99.1	100	64.8-155			1.04	20
Dibenz(a,h)anthracene	0.00200	0.00199	0.00197	99.4	98.5	53.5-153			0.940	20
Fluoranthene	0.00200	0.00196	0.00194	98.2	97.1	68.6-153			1.16	20
Fluorene	0.00200	0.00196	0.00197	97.9	98.3	67.3-141			0.400	20
Indeno(1,2,3-cd)pyrene	0.00200	0.00203	0.00200	101	100	57.0-155			1.47	20
Naphthalene	0.00200	0.00198	0.00198	98.9	98.9	66.7-135			0.0300	20
Phenanthrene	0.00200	0.00182	0.00189	91.1	94.5	64.3-143			3.61	20
Pyrene	0.00200	0.00197	0.00198	98.5	98.8	60.2-154			0.300	20
1-Methylnaphthalene	0.00200	0.00200	0.00202	100	101	68.3-144			1.01	20
2-Methylnaphthalene	0.00200	0.00200	0.00199	100	99.6	67.6-143			0.610	20
2-Chloronaphthalene	0.00200	0.00202	0.00205	101	102	69.7-144			1.42	20
(S) Nitrobenzene-d5				*112*	*114*	*45.1-170*				
(S) 2-Fluorobiphenyl				*102*	*103*	*57.7-153*				
(S) p-Terphenyl-d14				*94.4*	*95.8*	*53.2-156*				

Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND,U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Rec.	Recovery.
SDL	Sample Detection Limit.
MQL	Method Quantitation Limit.
Unadj. MQL	Unadjusted Method Quantitation Limit.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.

ESC Lab Sciences is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our "one location" design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be **YOUR LAB OF CHOICE.**

State Accreditations

Alabama	40660	Nevada	TN-03-2002-34
Alaska	UST-080	New Hampshire	2975
Arizona	AZ0612	New Jersey–NELAP	TN002
Arkansas	88-0469	New Mexico	TN00003
California	01157CA	New York	11742
Colorado	TN00003	North Carolina	Env375
Conneticut	PH-0197	North Carolina [1]	DW21704
Florida	E87487	North Carolina [2]	41
Georgia	NELAP	North Dakota	R-140
Georgia [1]	923	Ohio–VAP	CL0069
Idaho	TN00003	Oklahoma	9915
Illinois	200008	Oregon	TN200002
Indiana	C-TN-01	Pennsylvania	68-02979
Iowa	364	Rhode Island	221
Kansas	E-10277	South Carolina	84004
Kentucky [1]	90010	South Dakota	n/a
Kentucky [2]	16	Tennessee [1,4]	2006
Louisiana	AI30792	Texas	T 104704245-07-TX
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	6157585858
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	109
Minnesota	047-999-395	Washington	C1915
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA
Nebraska	NE-OS-15-05		

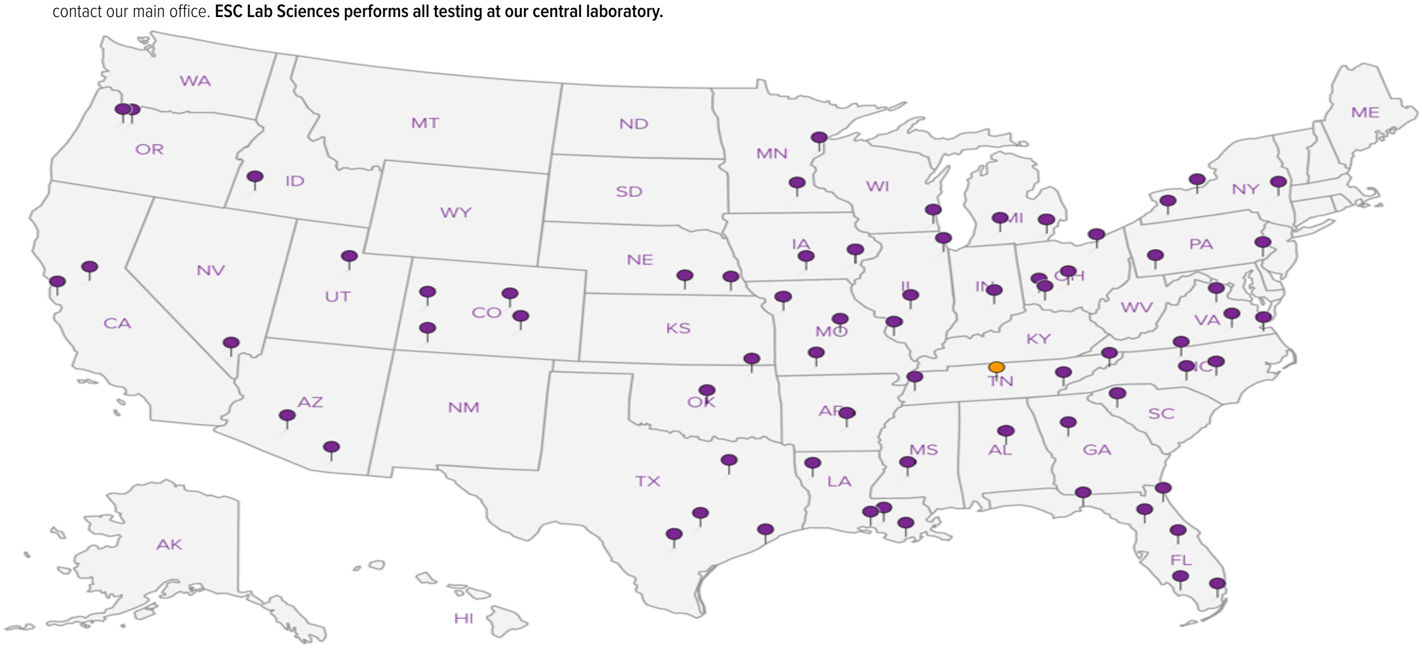
[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [n/a] Accreditation not applicable

Third Party & Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA	100789
Canada	1461.01	DOD	1461.01
EPA–Crypto	TN00003	USDA	S-67674

Our Locations

ESC Lab Sciences has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. **ESC Lab Sciences performs all testing at our central laboratory.**



State of Oregon Chain of Custody

Agency, Authorized Purchaser or Agent:	Contract Laboratory Name:	Lab Selection Criteria:	Turn Around Time:
Oregon DEQ	ESC	☐ Proximity (if TAT < 48 hrs)	☒ 10 days (std.)
Send Lab Report To: Scott Manzano	**Lab Batch #:**	☐ Prior work on same project	☐ 5 days
Address: 700 NE Multnomah Street, Suite 600 Portland, Oregon 97232	**Invoice To:** ODEQ/Business Office Address: 811 SW 6th Ave Portland, OR 97204	☒ Cost (for anticipated analyses) ☐ Other labs disqualified or unable to perform requested services	☐ 72 hours ☐ 48 hours ☐ 24 hours
Tel. #: 503-229-5263 E-mail: MANZANO.Scott@deq.state.or.us	Tel. #: (800) 452-4011	☐ Emergency work	☐ Other

Project Name: McCormick and Baxter
15670-11/Task 2

Sampler Name: Chris Martin

A079

Sample ID#	Collection Date/Time	Matrix	Number of Containers	Total Metals* 6020 (HNO3 <2)	PAHs 8270SIM (None)	TSS SM2540D (None)								Comments
MW-59S	10/2/15 0834	W	5	X	X	X								792468-01
Trip Blank	—	W	1											

Notes: *Total Metals include As, Cu, Cr, & Zn. Sample was field filtered.
Please also send laboratory results to Phil Cordell (Hart Crowser) at phil.cordell@hartcrowser.com

Relinquished By: Chris Martin	Agency/Agent: Hart Crowser	Received By:	Agency/Agent:
Signature: [signature]	Time & Date: 10/2/15 1000	Signature:	Time & Date:
Relinquished By:	Agency/Agent:	Received By: [signature] McCott	Agency/Agent:
Signature:	Time & Date:	Signature:	Time & Date: 10/3/15 0900

THIS PURCHASE IS SUBMITTED PURSUANT TO STATE OF OREGON SOLICITATION #102-1098-07 AND PRICE AGREEMENT # 8903. THE PRICE AGREEMENT INCLUDING CONTRACT TERMS AND CONDITIONS AND SPECIAL CONTRACT TERMS AND CONDITIONS (T'S &C'S) CONTAINED IN THE PRICE AGREEMENT ARE HEREBY INCORPORATED BY REFERENCE AND SHALL APPLY TO THIS PURCHASE AND SHALL TAKE PRECEDENCE OVER ALL OTHER CONFLICTING T'S AND C'S, EXPRESS OR IMPLIED.

6503 7151 1194 total=6 ph=<2

Matt Shacklock

ESC Lab Sciences
Non-Conformance Form

Login #L792468	Client: OREGONDEQ	Date:10/03/15	Evaluated by:Matt S

Non-Conformance (check applicable items)

	Sample Integrity		Chain of Custody Clarification		
	Parameter(s) past holding time	x	Login Clarification Needed		**If Broken Container:**
	Improper temperature		Chain of custody is incomplete		Insufficient packing material around container
	Improper container type		Please specify Metals requested.		Insufficient packing material inside cooler
	Improper preservation		Please specify TCLP requested.		Improper handling by carrier (FedEx / UPS / Courie
	Insufficient sample volume.		Received additional samples not listed on coc.		Sample was frozen
	Sample is biphasic.		Sample ids on containers do not match ids on coc		Container lid not intact
	Vials received with headspace.		Trip Blank not received.		**If no Chain of Custody:**
	Broken container		Client did not "X" analysis.		Received by:
	Broken container:		Chain of Custody is missing		Date/Time:
	Sufficient sample remains				Temp./Cont. Rec./pH:
					Carrier:
					Tracking#

Login Comments: Client has says total metals includes AS, CU, CR, ZN. Is these all the metals are is there more? Also client says these are field filtered,but requesting totals.

Client informed by:		Call		Email	X	Voice Mail		Date: 10/8/15	Time: 0915
TSR Initials: JCR	Client Contact: Scott Manzano/Heidi Blischke								

Login Instructions:

Per client email, do not analyze for Metals. Remove TSS. Run for PAHSIMLVID only.

This E-mail and any attached files are confidential, and may be copyright protected. If you are not the addressee, any dissemination of this communication is strictly prohibited. If you have received this message in error, please contact the sender immediately and delete/destroy all information received.

ANALYTICAL REPORT

October 30, 2015

Oregon Dept. of Env. Quality - ODEQ

Sample Delivery Group:	L796442
Samples Received:	10/23/2015
Project Number:	15670-11/TASK 2
Description:	McCormick and Baxter
Report To:	Scott Manzano 700 NE Multnoma St, Suite 600 Portland, OR 97232

Entire Report Reviewed By:

Jarred Willis
Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.

12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.esclabsciences.com

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			Collected by	Collected date/time	Received date/time
MW-59S L796442-01 GW				10/21/15 16:00	10/23/15 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analysis Analyst
Gravimetric Analysis by Method 2540 D-2011	WG824850	1	10/27/15 23:40	10/28/15 15:50	JM
Metals (ICPMS) by Method 6020	WG825253	1	10/29/15 13:51	10/30/15 02:19	JDG

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times. All MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Jarred Willis
Technical Service Representative

Gravimetric Analysis by Method 2540 D-2011

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Suspended Solids	84000		350	2500	1	10/28/2015 15:50	WG824850

Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Arsenic	45.3		0.250	2.00	1	10/30/2015 02:19	WG825253
Chromium	0.543	J	0.540	2.00	1	10/30/2015 02:19	WG825253
Copper	0.646	J	0.520	5.00	1	10/30/2015 02:19	WG825253
Iron	50500		15.0	100	1	10/30/2015 02:19	WG825253
Zinc	5.67	J	2.56	25.0	1	10/30/2015 02:19	WG825253

Method Blank (MB)

(MB) 10/28/15 15:49

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Suspended Solids	U		0.350	2.50

L796002-01 Original Sample (OS) • Duplicate (DUP)

(OS) 10/28/15 15:52 • (DUP) 10/28/15 15:52

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	30.7	30.9	1	0.722		5

L796442-01 Original Sample (OS) • Duplicate (DUP)

(OS) 10/28/15 15:50 • (DUP) 10/28/15 15:50

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Suspended Solids	84.0	80.0	1	4.88		5

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/28/15 15:49 • (LCSD) 10/28/15 15:49

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Suspended Solids	773	844	844	109	109	85.0-115			0.000	5

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) 10/30/15 01:19

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Arsenic	0.000279		0.00025	0.00200
Chromium	0.00122		0.00054	0.00200
Copper	U		0.00052	0.00500
Iron	U		0.015	0.100
Zinc	U		0.00256	0.0250

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) 10/30/15 01:21 • (LCSD) 10/30/15 01:24

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Arsenic	0.0500	0.0579	0.0552	116	110	80-120			5	20
Chromium	0.0500	0.0537	0.0515	107	103	80-120			4	20
Copper	0.0500	0.0514	0.0508	103	102	80-120			1	20
Iron	5.00	5.08	5.01	102	100	80-120			2	20
Zinc	0.0500	0.0495	0.0558	99	112	80-120			12	20

L796295-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) 10/30/15 01:27 • (MS) 10/30/15 01:33 • (MSD) 10/30/15 01:35

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Arsenic	0.0500	0.000525	0.0541	0.0554	107	110	1	75-125			2	20
Chromium	0.0500	0.00137	0.0502	0.0507	98	99	1	75-125			1	20
Copper	0.0500	0.000472	0.0487	0.0488	96	97	1	75-125			0	20
Iron	5.00	0.0506	4.92	4.97	97	98	1	75-125			1	20
Zinc	0.0500	0.00830	0.0540	0.0541	91	92	1	75-125			0	20

Abbreviations and Definitions

SDG	Sample Delivery Group.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
ND,U	Not detected at the Reporting Limit (or MDL where applicable).
RPD	Relative Percent Difference.
(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
Rec.	Recovery.
SDL	Sample Detection Limit.
MQL	Method Quantitation Limit.
Unadj. MQL	Unadjusted Method Quantitation Limit.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.

ACCREDITATIONS & LOCATIONS

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Alabama	40660
Alaska	UST-080
Arizona	AZ0612
Arkansas	88-0469
California	01157CA
Colorado	TN00003
Conneticut	PH-0197
Florida	E87487
Georgia	NELAP
Georgia [1]	923
Idaho	TN00003
Illinois	200008
Indiana	C-TN-01
Iowa	364
Kansas	E-10277
Kentucky [1]	90010
Kentucky [2]	16
Louisiana	AI30792
Maine	TN0002
Maryland	324
Massachusetts	M-TN003
Michigan	9958
Minnesota	047-999-395
Mississippi	TN00003
Missouri	340
Montana	CERT0086
Nebraska	NE-OS-15-05
Nevada	TN-03-2002-34
New Hampshire	2975
New Jersey–NELAP	TN002
New Mexico	TN00003
New York	11742
North Carolina	Env375
North Carolina [1]	DW21704
North Carolina [2]	41
North Dakota	R-140
Ohio–VAP	CL0069
Oklahoma	9915
Oregon	TN200002
Pennsylvania	68-02979
Rhode Island	221
South Carolina	84004
South Dakota	n/a
Tennessee [1,4]	2006
Texas	T 104704245-07-TX
Texas [5]	LAB0152
Utah	6157585858
Vermont	VT2006
Virginia	109
Washington	C1915
West Virginia	233
Wisconsin	9980939910
Wyoming	A2LA

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [n/a] Accreditation not applicable

Third Party & Federal Accreditations

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Canada	1461.01
EPA–Crypto	TN00003
AIHA	100789
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USDA	S-67674

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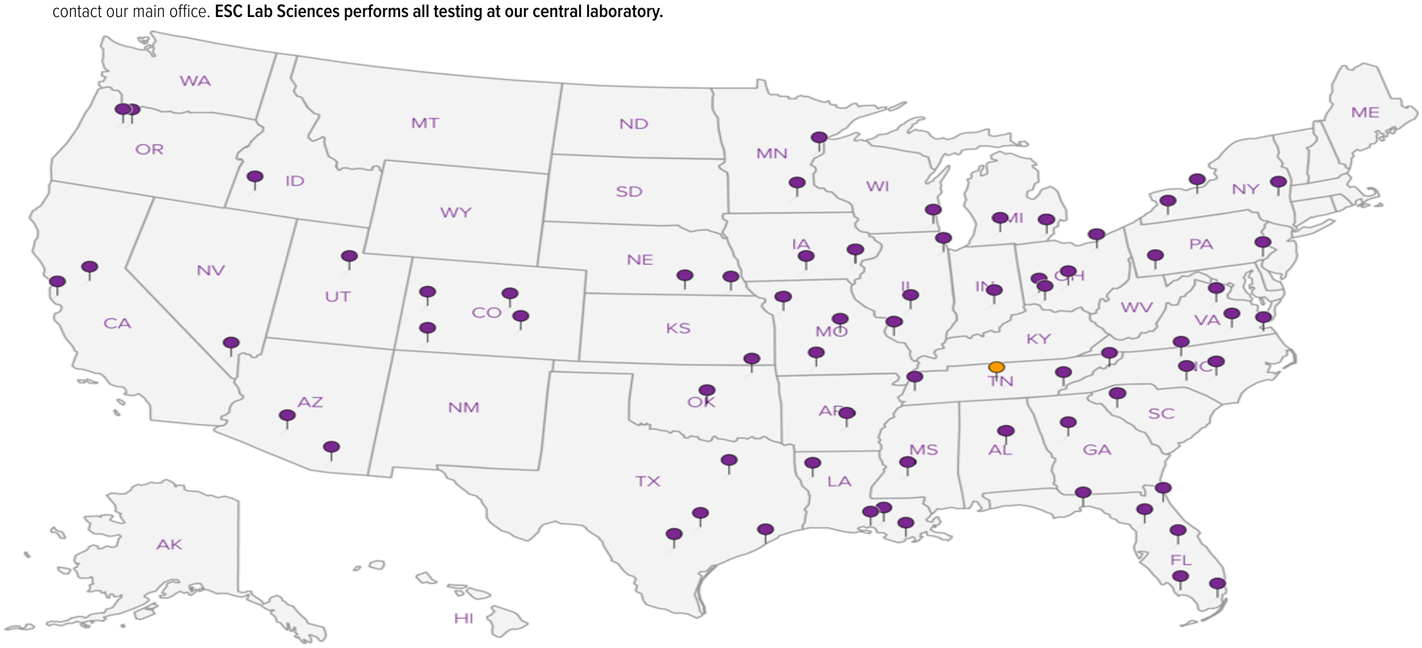

State of Oregon Chain of Custody

Agency, Authorized Purchaser or Agent: **Oregon DEQ**	**Contract Laboratory Name:** **ESC**	**Lab Selection Criteria:**	**Turn Around Time:**
Send Lab Report To: Scott Manzano	**Lab Batch #:**	☐ Proximity (if TAT < 48 hrs)	☒ 10 days (std.)
Address: 700 NE Multnomah Street, Suite 600	**Invoice To:** ODEQ/Business Office	☐ Prior work on same project	☐ 5 days
Portland, Oregon 97232	Address: 811 SW 6th Ave	☒ Cost (for anticipated analyses)	☐ 72 hours
Tel. #: 503-229-5263	Portland, OR 97204	☐ Other labs disqualified or unable to perform requested services	☐ 48 hours ☐ 24 hours
E-mail: MANZANO.Scott@deq.state.or.us	Tel. #: (800) 452-4011	☐ Emergency work	☐ Other ______

Project Name: McCormick and Baxter
15670-11/Task 2

Sampler Name:

J118

Sample ID#	Collection Date/Time	Matrix	Number of Contain-ers	Total Metals*	TSS – SM240D									Comments
MW-59s	10/21/15 - 1600	Water	2	X	X									As, Cu, Cr, & Zn by 6020. L796442-01

Notes:
Please also send laboratory results to Phil Cordell (Hart Crowser) at phil.cordell@hartcrowser.com

Relinquished By: Phil Cordell	Agency/Agent: Hart Crowser	Received By: Robert Adana	Agency/Agent:
Signature: [signature]	Time & Date: 10/22/15 0900	Signature: [signature]	Time & Date:
Relinquished By:	Agency/Agent:	Received By: TOTAL=2	Agency/Agent: 10-23
Signature:	Time & Date:	Signature: [signature]	Time & Date: 0900

OK

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7F 3.4°

Andy Vann

From: Jarred Willis
Sent: Monday, October 26, 2015 9:07 AM
To: Login
Cc: Reporting
Subject: L796442-01 - OREGONDEQ - add FEG

Please add FEG to L796442-01 from *OREGONDEQ* per client request. Scan this e-mail with the COC.

Thanks,
Jarred

-----Original Message-----
From: Phil Cordell [mailto:phil.cordell@hartcrowser.com]
Sent: Monday, October 26, 2015 9:02 AM
To: Jarred Willis
Subject: RE: ESC Lab Sciences Login for 15670-11/TASK 2 McCormick and Baxter L796442

Hi Jarred,

Can you please add total iron? Thanks!

Phil

Philip R. Cordell, RG
Geologist
phil.cordell@hartcrowser.com
8910 SW Gemini Drive
Beaverton, OR 97008-7123
503.620.7284
971.327.9101 (direct)
206.730.5016 (cell)

APPENDIX E
Photograph Log – Vegetation Observations

Photograph 1 – Earthen cap and drainage swale in the foreground with the impermeable cap in the background. Taken looking south from Photograph Location 1 comparing baseline and current conditions. (Left - June 2011, Right - June 2015)

Photograph 2 - Tree and shrub plantings on the earthen cap. Taken looking southeast from Photograph Location 2. (June 2015)

Photograph 3 – Eastern edge of the earthen cap looking toward the drainage swale. Taken looking west from Photograph Location 3. (June 2015)

Photograph 4 – View of stormwater pond. Willow and alder have increased in size, although most of the pond remains barren or vegetated with grasses. Taken looking northeast from Photograph Location 4 comparing baseline and current conditions. (Left - June 2011, Right - June 2015)

Photograph 5 – Tree plantings on the earthen cap. Taken looking north from Photograph Location 5. (June 2015).

Photograph 6 – Impermeable cap dominated by grasses and herbaceous vegetation. Baseline photograph on the left taken looking east from Photograph Location 6 (June – 2011). Current conditions from June 2015 shown on the right. Although not visible in the photo, skeletonweed rosettes are common in this area.

Photograph 7 – Vegetation growth and wood debris within the lower riparian component and along the shoreline. Taken looking southeast from Photograph Location 7 comparing baseline and current conditions. (Left - September 2011, Right – June 2015)

Photograph 8 – Upper riparian component with native trees and shrubs performing well. Taken looking southwest from Photograph Location 8. (June 2015)

Photograph 9 – Lower riparian component with large wood debris along the edge. Taken looking northwest from Photograph Location 9 comparing baseline and current conditions. (Left - June 2011, Right – June 2015)

Photograph 10 – North end of the lower riparian area, looking east. Oregon ash and red osier-dogwood appear to have survived the summer drought conditions relatively well. (December 2015)